UNIVERSITY OF CAPE COAST

EFFECTS OF REMITTANCES AND INFRASTRUCTURE ON PRIVATE INVESTMENT: EVIDENCE FROM GHANA

SAMUEL MENSAH

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BY

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: …… Date: …….

Name: Samuel Mensah

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature: ……. …… Date……..…….

Name: Dr. James Atta Peprah

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ABSTRACT

This thesis examined the effects of remittances and infrastructure on private investment in Ghana. Specifically, the study investigated the combined effects of remittances and infrastructure on private investment as well as the causal relationship between remittances and private investment and between infrastructure and private investment. The Autoregressive Distributed Lag (ARDL) approach to cointegration was used with annual data from WDI, IMF, BOG and ISSER for the period of 1984 to 2017. The research finds that remittances alone does not influence private investment in Ghana. However, given the existence of infrastructure, remittances can simulate private investment in Ghana. The results indicate that existence of infrastructure might be a significant channel through which remittances affect private investment in Ghana. Thus, the net effect of remittances and infrastructure on private investment is empirically higher in promoting private investment in Ghana. The Granger Causality test reveals that there is bidirectional causality between remittances and private investment but unidirectional causality between infrastructure and private investment. Based on the findings, it is recommended that the Ministry of Finance should allocate more funds to the Ministry of Roads and Ministry of Power and Energy to boost infrastructural development such as road construction and electricity generation. This will create and ensure favorable investment climate for remittances to be invested.

KEY WORDS

Accelerator model

Autoregressive distributed lags

Infrastructure

Private investment

Remittances

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DEDICATION

To Professor Akwasi Kumi-Kyereme

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
AICD	African Infrastructure Country Diagnostic
ARDL	Autoregressive Distributed Lag
BOG	Bank of Ghana
BOP	Balance of Payment
CTI	Composite Trade Index
CUSUM	Cumulative Sum of Recursive Residuals
CUSUMSQ	Cumulative Sum of Square of Recursive Residuals
DOLS	Dynamic Ordinary Least Squares
ECM	Error Correction Model
ECOWAS	Economic Community of West African Countries
ECT	Error Correction Term
ERP	Economic Recovery Program
FDI	Foreign Direct Investment
FPE	Final Prediction Error
FSD	Financial Sector Development
GDP	Gross Domestic Product
GIAC	Ghana Investment Advisory Council

GhIE	Ghana Institution of Engineers
GLSS	Ghana Living Standards Survey
GMM	Generalized Method of Moments
GSS	Ghana Statistical Service
HQC	Hannan Quinn Criterion
IASCM	International Association for Structural Control and Monitoring
IEA	Institute of Economic Affairs
IFF	Infrastructure Investment Fund
IMF	International Monetary Fund
IOM	International Organization for Migration
ISSER	Institute of Statistical Social and Economic Research
MEC	Marginal Efficiency of Investment
MPK	Marginal Product of Capital
ODA	Official Development Aid
OECD	Organization for Economic Co-Operation and Development
OLS	Ordinary Least Squares
PARDL	Panel Autoregressive Distributed Lag
PP	Phillip-Perron
PPP	Public Private Partnership

RESET	Regression Specification Error Test
RWTI	Relative World Trade Intensity
SAPS	Structural Adjustment Program
SBC	Swartz Bayesian Criterion
SDG	Sustainable Development Goals
SHEP	Self-Help Electrification Program
SIC	Swartz Information Criterion
SSA	Sub-Sahara Africa
TI	Trade Intensity
UK	United Kingdom
UN	United Nation
USA	United States of American
VAR	Vector Autoregressive

CHAPTER ONE

INTRODUCTION

Background to the study

The role of investment in the growth and development strategy of every country has become increasingly important. Stampini, Leung, Diarra and Pla (2013) reveal that investment is the nucleus of an economy and any fluctuations in investments have considerable effects on economic activity and long-term economic growth of a country. Investment leads to the growth of incomes, generation of employment opportunities and improves national welfare. According to Emene (2012), most countries rely on investment to find solutions to their economic problems such as unemployment, low productive capacity and poverty. It is further evident that economies with high level of investments have higher economic growth (Guma, 2013; Mustefa, 2014).

Investment in a country is composed of private and public investments. Whiles private investment is the change in private capital stock during a period, the latter is mainly investment by the government. Empirical evidence reveals that both private and public investments are influenced by different factors (Aizenman & Marion, 1999). However, the impact of private investment on economic growth is greater than the impact of public investment as private investment is more efficient and less connected with corruption (Karagöl, 2004; Laopodis, 2001; Mamatzakis, 2001). As a result, considerable attention has been devoted to the development of private investment especially in developing countries to help improve economic growth (Ouattara, 2004).

Current statistics shows that global private investment declined by 13% in 2016 with various regions registering a decline as follows: Africa (-25%), Europe (-29%), Developing Asia and Oceania (-22%), Latin America and the Caribbean (-19%) which in aggregate led to the decline globally (UNCTAD, 2016). The devastating effect of the situation is not only seen in a decline in job creation and rising inequality but also high global poverty level and fewer opportunities for the poor to improve their livelihoods (White, 2005).

Private investment is determined by a number of variables which significantly contribute to its growth. For instance, availability of credit to the private sector, domestic savings, external debt, openness to trade, institutions that protect and foster market exchange are variables that contribute to the growth of private investment (Asante, 2000; Marbuah & Frimpong, 2010; Ouattara, 2005). However, private investment may also be sensitive to the user's cost of capital. The Flexible accelerator model postulates that the real interest rate acts as the user's cost of capital. When the user's cost of capital rises, it means the cost of capital has gone up and this becomes a disincentive to the private sector to invest (Erden & Holcombe, 2005). Thus, the cost of funding private investment projects and other variables can be expected to play a major role in private investment activities. Improvements in the investment climate will also need government investments in infrastructure and improved logistics. The quality and availability of infrastructure, particularly energy, stood out in the World business survey (WB's) survey on constraints for investment in 2015.

The rise in remittance inflows above official development assistance (ODA) and other private capital inflows in recent years has baffled both economists and policy makers worldwide (World Bank, 2016). The role of remittances as a source of external finance globally has become increasingly important. It provides capital for business and entrepreneurial activities. Giuliano and Ruiz-Arranz (2009) show that remittances provide an alternative way to enhance investment especially in low income countries. They emphasize that remittances increase savings which intend increases investment by making funds available to investors. Fayissa (2010) reveals that for 37 African countries, remittances promote economic growth and reduce liquidity constraints in less financially developed countries. Remittances are likely to enlarge the volume of funds passing through the financial system (Barajas, Fullenkamp, Gapen, & Montiel 2009).

Over the past decades, there has been a substantial increase in remittances inflow globally and especially in developing countries outstripping other sources of international money inflows (World Bank, 2016). Available Statistics indicate that in 2015, the world remittances inflow stood at US$ 263 billion. This figure increased to US$ 429 billion in 2016 and is expected to increase further overtime as the number of international migrants reached 232 million up from 175 million in 2016 (World Bank, 2016). World Bank (2017) shows that remittances inflow to Latin America and Caribbean was around US$73 billion, an increase of 6.9 % in 2015 representing about 70 % of Foreign Direct Investment (FDI). This is almost eight times more than ODA to the region. Relative to Gross Domestic Product (GDP), remittance inflows to Sub-Sahara Africa (SSA) countries were higher than the average for

all developing countries. This is expected to increase by 3.3 % to $34 billion in 2017 (World Bank, 2017).

Due to rising youth unemployment, climate change and the continual migration of people from less developed countries to richer ones, inflow of remittances may persist into the future. The contribution of remittances to economic growth and development is unquestionable as established by several studies (Fayissa & Nsiah ,2010; Lartey, 2013; Meyer & Shera ,2016). However, these studies failed to lay much emphasis on the channels through which remittances inflow can enhance economic growth and development. Whether remittances can influence economic growth and development in a country depends on how it is used. Burnside and Dollar (2000) opine that the influence of remittance inflows on the economic development of recipient countries hinges on whether they are invested or consumed. Wagner, Pellegrini and Hague (2013) argue that remittances spent on consumption is not productive and does not contribute to growth and development. Barajas (2011) also indicates that the growing consumption of remittance inflow has the tendency to cause a rise in market prices and exchange rate appreciation in the recipient country which can lead to the phenomenon of "Dutch Disease' with a decline in tradable sector of domestic economy and consequently, an increase in current account deficit.

The decision to utilize remittances for productive investment hinges on the amount that remain available after satisfying basic needs, but it is also determined by the larger macro-economic environment, especially the financial market, infrastructure and interest rates (Goschin, 2014). A well-developed infrastructure which increases the returns on investment and raises

the opportunity cost on consumption of remittances may help direct remittances to projects that yield the highest return and therefore promote economic growth. For instance, a better road network may reduce expenses associated with the construction of a new factory or setting up of small-scale businesses with remittances. In this sense, the impact on unit production costs and the productivity of private capital (remittances) can be substantial (Cohen & Paul, 2004). Moreover, embarking on rural electrification projects where rural areas (village) are connected to the national electricity supply may attract remittances recipient to set up small-scale enterprises. Electricity access and water supply in rural areas will reduce the cost of setting up small-scale business or the costs that private investors may incur when investing with remittances. The existence of infrastructure like roads, electricity and water supply signals the presence of attractive investment opportunities at home with remittances; such opportunities encourage recipient of remittances to undertake more private investment.

In Ghana, successive governments since 2000 have encouraged private investment as an integral part of Ghana's economic policy (Asare, 2012). With the help of the World Bank, The Ghana Investment Advisory Council (GIAC) was established to help shape government policy aimed at creating an enabling investment environment. Also, Ghana adopted the Structural Adjustment Programs (SAPs), Economic Recovery Programs (ERPs), enacted various investment codes and other financial reform programs to enhance private investment. The overriding purpose of the ERP was to reduce Ghana's debt and improve its trading position in the global economy. The objectives of the ERP program focused on restoring economic productivity at minimum cost to

the government and included the following policies: lowering inflation and increasing the flow of foreign exchange into Ghana. In short, the government hoped to create an economic climate conducive to the generation of private capital. Nevertheless, it is evident that the growth in private investment, particularly from domestic sources has been sluggish on account of low domestic savings, limited financing opportunities, poor infrastructure and high rate of interest on funds provided by financial institutions (Kamasa, 2013).

Since 2010, Ghana has witnessed a substantial rise in remittances inflow from US$ 2billion in 2016 to US$ 2.2billion in 2017 (Ghanabusinessnews.com shows, 2017). The Bank of Ghana's estimates of the balance of payments suggest that remittances place second after exports in terms of resource inflow in Ghana. Thus, in Ghana, where access to credit is limited, individuals might use remittances to relax such constraints and subsequently enhance private investment but remittances inflow is not a sufficient condition for the accomplishments of investment, directing remittances to investment needs and appropriate environment in terms of the existence of infrastructure for investment within the recipient's country as agued by Încalțărău (2012).

Even though remittances in Ghana may ease credit constraints, it can also help private investors bypass lack of collateral securities. There should be availability of infrastructure such as roads, electricity and water to utilize remittances for productive activities, there seems to be a correlation between remittances, infrastructure and private investment (Încalțărău, 2012; World Bank, 2006). Thus, infrastructure and remittances have been adduced as major sources of growth of private investment. The sources of growth of private

investment in Ghana have, for a long time, been debated upon and among the perceived sources are low real interest rate, credits availability, increased domestic savings and low rate of inflation. In fact, before 1990, remittances were not popular in terms of their contributions to investment (Cherono, 2015). However, in recent years, much emphasis has been laid on the possible effects of infrastructure and remittances in promoting private investment (Owiafe, 2008; World Bank, 2006).

Currently, when compared with other middle-income countries in Africa, Ghana has a very advanced infrastructure platform. For instance, electricity access rate in Ghana for the total, urban, and rural population were 78.3%, 90.8%, and 63% respectively in 2014 and through the Self-Help Electrification Program (SHEP), about 82.5% of the population had access to electricity as at the end of 2016 (Ministry of Power, 2016). Also, in 2016, road networks in Ghana were about 67,291km where 83% of trunk roads, 36% of urban roads and 72% of feeder roads were considered to be in good condition. However, much has not been done to unveil the potentials of Ghana's infrastructure and rising remittances in stimulating private investment. Researchers and policy makers have articulated the complementary role of infrastructure and remittances in the conviction that availability of infrastructure and remittances can help private investors improve their productive capacity.

It is in the light of this that the study sought to investigate the combined effects of remittances and infrastructure on private investment in Ghana to ensure that private investment is enhanced through policies that target remittances and infrastructure simultaneously The motivation of the

study is based on the country's (Ghana) action plans for remittances policy that seeks to maximize the benefits of remittances in nation building.

Statement of the Problem

Availability of seed capital remains a major obstacle to private sector investment in Ghana despite numerous education programs to promote savings mobilization and increase credit allocation for investment (Quarshie, 2013). As a result, the expected role of private investment as the main engine of growth has not materialized in the Ghanaian economy due to the country's inability to increase private investment to an appreciable level (Konor, 2014). However, remittances inflows have proven to be a more sustainable source of international inflow in Ghana as evidenced by the increasing number of formal and informal money transfer institutions in Ghana (Addison, 2005).The major question arising is whether these inflows have aided private investment in Ghana?

Several studies have attempted to address the effects of remittances on investment on cross-country basis (Balde, 2011; Githaiga, 2014; Khan, 2017, Mallick, 2012) but the contribution of remittances and infrastructure on investment has not yet been established in empirical literature. Other empirical studies (Anupam, 2009; Okuda 2010) in relation to remittances have focused specifically on gross investment rather than disaggregating investment into public and private investment. However, theory and evidence have suggest that both public and private investments are influenced by different factors. This study focuses on joint effects of remittances and infrastructure on private investment which remain largely unknown. Another important question in

relation to remittances and investment is that of causation. Such a question asks whether investment causes remittances or visa-versa.

Although quite a number of empirical studies have been undertaken in an attempt to determine the effects of remittances on investment, these studies have yielded mixed results (Anupam Das, 2009; Mallick, 2012; Okuda, 2013; Rahman, 2015; Singh & Mehra, 2014). Generally, the reasons for mixed results is that, most of these studies were based on cross-country analysis and largely grounded on aggregate investment (Balde, 2010; Mishra, 2005; Paolo Giuliano & Ruiz-Arranz, 2009). While these studies have broadened knowledge on remittances and investment, the findings cannot adequately reflect country specific experience since the heterogeneity of the countries impacts on the validity of their results and the channels through which remittances affect investment are complex and are likely to be country-specific. This necessitates the need to focus on individual country analysis.

In Ghana to be specific, rigorous empirical studies are yet to be taken to provide quantitative indication of the size of the private investment that is likely to be realized as a consequence of targeted joint effect of remittances and infrastructure and this has motivated the study.

Objectives of the Study

The general objective of the study was to empirically analyze the effects of remittances and infrastructure on private investment in Ghana. The specific objectives of the study were to:

1. Determine the causal relationship between remittances and private investment

2. Determine the causal relationship between infrastructure and private investment in Ghana.
3. Estimate the joint effect of remittances and infrastructure on private investment in Ghana.

Hypotheses of the study

1. H_O: There is no causal relationship between remittances and private investment in Ghana.

   H_1: There is causal relationship between remittances and private investment in Ghana.

2. H_O: There is no causal relationship between infrastructure and private investment in Ghana.

   H_1: There is causal relationship between remittances and infrastructure and private investment in Ghana.

3. H_O: There is no joint significant effect of remittances and infrastructure on private investment in Ghana.

   H_1: There is joint significant effect of remittances and infrastructure on private investment in Ghana.

Significance of the study

The importance of the study cannot be overemphasized given the stability and recent sheer volume of remittances inflow in Ghana over official development aid and other private capital inflow. However, this study will make noteworthy contributions to the remittances, infrastructure and private investment literature. Also, this study adds to the single-country study of remittances and infrastructure on private investment literature, the first

systematic quantitative analysis on the subject of remittances, infrastructure and private investment.

Subsequently, the study is motivated by the fact that it employed the new measurement of remittances by the International Monetary Fund (IMF) Balance of Payments and International Investment Position Manual (BPM6) called 'personal remittances' which is recognized as a significant improvement compared with the older measurement.

Moreover, the findings of the study will provide evidence to unveil the potentials of Ghana's infrastructure in directing remittances to private investment so as to monitor remittances and infrastructure simultaneously. Finally, the study can also serve as a reference for further research.

Delimitations

The scope of this study is to determine the impact of remittance inflows and infrastructure on private investment in Ghana using a time series data for the period 1984-2017. The total observations for the study is 34. The study is limited to Ghana only so as to avoid bias of any form when all developing and developed countries are analyzed simultaneously, however, the findings will be generalized. The data coverage of the study was informed by the fact that it was much challenging to get data before 1984. Other variables were included in the study. This includes the following: GDP growth, domestic savings, real interest rate, external debt, remittances, government capital expenditure as a proxy for infrastructure, Gross fixed capital formation (private sector) as a proxy for private investment and Trade openness. The study also considered only financial remittances which is a measure of workers' remittances and compensation of employees received as

percentage of GDP. The study employs the ARDL approach in estimating the results of the study.

Limitations

The limitation encountered in the study primarily involves unavailability of data. There were not enough data points for all the variables included in the study thereby making the study to use a smaller sample size from 1984 to 2017. Despite the above limitation, the study complements the existing knowledge on remittances and private investment, because this study represents one of the few attempts to examine how remittances can be channeled into productive investment.

Organization of the study

The study is divided into five chapters. The background to the study, problem statement, objectives of the study, hypotheses to be tested, significance of the study and the organization of the study are presented in chapter one. The literature review, both the theoretical and empirical, which investigated the relationship between remittances, infrastructure and private investment in Ghana are presented in chapter two. The methodology to be employed, empirical specification of the model and estimation technique are presented in chapter three. The results and main findings obtained from the study with reference to both the theoretical and empirical literature are presented in chapter four. The summary of the results, policy recommendation based on the results and potential areas for further research are presented in chapter five of the study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

The review of related theoretical and empirical literature on the relationship between remittances, infrastructure and private investment are presented in this chapter. Specifically, the chapter is organized into three sections. The first section provides the definition and measurement of remittances, theories on motives for sending remittances, definition and theories of private investment. Trend of remittances globally and in Ghana are presented in the second section. Determinants of remittances including macro-economic determinants of remittances and overview of infrastructure situation in Ghana are presented in the third section. Lastly, literature on empirical work on remittances, infrastructure and private investment are reviewed.

Remittances: Definition and Measurement

Over the years, scholars and researchers from different disciplines and organizations have come up with several definitions of remittances. This has made Taylor and Fletcher (1999) assert that lack of common definition of remittances is responsible for the inability to estimate the total value of remittances inflows to a particular country and region. The International Monetary Fund (IMF) defined remittances as monies sent by migrant workers staying in a foreign country for more than one year to their household members in their countries of origin excluding migrants that are self-employed (IMF, 1999). Samson (2011) perceives remittances as a significant source of external finance which migrant workers transfer back home to their families in the form of aid and financial assistances. Daianu (2001) maintains that

remittances are money migrants earn on foreign land that are transferred back home which constitutes private flow of capital from their country of employment to their home country. From the International Organization for Migration (2006), remittance is limited to all the monetary flows associated with migration which constitutes cash sent by migrants or immigrants residing abroad to home countries relations. Remittances are also restricted to migrant worker cash transfers transferred to their families and their communities to their home countries which do not include transfers from refugees and other migrants excluded from enjoying the benefit of legal status of migrant workers (Sorensen, 2004; Van Door, 2001). Moreover, it is argued by some researchers that non-financial materials including gifts transmitted back home by migrants to their families form part of remittances (Chukwuone, 2007; Odozi, Awoyemi, & Omonona, 2010; Quartey, 2006; Tewolde, 2005).

Researchers such as Adams and Page (2005) have criticized this measurement by the IMF with the assertion that these records failed to provide a full picture of remittances inflow into a country since the estimates include only official worker remittance flows that passes through the financial system and do not include unofficial channels. Other researchers including Chami. Barajas, Cosimano and Fullenkamp (2008) have also advocated for using only workers' remittances to measure remittances. It is important to know that whereas some modalities for sending and receiving remittances are recorded, others are not. For instance, we only record remittances that pass through the formal channel in the balance of payment current account of a country but other cash remittances received through informal avenues, for example, through friends are not recorded in the official statistics of the receiving

country. In a document prepared by the IMF entitled "International Transaction in Remittance: Guide for compilers and Users'' they indicated that the quality of statistical remittance is not high and further asserted that measuring remittances is a challenge due to their nature (IMF, 2009). Remittance are seen to be heterogeneous with small numerous transactions conducted by individuals through a wide range of channels.

However, in this study, the term remittances will mean workers' remittances, migrants' transfers and compensation of employees. The workers' remittances comprise all monetary transfers currently sent home by workers residing outside their home country for a year or more. Migrants' transfers, on the other hand, constitute all transfers in cash or in kind currently made or received by resident household to or from non-resident household and the compensation to employees also consists of income of border, seasonal and other short-term workers employed outside their home countries (World bank, 2012). This is in line with the definition and measurement of the IMF's Balance of Payment Statistical Yearbook at country level on statistics of remittances.

Theories on Motives for Remittances

There are varieties of motives influencing the remittance behavior of migrants. These motives may differ between different groups of migrants from different countries. The motive of remittances determines the effect on the economy as well as the uses of the remittances. Below are some of the motives why migrants send remittances home.

Altruistic Motive

According to this motive, a migrant remit home out of concern for the wellbeing of his family and associates in his or her home country. Such transfers by migrant are intended to improve the welfare of their relatives in the country of origin implying that adverse condition back home is positively related to amount of remittances. Chami et al., (2003) posit that the migrant worker derives his utility from that of his family members which motivate him to remit the money under altruistic motive. There are three basic assumptions underlying this motive.

Firstly, remittance is a function of migrant income. Secondly, the amount to remit depends on the income level of the migrant family and associates in country of origin. Finally, how the migrant is attached to his family relation back home (Oluwafemi & Ayandibu, 2014). Bouhga-Hagbe (2004) argues that the level of workers' remittances is determined by their degree of altruism and attachment to their family relation back home. The family attachment may decrease as migrant workers stay for a longer period and as such will find it worthwhile to bring their immediate family to join them which will reduce the amount of remittances sent home but the level of remittances will rise when the receiving economy is in distress. This means that remittances are countercyclical which rises in period of economic downturns and decline in period of high economic growth. The level of remittances out of altruism motive is predicated to rise in developing countries where the economic conditions are unlikely to experience abrupt improvement which would improve the living conditions of the home country households.

Empirical literature has provided enough evidence indicating that migrants are motivated by altruism to remit back home (Aggarwal & Horowitz, 2002; Pozo, 2005), however, under this motive, remittances will be negatively related to private investment in the short run since they are mainly spent on consumption activities but as those needs have been satisfied, private investment can take place in the long run.

Self- interest / investment Motive

Unlike the altruism motive, the decision to remit under this motive is based on the migrant's own financial and economic self-interest. These motives of remittances are driven largely by investment and return on investments of migrants. Remittances are not only compensatory but also investment motivated. Sometimes, migrants have investments that need to be tendered by their family members as agents on their behalf during their exile and as such they remit for such purpose. The return on investment determines the motivation and the amount to remit. More will be remitted when return on their investments is high and vice versa. Family members will only agree to act on migrant's behalf when they expect a higher utility than the situation when they do not perform such service (Rapoport & Docquier, 2006). The advocates of self-interest motive of remittances see the family as a business or as nexus of contract that permits family members to engage in Pareto-improving exchanges (Chami et al., 2005).

The Pareto-improving exchanges can manifest itself in various situations such as managing assets belonging to the migrant at home and where migrant remits to exhibit laudable behavior as an investment for the future or with the aspiration to inherit (Hagen-Zanker & Siegel, 2007). This

motive maintains that remittances rise with the asset and income of the household, the probability of inheriting, the wealth and income of the migrant and also decline with risk aversion. Under this motive, remittances are pro-cyclical. The worth of bequest rises during a favorable economic condition motivating migrant to remit more in such situation. According to the self-interest motive, when migrant believes that the home country has become attractive for future investment plans; they remit more to take advantage of such opportunity. Where remittances are out of self-interest motives especially for investment purposes, macroeconomic factors such as interest rate, infrastructure situation, government policies in the home country turn to influence the decision and amount to remit (Leon-Ledesma & Piracha, 2004; World Bank 2006). Adams (2007), provides empirical evidence of self-interest as a motive to remit after investigating the nexus between per capita GDP at home and remittances. He indicated that remittances rise as per capita GDP of home country increases meaning self-interest motive could be playing a major role in the decision to remit.

Portfolio Approach

It is argued in empirical literature that it is only this motive that affects investment directly and also enhances economic growth. Under theory, the risk return differential of assets in both the host country and the country of origin influences the decision of the migrant to remit. Among the determinant of the decision to remit identified in literature are; inflation rate, real estate return, political stability exchange rates, savings rate and government policies (Pozo, 2005; Prakash, 2009). According to this approach, the migrant decides how to allot his accumulated savings between the assets of the home country

and the country of destination based on his earnings. The Organization for Economic Co-operation and Development OECD (2006) report also suggests that the decision to invest in home country is highly influenced by the desire of the emigrant worker to return back home with dignity, should in case he returns to his country of origin. Profit and responds to investment opportunities back home enhance the motivation of migrant to remit more.

The effectiveness of this approach, however, would require the government to implement policies aimed at enhancing the investment climate in the home country as well as provision of basic infrastructure as an incentive for more remittances to be channeled into private investment. Under this approach, remittances and private investment are positively related since remittances are fundamentally remitted for investment motive.

Implicit Family Contract I: Loan Repayment

This is an economic theory that provides a discussion on the remittances process that deals with the family rather than the individual as the major unit of analysis. The theory assumes that families tend to develop an implicit contract among those who stay abroad, the migrant, and those who live in the home country (Owiafe, 2008). The implicit contract has a horizon which can span for several years and an inter-personal dimension. The contract includes elements of investment and repayment. The loan (investment) feature of the theory is where the family invests in the emigrant's education and caters for his costs of migration that is paid for his travel and subsistence in the country of destination.

However, after the migrant settles in the host country and over time begins to experience a rise in income, he or she commences the repayment of

the loan which comprises the principal with interests to the family back home in the form of remittances. These constitute the repayment feature of the theory. The family begins to view the migrant who earns a higher income in the host country than other family members of comparable status back home as a high yielding asset and invests in him. The income profile of the migrant will influence the amount to be remitted under this theory.

Implicit Family Contract II: Co-Insurance

The principle of diversification of risk is often considered as a variant of the theory of remittances as an implicit family contract between the migrant and the family at home. The idea of the implicit Family Contract II is that many risks are undiversified due to unavailability of financial assets that can be utilized to hedge them since capital and insurance markets are incomplete in the real world. The model suggests that if economic risks between the sending and foreign country are positively uncorrelated then it is necessary to diversify the economic risk by sending abroad, especially, the educated members.

The migrant serves as an insurer and the family plays the role of an insured. For instance, in times of family distress, the migrant provides support for the family and similarly, the family also serves as a form of insurance for the migrant during hard times. The family gains an opportunity to smoothen its consumption and undertake investment opportunities after receiving the remittances. According to the model, while emigration becomes a co-insurance strategy, remittances serve as an insurance claim.

Private investment

According to the World Bank, private investment of a country constitutes the gross contribution by the private sector, private profit and non-profit agencies to its fixed domestic assets (World Bank, 2013). From the macroeconomic perspective, private investment is the acquisition of capital asset that is expected to generate income, increase in value, or both produce income and increase in value. Other scholars also define it as the change in private capital stock during a period. They are mainly influenced by profit motive and characterized by risk and uncertainty. Private investment has been a powerful catalyst for economic growth, job creation, foreign direct investment, poverty alleviation and improved per capita income (Haroon & Nasr, 2011). Recently, the focus of investment policies has shifted towards reviving private investment owing to its significance as part of measures to limit the effort of government in undertaking productive ventures.

Among the determinants of private investment are capital, government investment on infrastructure, GDP growth rate, financial sector lending rate and inflation rate (IFC, McKinsey, & Company, 2010; Lika & Farid, 2010). Private investment especially in Ghana has been saddled with a lot of constraints including low savings, limited financing opportunities and lack of infrastructure making it difficult to materialize the role of the private sector as an engine of growth in most countries. Therefore, policymakers are required to identify the proper balance between creating an environment conducive to investment and removing any bottlenecks to attract private investors (UN, 2014).

Review of theoretical literature on Private investment

This section of the study provides a discussion of several theories of investment and illustrates how the various theories differ. The empirical part of the study relies on some of these theories.

Keynesian investment theory

According to Keynes (1936), investment is the main driving force that influences aggregate output, employment and short run fluctuations in economic activity. Keynes opines that since investment is volatile and highly dependent on expectations of firm's profitability, investment will take place as long as the expected yield on investment exceeds the real interest rate. From the theory, individuals and firms undertake investment decision by comparing their expected yield with the cost of capital (real interest rate). Therefore, investment depends on the prospective Marginal Efficiency of Capital (MEC) which is the rate of discount that equates the present value of a series of cash flows obtainable from an income-earning asset like a machinery over the machinery's entire economic life to the cost of that machinery relative to some interest rate (Serven & Andres, 1992). This relation is expressed mathematically in the investment function postulated by Keynes as:

$$I = I_0 + I(r) \quad (1)$$

Where $I'(r) < 0$

Higher investment is realized when interest rate is low as capital project appears to be financially viable and vice versa. However, diminishing marginal product of capital will cause the MEC to decline as more and more capital is utilized in the process of production. The theory maintains that firms and individuals will not undertake new investment when MEC equals the

interest rate. The Keynesian economists indicated that monetary policy is ineffective in influencing the level of investment in any economy since they argued that investment hinges largely upon expected return and less interest rate sensitive, which implies that even large changes in interest rates have little effect on investment. This explains why their marginal efficiency of capital curve is steep. Erden and Holcombe (2006) asserted that the Keynesian investment model is related to the complementarity theory of public investment which postulates that government investment in core infrastructure enhances productivity of invested private capital. To Keynes, investment is not regarded as an adjustment process towards equilibrium and further debunked the assertion that investment was based exclusively on technological conditions of capital productivity, instead, radical uncertainty and monetary factors play a crucial role in individual and firm's investment decisions.

However, the Keynesian theory of investment has been criticized as unrealistic by the neo-classical economists such as Dale Jorgenson and his co-workers.

Neo-classical theory of investment

The basic idea of this theory of investment relates to the cost function which indicates how cost affects the stock of capital and how total investment in the private sector is also affected by rental cost of capital. It was developed by Dale W. Jorgenson (1971) to explain investment behavior of firms with an assumption of fixed business investment. The neo-classical supply-side model incorporates all cost-minimizing and profit maximizing decision-making processes by private firms. From the theory, the speed with which firms adjust their capital stocks towards the desired level determines the rate of investment

by a particular firm. Hence, addition to the stock of capital by a firm is determined by marginal product of capital (MP_k) and real rental cost of capital. The firm will maximize its profits when the stock of capital attained is at the point where marginal product of capital (MP_k) equals user cost of capital. The desired stock of capital is derived using the neo-classical production model which is given by:

$$Y = AK^{\beta}L^{1-\beta} \tag{2}$$

Where Y, K, L, and A are the level of output, capital and labor and technology level respectively. To find the marginal product of capital, we differentiate the production function above with respect to capital

$$MPK = \frac{\partial Y}{\partial K} = \beta AK^{1-\beta}L^{1-\beta} \tag{3}$$

$$MPK = \frac{\beta AK^{\beta}L^{1-\beta}}{K} \tag{4}$$

$$MPK = \frac{\beta Y}{K} \tag{5}$$

Let $r =$ cost of capital and $p =$ price

For the firm to maximize profit, the marginal product of capital must be equal to real return of capital $\frac{r}{p}$ which is given by $\frac{\beta Y}{k} = \frac{r}{p}$

$$K = \frac{\beta PY}{r} \tag{6a}$$

Hence the desired stock of capital is given by

$$K^{*} = \frac{\beta P}{r}Y \tag{6b}$$

From 1, the desired stock of capital (investment) is a function of output, price of output, and real cost of capital. That is:

$$K^* = f(P, Y, r) \quad (7)$$

Where $\frac{\partial K}{\partial Y} > 0$ and $\frac{\partial K}{\partial r} < 0$

Investment is the change in capital between two periods which is given by:

$$I = \frac{\beta P}{r} Y - K^*(t - \tau) \quad (8)$$

Where;

The theory assumes that K(t) adjusts instantaneously and fully to $K^*(t)$. The above equation shows that investment varies directly with the level of output and inversely related to the cost of capital. The neo-classical theory also maintains that firms and individuals should also take into account anticipated earning during investment. The neo-classical investment function is completely eliminated due to the assumption that capital adjusts immediately and completely to the desired capital stock. This has led to the criticism that Jorgenson's theory is rather a capital theory and not an investment theory. Other empirical works have also noted that this theory of investment is not fully consistent with the profit-maximization condition.

The Classical theory of investment

According to the classical economists, variations in monetary policy, particularly government domestic debt negatively affects private sector investment. The government debt as a result of borrowing is seen as competing with the private sector for the limited loanable funds that are available for private investment available in the economy. The classical

economists equated national savings to investment. As government increases its expenditure by the changes in monetary policy, it inhibits the ability of the private sector to get access to enough funds to undertake investment. This theory maintains that government crowds out private sector investment. That is where an increased interest rate as results of excessive government borrowing leads to a reduction in private investment spending. According to Barro (1997), there are two possible ways in which the government can crowd-out private sector investment either through a tax cut or rise in government consumption spending. The classical theory indicates that other factors such as the public debt structure, its maturity and composition of ownership determine the behavior of private sector investment in the economy.

However, the classical investment theory is limited in appeal since it failed to perceive the role of profitability, expectations and the cost of capital in analyzing private investment decision in the economy.

The Accelerator principle of investment

This theory was specifically introduced to explain variations in investment over the business cycle. It is under the assumption of constant capital-output ratio implying that changes in output are made possible by changes in the stock of capital. The accelerator principle postulates an increase in the demand for production and the demand for capital and machinery whenever there is an increase in demand for consumer goods. The model makes investment a linear proportion of changes in output. This means that once firms or individuals anticipate an increase in output, the capital stock has to be increased consistent with the new level of output. Therefore, increasing

productivity leads to increasing investment. This model determined investment as the sum of the difference between the existing and the desired capital stock, and the replacement needed to substitute the depreciation of the existing stock (Clark, 1917). The Accelerator principle is mathematically expressed as:

$$K_t^* = vY_t \qquad (9)$$

Where K_t^* is the desired capital stock in period t, v is the desired capital-output ratio which is assumed to be constant and Y_t is the level of output in the same period.

However, in recent years the accelerator principle has witnessed a great deal of criticism. Kaldor argued that we cannot assume a constant capital-output ratio over the business cycle, that is, it is a falsehood that an increase in output or income by an amount must necessarily give rise to a multiple increase in investment. Firms or individuals can utilize their machines which are lying idle before rushing in for new equipment. Also, the theory failed to consider investor's expectations, profitability, and the cost of capital as determinants of investment behavior. If entrepreneurs expect a temporal rise in demand which is brought about by an increase in income or output they will try to meet it by overworking the existing machinery instead of installing a new plant.

The above limitations of the simple accelerator have given rise to the Keynesians to traditionally favor a more general form of the accelerator model called the flexible accelerator model. The flexible accelerator principle which was developed by Goodwin (1951) and Chenery (1952) uses a partial adjustment mechanism. It is a flexible model as it allows investment to vary

with other relevant variables, including those related to uncertainty and market imperfections and the desired increase in capital does not occur instantaneously. The fundamental idea of this model is that as the gap between the existing capital stock and the desired capital stock becomes larger, the greater a firm's rate of investment. In this approach, investment depends on the difference between the actual and the desired capital stock. The speed of adjustment depends on various factors including the size of capital stock changes, the level of capacity utilization, interest rate and technology. The flexible accelerator model is regarded as the most popular of all investment models utilized in applied work because it relies largely on firm-level variables (Ouattara, 2004). But one major drawback of the flexible accelerator principle is its underlying assumption of perfect competition which tends to overlook the role of dynamic expectations of investors behavior concerning future prices, interest rate and output.

McKinnon and Shaw Model

Mckinnon (1973) and Shaw (1973) advocated for a complementary relationship between real money balances and investment in real physical balances. They further asserted that financial deepening enhances high investment and economic growth (Salahuddin & Islam, 2008). Accordingly, higher saving rates finance higher level of investment, leading to higher economic growth. McKinnon and Shaw viewed financial liberalization as a means to foster economic growth via increase in savings through an increase in real deposit rate and a rise in private investment. This model postulates that a high real interest rate policy enhances savings and investment, thereby promoting economic growth. They argued that a rise in real rate of interest

increases saving and total real supply of credit thereby induces a higher volume of investment. McKinnon terms this as 'Conduit Effect'. With this, a significant proportion of investible funds would be available to the private sector to invest. This assertion is in contrast to the neoclassical and Keynesian view that lowering the rate of interest rather stimulates investment and economic growth.

McKinnon and Shaw attributed the poor performance of investment and economic growth in developing countries to interest rate ceilings, high reserve requirements and quantitative restrictions in the credit allocation mechanism. They indicated that government restrictions on the banking system restrain the quantity and quality of investment in an economy. The model has been criticized especially on the dual nature of the effect of interest rates on private investment. Empirical studies have found that increasing interest rates cause a rise in the cost of funding and the associated debt servicing costs, thereby reduces profitability and discourage private investments (Claeys, Moreno, & Suriñach, 2012).

Global trends in remittances

In a global perspective, the top five remittance recipients were India, China, the Philippines, Mexico, and Pakistan, with Nigeria in the sixth place according to a recent publication by the World Bank (World Bank, 2016). In regional wise, East Asia and Pacific and South Asia were the largest recipient of recorded remittances in 2016 with $125.8 billion followed by Latin America and Caribbean and Europe and Central Asia with $78.1 and $38.4 billion respectively. Flows to Sub Saharan Africa was less compared to other regions at $33 billion. This estimated figure of remittances in Sub-Saharan

Africa may be largely due to underreporting or complete lack of data (World Bank, 2016). According to the World Bank reports, remittances to East Asia and Pacific Region, which is the highest recipient of remittances in regional wise is estimated to have risen by 4.2% in 2015 with a decline from 7.4 % in 2014. Similarly, China, which receives the largest remittances globally is estimated to have increased by only 2.6% in 2015 as compared to 4.8 % in 2014. Other regions and countries are all set for growth.

It is evident in empirical works that remittance inflows have outstripped other types of capital inflows into developing countries (Prakash, 2009; Yang, 2011) and have proven to be one of the significant sources of external finance. Remittances continue to have a major impact on recipient economies. For instance, in Philippines, remittances enhance domestic consumption and maintain their current account in surplus (Bangko Sentral & Pilipinas, 2012). It has revitalized local businesses and real estate markets in Vietnamese. In Nigeria and Senegal, a larger proportion of their imports is financed by remittances where one-fourth of imports in Nigeria were solely financed through remittances. Moreover, remittances can reduce the adverse effects of natural disasters (World Bank, 2016).

Trends of remittances in Ghana

The recent upsurge in remittances in Ghana has placed Ghana as one of the highest remittance-receiving countries in the world and second largest recipient in the Sub-Sahara region. According to the World Bank, remittance to Ghana has risen steadily since the 1980s with a rapid increase since 2010. Before 2010, remittance averaged between $500 000 and $1 million (World Bank, 2016). In 2015, the World Bank indicated that Ghana received almost

$5 billion in remittances. The Bank of Ghana in recent release to ghanabusinessnews.com revealed that remittances in 2016 far exceeded tax revenue in that same year. While tax revenue collected in 2016 amounted to GH¢183 million as announced by Ghana Revenue Authority, the total inflow of remittances into Ghana was GH¢8.7 billion or a little over $2 billion in the same year (Ghanabusinessnews, 2016). The amount of remittances in Ghana will be much higher as only a portion of total remittances passes through official channels.

Remittances in Ghana are measured in three ways. The first approach is through the Balance of Payments (BOP) estimates, the second way relies on inferences from the Ghana Living Standards Survey (GLSS) and the last approach focuses on transfers through financial institutions in origin countries (Addison, 2005). The determinants of remittances in Ghana include personal and family situation back home, total earnings, the amount saved, number of dependents at home as well as total number of emigrants. The economic situations in the host countries such exchange rates, political risk and educational level of migrant also determine the amount remitted home. Boakye-Yiadom (2008) linked remittances in Ghana to migration. Remittances have become a very significant component of Ghana's economy as evidenced by the increasing number of formal and informal money transfer institutions in Ghana. A survey undertaken in March 2003 by the Sussex Centre for Migration Research in Ghana reveals three major uses of remittances in Ghana: Firstly, remittances are used to satisfy individual needs, for example consumption needs, organizing funerals and other important social needs. Secondly, to support migrant's community project and lastly, for

productive investments. The IEA report in 2003 indicated that currently, remittances in Ghana are mostly used to set up small-scale businesses (Quartey & Blankson, 2003).

The major sources of Ghana's remittances include United States and Canada which accounted for about 62.4% of total remittances. The other sources are United Kingdom (16.2%), Europe (13.4%), other economies (3.8%), Economic Community of West Africa states (ECOWAS) (2.6%) and the rest of Africa (1.7%) (Quartey, 2006). Remittances have played an important role in the economic growth and development as wells as contributed to poverty alleviation and improvement of household welfare in Ghana. Quartey revealed that in Ghana, remittances serve as a source of income smoothing and better welfare. These inflows are utilized for both consumption and investment purposes that impacted positively on welfare. Adams et al., (2008) concluded that international remittances diminish poverty in Ghana. Remittances in Ghana have also served as a significant means of maintaining ties between migrant and family relation (Akyeampong, 2000). Addison (2005) also asserted that remittances to Ghana were larger and steadier than FDI and ODA and have contributed in improving the country's balance of payment in his study of macroeconomic impact of remittances.

The flow of remittances in Ghana is counter-cyclical in nature which rises in times of economic distress and smoothing consumption (Owiafe, 2008). Indeed, most researchers have identified the contribution of remittances to Ghana but little is known in terms of a comprehensive study that assesses the relationship between remittances, infrastructure and private investment in Ghana.

Determinants of Remittances

Massey, Durand and Pren (2011) posit that "the propensity to remit and save is not uniform among migrants, but varies with personal, household and trip characteristics including structural economic condition''. The amount of remittance flows by migrants hinges largely on migrants' ability to remit, their motivation and willingness (OECD, 2006). The ability to remit depends on their income and savings. Similarly, their motivation and willingness are influenced by the duration of migration and the family situation at home and in the host country. Income and savings of the migrants will have positive relationship with remittances. High income migrants will be more likely to remit than migrants with lower income. The migrant's family situation will also motivate the frequency and the amount of remittances to be sent. In a situation where there are large number of dependent siblings in the household, there will be high propensity to remit and vice versa. With regards to duration, empirical literature has suggested a significant inverse relationship between duration and amount of remittances sent. This means that migrants have less tendency to remit as they stay longer in their country of destination and vice versa.

Other determinants include migrant legal status and migrant educational level. Amuedo-Dorantes and Pozo (2006) indicate that illegal migrants remit 3% higher than legal migrants as illegal migrants do not feel safe in the host country and as such has the high tendency to remit more with the motive of returning home at any time. Moreover, the purposes and uses of the remittances are also a significant determinant.

Macroeconomic factors also influence the level of remittances. The literature treats these factors separately as determinants of remittances. Factors such as financial costs associated with remitting money, number of migrant workers, wage rate differentials, the economic climate in the host and home country, inflation, exchange rate movements, and government policies and political stability in the receiving country have been identified as the major macroeconomic determinants of remittances (Buch & Kuckulenz, 2004; Pozo, 2005). High financial cost has been recognized to have a negative effect on the amount remitted. For instance, Freund and Spatafora (2008) indicated that high cost of transaction by money transfer institutions causes a decline in the amount of remittance. The World Bank reveals that average remittance costs in SSA rose from 9.7 % in 2016 Q1 to 9.8 % in 2017 Q1 with an average cost of $45 for every transaction of $200 in Ghana and Nigeria which adversely affected the amount remitted in the region (World Bank, 2017). Hence, as part of the Sustainable Development Goals (SDGs), efforts have been made to reduce transactional cost of remittance to induce more inflow of funds. It is obvious that the greater the number of migrant workers, the larger the volume of remittances in the home country.

A country with a greater stock of emigrants receives on average greater volume of remittances than the others (Frankel, 2011; Freund & Spatafora, 2008; Lueth & Ruiz-Arranz, 2008). The stock of migrants rises in a situation where there is high level of unemployment and high wage differential between the countries of origin and host countries (Carling, 2008). Moreover, the economic climate in the country of destination and the country of origin significantly affect the movements in remittances. Favorable

economic conditions in the host country raises migrant prospects of employment and high earnings leading to high tendency to remit more (IMF, 2005). Similarly, negative shocks in the country of origin may increase the need for high level of remittances especially in a situation where remittances are an important source of income for migrant family relations (Ratha, 2003).

Other macroeconomic instability such as high inflation, exchange rate restrictions adversely affect the volume of remittances by migrant. On the other hand, risk factors as manifested in political instability, lawlessness, poor infrastructure, unfavorable government policies in the home country may have similar negative effects on the flow of remittances especially for investment purposes. Recently, incidence of natural disasters has been identified in cross country studies as a macroeconomic determinant of remittance. David (2010), Mohapatra, Joseph and Ratha (2009) and Yang (2008) revealed that remittances rise substantially after an occurrence of natural disasters in the home country. This suggests that remittances serve as a hedge to households against natural shock.

Finally, a well-developed financial sector is also an incentive to increase the volume of remittances. Countries with greater financial sector development induce an inflow of remittances as it becomes easier and less costly to remit and receive.

Overview of infrastructure situation in Ghana

Even though, the Ghanaian economy has experienced a steady growth in development for the past decades where the Ghana Statistical Service pegged the Gross Domestic Product (GDP) of the country at 6.9 % in 2014 (GSS, 2014), this impressive growth has not translated into the provision of

requisite infrastructure to further advance the socio-economic development of a country newly promoted to lower middle-income status. Ghana, compared with other low-income countries is doing quite well in relation to advanced infrastructure development policies such as the Infrastructure Investment Fund (IIF) to provide financial resources to engage in management, coordination and investment in a diversified portfolio of infrastructural projects in Ghana for national development (The Africa Infrastructure Country Diagnostic Report, 2010). In fact, the country's location in the West African sub-region provides an opportunity for the development of the country's infrastructure as an incentive for regional and international trade as well as foreign direct investment. Despite these efforts, Ghana's infrastructure is far below the levels found in middle-income countries in Africa.

The Ghana Institution of Engineers (GhIE) in a recent report has described Ghana's road infrastructure as poor and incapable to meet international standards. The decline in Ghana's infrastructure investment was partly due to low funds, higher informal sector and high expectation of the private sector to be actively involved in provision of infrastructure. Africa Infrastructure Country Diagnostic (AICD) report revealed that the country faced a large US$1.1 billion efficiency gap per year in infrastructure which represented a 7.5 per cent of Gross Domestic Product (GDP) in 2009 (AICD,2010).

Moreover, low capital expenditure as against high recurrent expenditure, decline in revenue mobilization and foreign aid and other developmental assistance has thwarted the effort of the government to actively invest in infrastructure. For instance, Ghana spends an average of 3 to 4 % of

GDP on infrastructure development as against the 7 % recommended by the World Bank in 2006. To deal with the massive deficit in infrastructure in Ghana, it has become imperative for government of Ghana to be proactive and discover other possible ways to finance infrastructure projects in the country. Hence, the need for the government to collaborate with the private sector to fill the infrastructure gap. Mr Seth Tekper, the former finance minister, further reiterated that the infrastructure deficit in the country cannot be met by the public sector alone as the country grapples with limited budget resources but through the Public Private Partnership (PPP) initiative the country can close the gap. The PPP is a more prudent way to meet Ghana's infrastructure needs rather than the conventional public funding of major infrastructure projects. It is of this reasons that the government of Ghana is receiving assistance from the World Bank through the preparation of the legal framework and other initiatives to develop a strong PPP policy to the benefits of the parties involved. In order to ensure proper capacity building at all levels and an effective implementation of the PPP policy, the World Bank has provided an amount of US$30 million to fully commence the program in 2017 (World Bank, 2006).

To this end, the government is required to ensure that the necessary environment is created for public private collaboration to provide the needed infrastructure to attract private investment through remittances for economic growth.

Empirical Literature Review

Remittances and Private investment

There are a number of studies which have been carried out to find the relationship between remittances and investment which are mainly cross-country but few comparative studies on the impact of remittances and infrastructure on private investment. The findings of these studies tend to give conflicting results depending on the sample and the econometric method used by authors. Some studies have shown that remittances have no impact on private investment levels. On the other hand, some studies have shown little evidence to prove strong relationship between remittances and private investment. Most empirical works have argued that remittances were primarily spent on consumption of goods and repayment of debts (Carletto, Davis, Stampini, Trento, & Zezza, 2004; Mishra, 2005). The biases towards consumption have been attributed to inadequate infrastructure in stimulating the use of remittances for private investment. For instance, Carletto et al., (2005) argue that poor rural infrastructure and low public investment are mainly responsible for low levels of investment activities through remittances. As indicated by the World Bank (2006), remittances are more effective in both raising investment and stimulating economic growth in countries with adequate infrastructure, human capital, strong institutions, and good policy environments.

Taking 73 developing countries over the period 1975 to 2000, Giuliano and Ruiz-Arranz (2005) applied the Generalized Method of Moments (GMM) approach to determine the relationship between remittances and economic growth focusing on how the interaction between remittances and financial

development enhances a country's capacity to channel remittances into investment activities. The study found that in countries where the financial markets are underdeveloped, remittance enhances investment and economic growth. The results are likely not to be generalized as the heterogeneity among countries with respect to the nature and considerable differences that exist across countries will impact on the validity of their results.

Besides, in another comprehensive study to address the question of whether government policies aimed at improving the business environment could influence the use of remittances for investment activities, Calderon, Fajnzylber and Lopez (2008) utilized the multiple regression models with the use of the simple accelerator model relating investment to output growth to examine the remittance-investment nexus. To them, human capital complements remittances in the capital accumulation process. The findings of the study indicated that remittances and investment nexus positively correlated with institutional quality and policy environment. The authors argued that financial development and remittances are substitutes since remittances were found to negatively relate to financial development. The results cannot be considered as conclusive because the multiple regression model employed provides bias and inconsistent results in the case of endogeniety problems as remittances are likely to be correlated with other (internal) variables, but they are certainly suggestive as they argued.

Similar to the study of Paolo Giuliano and Ruiz-Arranz (2005); Bjuggren, Dzansi and Shukur (2010) examined the impact of remittances on investment using 79 developing countries using dynamic panel approach. They asserted that remittances have become significant external sources of

funds for consumption and investment and emphasized the key role of financial and institutional framework interaction with remittances. The study results indicated that remittances, high quality institutional framework and well-developed credit market raise investment among the developing countries considered. However, the study was grounded on aggregate investment but existing theories and evidence argued that both public and private investments are influenced by different factors. This will likely make their results not reliable for specific policy implementation.

In examining the contribution of Financial Sector Development (FSD) in the remittances-investment nexus, Mata and Traça (2008) used longitudinal data of 70 countries for the period 1970-2004 from the World Bank and Levine, Aghion and Durlauf (2005) financial indicators. The findings of the study revealed a robust quadratic effect. That is, in a case where FSD is low, more FSD induce a positive impact of remittances on investment. However, as FSD continues to rise, remittances positively influence investment but at decreasing rate. The study employed panel data methodology with fixed country effects. The results of the study are likely to be biased and inconsistent as the methodology employed will fail to deal with the endogeniety problem resulting from the reverse causality between remittances and investment.

In his study, Balde (2011) used Ordinary Least Square (OLS) and the instrumental variables technique to study the macroeconomic impact of remittances on savings and investment in case of Sub-Saharan Africa (SSA). The results of the study revealed that remittances stimulate savings and investment in SSA than foreign aid where the coefficient on the remittances variable was about 6 to 7 times higher than foreign aid coefficient.

For Kenya, Cherono (2013) examined the impact of remittances and financial development on private investment. In identifying the impact, data were collected from IMF African department database and Kenya National Bureau of Statistics. The time period selected was from 1980 to 2011. Using Error Correction Model (ECM), findings of the study confirmed a significant positive relationship between remittances and investment in Kenya. The joint effect of remittances and financial sector development was found to be positive and statistically significant. He further argued that remittances complement capital allocation in the credit market.

In order to determine the effect of remittances on the level of investment in Barbados, Griffith, Boucher and Mccaskie (2008) indicated that remittances are positively related with real investment in Barbados both in the short-run and long-run. The study revealed that the positive influence of remittances to investment and growth in Barbados requires the proper functioning of the systems and efficiency in the channels of remittance flows.

On the contrary, Hrushikesh and Mallick (2012) conducted a study in India to examine the effects of remittances on private investment in India using an error correction model and the Dynamic Ordinary Least Squares (DOLS) procedure developed by Stock Watson (1993). The conclusion of the study was that remittances negatively affect private investment in India. Due to this decline in private investment, he advocated for an effective government policy to influence the use of remittances for private investment.

Moreover, Aitymbetov (2006) employed a dynamic demand model to analyze the macroeconomic effects of remittances on investment in Kyrgyzstan and posited that approximately 10 % of remittances were utilized

in the form of investment implying that remittances positively impact on investment in Kyrgyzstan economy. He further asserted that $100 rise in income could lead to a $230 in income. Hence, the conclusion of his study also provides empirical evidence that through investment, remittances positively enhances economic growth.

In determining the micro-economic impact of remittances on marginal spending behavior of households on various consumption and investment goods by employing nationally-representative household survey from Ghana, Adams et al., (2008) came up with two results in their study. In the first place, they found that remittance recipients spend less at the margin on food which is a key consumption good in contrast with what they would have used without remittances. In the second place, recipient of remittances channeled a large proportion of it at the margin on investment good like education in contrast with what they would have spent without remittances. The findings of the study support the hypothesis that remittances help improve investment especially in human capital. The study controlled for selection bias and endogeniety.

Within investment research spheres, Vasco (2006) aims at examining the impact of migration and remittances on the likelihood of rural households owning a business for Ecuador using Living Standard Measurement Survey 2005-2006. The findings of the study reveal that neither migration nor remittances have any impact on the likelihood of setting up business but education and access to credit have a significant positive effect on the probability of setting up a business. Vasco further indicated that poor infrastructure is limiting the use of remittances in productive activities.

Another vital study carried out is the study of Leon-Ledesm and Piracha (2004). For this study, Leon-Ledesm and Piracha considered 11 transition economies of Eastern Europe for the period 1990-1999. They affirmed that remittances positively enhance both productivity and employment through investment.

Ratha and Sanket (2007) viewed the influence of remittances on poverty, growth, real wages and external competitiveness. They argued that in countries with a good investment climate, remittances are mostly utilized as funds for investment in small businesses. The study confirms the findings in Moldovan by Fetiniuc (2013) using household data for the year, 2008, that receivers of remittance positively enhance investment in small business by employing Probit model and Propensity Score Matching approach.

For Nigeria, Osili (2004) argued that migrants have high tendency to spend their income on investment than on consumption in his study on how migrants spend their income in Nigeria. He further suggested that migrants with higher incomes channel them in housing.

Furthermore, in determining the effects on the Romanian economy in terms of consumption and investment, Încalțărău (2012) indicated that remittances contribute significantly to investment than to consumption in Romania. The explanation behind the results consists of households' behavior which considers migration as an opportunity for accumulating capital in order to achieve an important pre-established objective. This is corroborated by IASCM (2011) findings that migration is a means of attaining a certain goal to save money for investment purposes rather than consumption.

Khan (2017) examines the nexus between remittances inflow and private investment for Pakistan, India, Sri-lanka, Nepal and Bangladesh for the period 1990 to 2014. The study used Panel Autoregressive Distributive Lags model (PARDL) to determine the long-run and short-run relationship between remittances and private investment. He concluded that there is a positive relationship between remittances inflow and private investment. He further indicated that there is a negative relationship between private investment and low business freedom in Pakistan, Bangladesh, Nepal, Sri-lanka and India.

Okuda Henry (2013) employed the Generalized Method of Moments (GMM) estimation method to determine the effect of remittance inflows on domestic investment in sub-Saharan Africa. The conclusion drawn from the study is that remittances crowd out domestic investment in Sub-Saharan Africa, such that a 10% increase in remittances from emigrant workers led to a 20.9 % decline in domestic investment in sub-Saharan Africa.

Anupam Das (2009) conducted a comparative study of the effect of remittance inflows and grants on capital formation and economic growth in Arab states. The data used in the study comprises of four countries receiving remittances from oil-rich Arab states. It is revealed that except Bangladesh, remittances have no relationship with investment. However, grants are positively related to investment in Pakistan and Syria, an inverse correlation with investment in Egypt and no effect in Bangladesh.

Using the system GMM methodology, Kondongo and Ojah (2016) indicate that remittances inflows positively influence the industrial sector's value addition and adversely affect services sector's value addition; and that

remittances flows are negatively related to the industrial sector but positively related to the services sector.

Infrastructure and Private Investment

Marbuah and Frimpong (2010) utilize the correction techniques within an Autoregressive Distributed Lag (ARDL) framework to explore the factors that affect private investment in Ghana. The results of the study indicated that, in the short-run, private investment is positively related to public investment in infrastructure, inflation, real interest rate, openness, real exchange rate and a regime of constitutional rule. However, in the long run, real output, inflation, real interest rate, openness and real exchange rate positively affect private investment while external debt adversely affect private investment. He suggested that provision of infrastructure by government should be of priority.

Asante (2000) utilizes time series analysis coupled with cross-sectional analysis to investigate the determinants of private investment in Ghana. The study found out that public investment in infrastructural projects, real interest rate and real exchange rate had a statistically positive effect on private investment in Ghana but political instability and growth rate of real GDP had a negative relationship with private investment in Ghana. He recommended that the government should developed infrastructure to promote private investment in Ghana. His results could have improved if he had employed the Error Correction Model (ECM) instead of the static OLS.

In a related study, Molapo and Damane (2015) utilized the Autoregressive Distributed Lag (ARDL) framework to explore the determinant of private investment in Lesotho over the period 1982–2013.

They found a positive public-private investment relationship level confirming the "crowding-in" effect of public investment on private investment. Their Granger causality test shows a bidirectional causality between public investment and private investment and recommended the government to laying down infrastructure to crowd in private investment in Lesotho.

Akpalu (2002) tried to fill the gap in the literature by employing annual time series data from 1970–1994 to investigate the determinants of private investment. Using the Engle-Granger Two Step procedure and the Johansen multivariate test, the study indicated that public investment in infrastructure crowd-out private investment. He also found significant negative relationship between cost of capital and private investment in both the short and long run.

With regards to Nigeria, Kanu (2015) investigated the relationship between capital expenditures and gross fixed capital formation by using the Vector Auto Regression technique as well as Granger causality tests. The results of the study revealed a negative significant relationship between capital expenditure and Gross Fixed Capital Formation in Nigeria.

Summary

This chapter dealt with literature (theoretical and empirical) on the effects of remittances and infrastructure on private investment and other concepts centering on private investment in Ghana. The study realized that the empirical literature reviewed had different results. The varying results can be attributed to the fact that most of these studies were multi-country studies and largely grounded on aggregate or gross investment but gross investment is composed of public and private investments. This indicates that findings from multi-country studies cannot be directly applied to specific countries like

Ghana since findings from these studies may not accurately and adequately reflect the specific country's experience. Also, empirical evidence and theory has revealed that both public and private investments are influenced by different factors .(Matsila, 2014; Aizenman & Marion, (1999). But these studies failed to disaggregate gross investment into public and private investment, as such disaggregation is paramount in identifying appropriate policy mixes targeted at stimulating private investment and this impacted on the validity of their results.

Finally, from the empirical literature reviewed, it was indicated that no specific study has looked at the joint effect of remittances and infrastructure on private investment in Ghana. Hence, this study will fill the gap by examining the joint effect of remittance and infrastructure on private investment in Ghana.

CHAPTER THREE

RESEARCH METHODS

Introduction

This chapter specifically outlines the detailed description of the research design adopted for the study, theoretical and empirical specification of the model that capture the relationship between remittances, infrastructure and private investment. It also includes definition, measurement and justification of the variables in the model, data source, and estimation technique. The chapter also focuses on the estimation technique with emphasis on the stationarity test, cointegration test using the bounds test approach, Granger causality test, the Autoregressive Distributed Lag model, and finally, how the model was estimated using the ARDL procedure.

Research design

According to Harwell (2011), the research design of the study reflects the research process in entirety ranging from conceptualizing a problem to the literature review, research questions, methods and conclusions. The study was situated within the context and assumptions of positivist philosophy which support the use of quantitative method. The fundamental assumptions of the positivist philosophy is that as knowledge is objective externally, researchers take strictly neutral and detached positions towards the phenomenon under investigation and it ensures that personal biases of the researcher do not influence outcome of the study. The positivist also believes that reality is stable and can be observed and described from an impartial viewpoint without interfering with the phenomena being studied (Levine, 1997).

The three main reasons for Social Science research as identified by Babie (2013) includes: exploratory, descriptive and explanatory. According to her, the exploratory research is conducted because a problem has not been clearly defined and the results are neither very useful for decision making by themselves nor generalization to the population at large, however, they provide significant insight into a given situation. The descriptive research also has its objective to describe things and answers the question ‘‘who’’ but there are always restrictions to that especially where one variable affects another and there are often data limitations and the need to make a decision within a short period of time.

Finally, Maxwell and Mittapalli (2007) indicated that explanatory research has traditionally been quantitative in nature and implies an intention to explain, rather than simply describe the phenomenon being studied. Ideally, the research design for a study can be quantitative or qualitative. Whereas qualitative research hinges on discovering and understanding the perspective, experiences and thoughts of participants–that is explores the meaning, purpose or reality (Haitt, 1986), the quantitative research method makes an effort to maximize objectivity, reliability and generalizations of research findings and are usually interested in predictions (Guba, Lincoln, & others, 1994). The study adopted the quantitative approach for the data analysis since this approach is widely described as deductive in nature where the conclusions from tests of hypothesis lead to general inferences about characteristics of the population. Guba and Lincoln (1994) further opined that quantitative research is characterized as assuming there is a single “truth” that exists independent of human perception. The study seeks to determine the direction of causality

between remittances, infrastructure and private investment and also examine the effects of remittances and infrastructure on private investment in Ghana.

The hypotheses of the study were either rejected or confirmed based on the quantitative and econometric methods. The internal validity of the study was attained when the study produced a single unambiguous explanation for the relationship between remittances, infrastructure and private investment indicators employed in the study whiles the external validity deals with the generalization of the findings of the research which concerns whether or not the findings of the study can be applied to a comparable unit of analysis or other countries. With the positive philosophy approach, the results of this study are objective to explain the relationship for Ghana.

Theoretical model

There are a lot of models used in the literature to analyze the determinants of investment. The study adopted the Flexible Accelerator model of investment which is widely employed in most empirical research in developing countries (Ouattara, 2004). The accelerator principle is most appropriate for developing countries as a result of institutional and structural factors present in most developing countries such as less developed financial markets, foreign exchange constraints and other market imperfections (Blejer & Khan, 1984). The theoretical model for the study is similar to Erden and Holcombe (2005) gross investment function with some modifications. The Flexible Accelerator model removes one of the major drawbacks of the simple accelerator principle that the capital stock is optimally adjusted without any time lag. Hence, there are lags in the adjustment process between the level of output and the level of capital stock.

The Model begins with the assumption that the desired capital-output of a firm is constant. This implies that the desired capital stock of any period is proportional to the level of output in time t, which is given by:

$$K_t^* = \omega Y_t \qquad (10)$$

Where K_t^* = desired capital stock by the private sector in period t, ω = desired capital-output ratio, and Y_t = output at period t

From equation (10), the existence of technical constraints and other issues such as the time to plan, decide and build new capital will not permit the actual stock of private capital to adjust completely to attain the desired level. Hence, according to Salmon (1982), through one period quadratic adjustment, we can introduce the dynamic structure of the private capital behavior as follows:

$$\gamma(K_t - K_t^*)^2 + (1-\gamma)((K_t - K_{t-1}^*)^2 = 0 \qquad (11)$$

Where K_t = actual private capital stock. The first term shows the cost of disequilibrium, and the second term the cost of adjusting toward equilibrium.

We then minimize equation (11) respect to K_t to get the partial adjustment mechanism.

$$\Delta I = \gamma(K_t^* - K_{t-1}) \qquad (12)$$

Where $\Delta I = K_t - K_{t-1}$, K_t^* is the desired capital stock, k_t is actual capital stock in the current period, and γ is the coefficient of adjustment, such that $0 < \gamma < 1$.

From equation (12) investment is, thus, proportional to the gap between the desired capital and actual capital of a firm and defined conventionally as:

$$PINV_t = (K_t - K_{t-1}) + \sigma K_{t-1} \qquad (13)$$

Where $PINV_t(private\ investment)$ be proxy for capital stock, σ =depreciation rate of private capital stock.

We simplify equation (13) as follows:

$$PINV_t = (K_t - K_{t-1}) + \sigma K_{t-1} \quad (14)$$

$$PINV_t = K_t - K_{t-1} + \sigma K_{t-1} \quad (15)$$

We then simplify equation (15) in a standard lag-operator notation as:

$$PINV_t = K_t - FK_t + \sigma K_{t-1} \quad (16)$$

$$PINV_t = K_t - (1 - \sigma)FK_t \quad (17)$$

$$PINV_t = [1 - (1 - \sigma)F]K_t \quad (18)$$

Where F is the lag-operator

We can write equation (18) in a steady state as:

$$PINV_t^* = [1 - (1 - \sigma)F]K_t^* \quad (19)$$

Re-specifying (13) using $PINV = \gamma(PINV_t^* - PINV_{t-1})$ (20)

Where $PINV = PINV_t - PINV_{t-1}$

We then augment equation (20) by assuming that remittances, infrastructure, their interaction term and other macroeconomic variables affect the speed of adjustment. Therefore:

$$\gamma = bo + \frac{1}{PINV_t - PINV_{t-1}}(b_1 REM + b_2 INFRA + b_3 REM * INFRA + b_5 X_t)$$

(21)

Where $bo =$ intercept, $REM =$ Remittances, $INFRA =$ Infrastructure, $REM * INFRA =$ interaction of remittances and infrastructure and $X_t =$ Vector of control variables.

Putting (21) into (20) and rearrange gives

$$PINV = b_0(PINV_t^* - PINV_{t-1}) + (b_1REM + b_2INFRA + b_3REM * INFRA + b_5X_t) \quad (22)$$

Where $PINV = PINV_t - PINV_{t-1}$

Putting equation (10) into equation (19) gives:

$$PINV_t^* = [1 - (1 - \sigma)F]Y_t^* \quad (23)$$

Putting equation (23) into equation (22) and rearranging yields the dynamic private investment equation.

$$PINV_t = \varphi b_0[1 - (1 - \sigma)F]Y_t^* + (1 - b_0)DINV_{t-1} + b_1REM_t + b_2INFRA_t + b_3REM * INFRA_t + b_5X_t + \varepsilon_t \quad (24)$$

Empirical Model Specification

If we let $X_t = f(DS, RIR, EXDEBT, GDPG, TO)$ and assume linearity in the relationship, the functional form of (24) which gives us the long-run equilibrium equation (cointegration) can be written as

$$PINV_t = \beta_0 + \beta_1 lnREM_t + \beta_2 lnDS_t + \beta_3 RIR_t + \beta_4 GDPG_t + \beta_5 TO_t + \beta_6 lnINFRA + \beta_7 lnEXDEBT + \beta_8 REM * INFRA_t + \varepsilon_t \quad (25)$$

Where $PINV$ is private investment, REM is personal remittances, DS is domestic savings,RIR is real interest rate which measures the user cost of capital ,$GDPG$ measures the Gross Domestic Product Growth ,TO measures trade openness, $EXDEBT$ is external debt, $REM * INFRA$ is the interaction term which measures how infrastructure will direct remittances into private investment. The coefficients $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6 \ \beta_7 \ \beta_8$ are the parameters of the respective variables in the model, β_0 is the constant term, ε_t is the error

term and t represents time. All the variables in equation (25) have their values in logs except Gross Domestic Product Growth, real interest rate and trade openness.

Definition, Measurement of Variables and Expectations of Signs

The following measurement and operational definitions were used for the variables being examined to achieve the purpose of this study. The variables included in the study are real interest rate, external debt, GDP growth, remittances, government capital expenditure as a proxy for infrastructure, trade openness, domestic savings, and gross fixed capital formation (private sector) as a proxy for private investment. The choice of the variables was based on existing literature, economic theory, available data as well as their significance to the study. The rationale for the expected signs of the respective coefficient of the variables is explained in the description of the variables below.

Gross Domestic Product Growth (GDPG)

GDP measures the final value of all goods and services produced within a country usually a year. The GDPG tells us how fast a country's economy is growing by comparing real GDP from one year/quarter to the next. The growth of GDP provides an indication about the investment opportunities open to the economy. In an economy with a high real growth, it has the potential increase in profit and this induces investors to make more investment. Konor (2014) indicates that GDPG enhances private investment. In this study, we expect a positive relationship between GDPG and private investment.

Remittances

This is broadly defined as personal monetary transfers that migrant workers make to their relatives back in their country of origin (IOM, 2009). It can be in the form of migrants' salaries and wages earned in the host countries transferred to the home country. Remittances are more effective in raising private investment in the recipient countries. It can also increase private investments by alleviating credit constraints in a country. Singh, Lee and Haacker (2009) indicated that remittances could enhance private investment by minimizing the volatility of consumption.

Trade openness

Trade openness is defined as the extent to which nationals and foreigners can undertake trade without artificial costs (Government imposed cost) as well as delays and uncertainty. This is mostly calculated as export plus import divided by GDP. However, this conventional method has been criticized as being one-dimensional measure of trade openness which focuses only at the relative position of a country's trade performance compared to its domestic economy. Other weaknesses are possible effects of resource endowment, size of economy, technology and the level of trade restrictions (Cantah, Brafu-Insaidoo, Wiafe, & Adams, 2016). Therefore, this study will employ the Composite Trade Intensity (CTI) which captures the combination of Trade intensity (TI) and Relative World Trade Intensity (RWTI) as a measure of trade openness as suggested and adopted by Squalli and Wilson (2006). Squalli and Wilson derived the CTI index which combines TI and RWTI as follows:

$$CTI = \frac{1}{X}[TI \times RWTI] \quad (26)$$

$$CTI = \frac{1}{\bar{X}}\left[\frac{(X+M)_i}{GDP_i} \times \frac{(X+M)_i}{\sum_{j=1}^{n}(X+M)_j}\right] \quad (27)$$

But $\bar{X}=\frac{1}{n}$ and $\sum_{j=1}^{n}(X+M)_j = 2(X+M)_j$ (28)

$$CTI = \frac{n[(X+M)_i \times (X+M)_i]}{GDP_i 2(X+M)_i} \quad (29)$$

$$CTI = \frac{(X+M)_i{}^2}{GDP_i 2(X+M)_i} \quad (30)$$

$$CTI = \frac{(X+M)_i}{2(GDP_i)} \quad (31)$$

Where CTI is the Composite Trade Intensity, X_i is the exports of a country of interest in this study , M_i is imports, GDP_i is gross domestic product of a country of interest, and n is the sample of countries considered in the study. n is equal to one since this study is country–specific study.

The use of the new measure (CTI) overcomes the drawback of the conventional method since it captures both dimensions of trade openness that is TI and Relative World Trade Intensity (RWTI). Bibi, Khan and Bibi (2012) asserted that trade openness helps in creating more chances for net flow of capital out of the economy, hence, it negatively affects private investment. Trade openness makes domestic countries have access to international market and also prepares suitable conditions for multiple countries to invest in these countries. Trade openness in this study is expected to be either positively or negatively related to private investment.

Infrastructure

Infrastructure is generally taken to mean a country's public capital. It comprises community buildings such as hospitals and schools; transport nodes of airports, seaports, rail and road networks; utility services such as water,

power and waste services. Capital expenditure is used as a proxy for infrastructure in this study. Capital expenditures are outlays by government on infrastructure. Governments view capital expenditure as the means to attract substantial private sector investment. Molapo and Damane (2015) indicated that public capital expenditure enhances private investment since government provision of basic infrastructures such as roads, energy and telecommunication create conducive environment for investment. Infrastructure is expected to be positively related to private investment in this study.

Real Interest rate

This is an important factor in any investment decision by the private sector. This is the rate of interest which is adjusted for either current or expected inflation. The user cost of capital (real interest rate) was normally considered by the Neo-Classical Economists. The effect of real interest rate on private investment is expected to be either positive or negative. A higher real interest rate means a high cost of capital, hence, a decrease in private investment. Kaputo (2011) indicated that real interest rate has a significant negative effect on private investment in the long-run. On the other hand, a lower rate of interest will encourage private economic agents to undertake investment activities as a result of low cost of borrowing investment funds. However, according to the McKinnon-Shaw complementarity hypothesis, there is a positive relationship between the real interest rate and private investment. For instance, in Nigeria, Agu (2015) asserted that real rate of return on bank deposits has a significant positive effect on investment. In this study, real interest rate is expected to be negatively related to private investment.

Domestic savings

This is computed as GDP less final consumption expenditure. Investors can borrow such domestic savings or use their own savings to finance their investment. Hence, when domestic savings increases, it is expected that private investment will also increase as more funds will be available for investors with the assumptions that funds borrowed directly, go into investment. Therefore, the coefficient of domestic savings is expected to have a positive relationship with private investment.

External Debt

This refers to the part of the country's debt that was borrowed from foreign lenders including governments, international financial institutions and commercial banks. External debt plays an important role in the determination of the level of private investment in country. Empirical works have suggested that too much dependence on external debt can adversely affect private investment (Naa-Idar, Ayentimi, & Frimpong, 2012; Ezeabasili & Nwakoby 2013). Also, an increasing debt service may cause a rise in government's interest bill and budget deficit as a result. External debt is used to determine the macroeconomic performance on the level of private investment. External debt is expected to inhibit private investment.

Estimation techniques

For us to understand the relationship between remittances, infrastructure and private investment, time series modeling is employed. There are several procedures to be undertaken initially in times series modeling to determine the regression model to be estimated in order to achieve the stated objectives of the study. Below are some of the procedures.

Unit roots test

The unit root test is used to test for the stationarity of each of the variables included in the model. Time series data are likely to be non-stationary in the level forms and that regression with non-stationary times series generate spurious regression. Spurious regression occurs when the regression results reveal a highly and statistically significant relationship among the variables when in actual sense, no relationship exists. A time series is stationary if its statistical properties such as the mean and variance are constant over time and the covariance only depends on the gap between the two periods and not on the exact time at which the covariance is calculated (Gujarati, 2003). If the series is stationary, then it has no unit root. To avoid the estimated coefficients from being spurious, we employ the Augmented Dickey-Fully (ADF) and the Phillip-Perron (PP) test. The equation to be estimated with the ADF is as follows:

$$\Delta X_t = \beta + \delta_t + \rho X_{t-1} + \sum_{i=1}^{\rho} \theta_i \Delta X_{t-1} + \epsilon_t \qquad (32)$$

Where ϵ_t is a pure white noise error term, and Δ is the first difference operator, X_t denoting the series at time t, ρ and δ are the parameters to be estimated.

The null and the alternative hypothesis for the test is given by:

$H_o: \rho = 0$ Has unit root

$H_1: \rho < 0$ Has no unit root

Therefore, the series is stationary if the t statistics is more negative than the critical values, otherwise, we fail to reject the null hypothesis and conclude that the series is non-stationary, meaning it has unit root. The ADF

test does not take into consideration heteroskedasticity and non-normality and unable to discriminate between stationary and non-stationary series which are associated with high degree of autocorrelation. Hence, the PP is adopted to deal with this problem. The PP suggested a non-parametric test as an alternative to the ADF test. The PP uses non-parametric methods to adjust for serial correlation and endogeneity of the explanatory variables which prevent the loss of observation implied by the ADF test. One advantage of the PP test over the ADF test is that the PP test is robust to general forms of heteroskedastic in the error term. The PP test involves fitting the regression:

$$Y_t = \alpha + \rho Y_{i-1} + \varepsilon_i \quad (33)$$

The null hypothesis is $\rho = 0$ against the alternative $\rho \neq 0$

Therefore, in this study, both the ADF and the PP test are used to check for stationarity.

Granger Causality Test

The first objective of the study is to determine the causality between remittances and private investment and between infrastructure and private investment in Ghana. Granger causality test was carried out to achieve this objective. Granger causality is a statistical hypothesis test used in determining whether one series is useful in forecasting the other. Hence, the Granger causality deals with the track of variables under consideration. Also, if cointegration exists between two variables, then Granger causality indicates that there must be either unidirectional or bidirectional Granger causality between these variables in the long-run. The null hypothesis is that the variable does not Granger cause the other variable. For instance, if event

remittances happen before event private investment, then it is likely that remittances are causing private investment (that is if remittances Granger cause private investment then changes in remittances should lead to a change in private investment). We are dealing with multilateral causality since there are several variables in the study.

To determine the causality in the presence of cointegrating vectors, the Granger causality is conducted based on the following:

$$\Delta Y_t = \gamma_0 + \sum_{i=1}^{\rho} \beta_{1i} \Delta Y_{t-1} + \sum_{i=0}^{\rho} \vartheta_{1i} \Delta X_{t-1} + \omega_{1i} ECT_{t-1} + u_t \quad (34)$$

$$\Delta X_t = \gamma_0 + \sum_{i=1}^{\rho} \beta_{2i} \Delta X_{t-1} + \sum_{i=0}^{\rho} \vartheta_{2i} \Delta Y_{t-1} + \omega_{2i} ECT_{t-1} + v_t \quad (35)$$

Where ΔY and ΔX are the non-stationary dependent and independent variables, ECT is the error correction term, ω_{1i} and ω_{2i} are the speed of adjustment and ρ is the optimal lag order.

To find out whether the independent variable (X) Granger-cause the dependent variable (Y) in equation (34), the joint significance of the lagged dynamic terms is examined by testing the null hypothesis:

$H_0: \vartheta_{1i} = 0$, implying the independent variable (X) does not Granger-cause the dependent variable (Y), against the alternative hypothesis that

$H_0: \vartheta_{1i} \neq 0$, implying the independent variable (X) Granger-cause the dependent variable (Y).

Similarly, to find out whether the independent variable (Y) Granger-cause the dependent variable (X) in equation (35), the joint significance of the lagged dynamic terms is examined by testing the null hypothesis:

$H_0: \vartheta_{2i} = 0$, implying the independent variable (Y) does not Granger-cause the dependent variable (X), against the alternative hypothesis that

$H_0: \vartheta_{2i} \neq 0$, implying the independent variable (Y) Granger-cause the dependent variable (X)

The standard F-statistics provides four possibilities: Firstly, we reject the null hypothesis in equation (34) but failing to reject the null hypothesis in equation (35) at the same time implies unidirectional causality running from X to Y. Secondly, a rejection of the null hypothesis in equation (35) but at the same time, failing to reject the null hypothesis in equation (34) implies unidirectional causality running from Y to X. Thirdly, a simultaneous rejection of the two null hypothesis implies bidirectional causality. Finally, a simultaneous failure to reject the two null hypothesis implies no causality between the variables under consideration.

Choice of Estimation Technique

There are a lot of co-integration techniques such as the Johansen (1995) full information maximum likelihood procedure, Engel and Granger (1987) procedure, Phillips and Hansen's (1990) fully modified OLS procedure and a current procedure developed by Pesaran and Smith (2001) known as the bounds testing procedure. To achieve the objectives, the study adopted the bounds testing approach to co-integration in the ARDL framework and the reasons are outlined as follows.

Autoregressive Distributed Lag (ARDL) Approach to cointegration

Some of the co-integration procedures above, such as the Engel and Granger (1987) procedure have been criticized for the inability to test hypothesis concerning the estimated coefficients in the long-run relationships

and small sample bias as a result of the exclusion of the short run dynamics. Even though the Phillips and Hansen's (1990) method deals with this shortfalls, their procedure also requires all the variables in the model to be integrated of order one (that is I(1)). However, the ARDL procedure has some advantages over these techniques.

Firstly, the ARDL cointegration procedure is relatively more efficient in small sample data sizes as is the case in this study. This study covers the period 1984–2017 inclusive. Thus, the total observation for the study is 34 which is relatively small.

Secondly, the ARDL procedure does not require the pretesting of the variables included in the model to establish their order of cointegration as compared with other techniques such as the Johansen approach. It is applicable irrespective of whether the variables in the model are I (0), I (1) or mutually cointegrated. Nevertheless, the procedure will crash when the variables are integrated of order two (that is I (2)). The ARDL approach can also facilitate the simultaneous testing for both the short and long-run relationships.

Most empirical literature has raised the issue of endogeneity resulting from potential reverse causality between remittance inflows and private investment. For instance, while remittances may stimulate private investment in Ghana, the level of private investment in Ghana may also influence the amount of remittances remitted in Ghana. Also, it is theoretically plausible that a rise in private investment could influence migrants to increase their inflows to finance the investment opportunity (Bjuggren et al., 2010).

Therefore, the choice of the ARDL procedure was largely due to the possible endogeneity problem and order of integration of the variables since the ARDL approach has the ability to eradicate any problems of autocorrelation and endogeneity in the estimated model. The study used a combination of I (0) and I (1) variables hence the appropriate procedure is the ARDL procedure. The general autoregressive (AR) model of order p, in Z_t:

$$Z_t = \alpha_0 + \beta_t + \sum_{i=1}^{p} \emptyset_i \, Y_{t-1} + \varepsilon_t \qquad t = 1, 2, \dots, T \quad (36)$$

With α_0 representing (k + 1) – a vector of intercept (drift), and β_t denoting (k + 1) – a vector of trend coefficients.

Cointegration Test

The study employed time series models due to the dynamics inherent in such models which take care of the expectational factors when modelling. Therefore, we needed to conduct a cointegration test if all the regressors are stationary. The cointegration analysis allows us to check for the long-run relationship among the variables included in the private investment model. The series are cointegrated, if they exhibit a well-established long run relationship or a common trend. That is if we consider two times series, X and Y that are non-stationary, we will expect that a linear combination of the two variables would also be non-stationary. In order to avoid the problem of non-stationary, it is necessary to make use of the first differenced data. Several methods are available for conducting the cointegration test. The most common used methods include the residual based Engle-Granger (1987) test, Johansen-Juselius (1990) test and the maximum likelihood-based Johansen (1995). This

remains the technique of choice for many researchers who assert that this is the most accurate method to apply for series integrated of order one (that is I (1)) and generally requires larger observation variables. However, the number of observations employed in the study will not permit us to use Johansen-Juselius test. The study employed the bounds test procedure to test for the presence of long-run relationship among the variables.

Bounds Testing Procedure

This bounds testing approach has some econometric merits over other cointegration methods. The bounds test is applicable irrespective of whether variables are either I (1), purely I (0), fractionally integrated meaning it does not require pre-testing of the series to determine their order of integration. Also, it is applicable in small samples. The ARDL bounds testing approach is to estimate equation (36) by ordinary least squares (OLS) in order to test for the existence of a long-run relationship among the variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables. This is done by restricting the coefficients of the lag values to zero. That is specified as:

$$H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$$

$$H_1 = \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq 0$$

Two asymptotic critical values bounds provide a test for cointegration when the independent variables are I(d) (where $0 \leq d \leq 1$): a lower value assuming the regressors are I (0), and an upper value assuming purely I (1) regressors. The null hypothesis of no long-run relationship can be rejected irrespective of the orders of integration for the time series if the F-statistic is

above the upper critical value. Conversely, if the F-statistic falls below the lower critical value the null hypothesis cannot be rejected. Finally, if the statistic falls between the lower and upper critical values, the result is inconclusive and depends on whether the underlying variables are I(0) or I(1). This necessitates the testing for unit root on the variable under investigation (Pesaran & Pesaran, 1997). The approximate critical values for the F-test can be obtained from Pesaran and Pesaran (1997, p.478). However, given that Pesaran's critical values are based on simulated large sample size, this study will use the critical values developed by (Narayan, 2004) since it is more appropriate for small samples.

Once the existence of long run relationship among the variables in the model is established, the ARDL methodology estimates number $(m + 1)^{k+1}$ of the regressors where m the maximum number of lags and k is the number of the variable in the equation (Shrestha and Chowdhury, 2005; Pesaran and Pesaran, 1997). The orders of lags of the ARDL models are selected using, either, Schawrtz-Bayesian Criteria, Akaike's Information Criteria, the R^2 criteria or the Hannan and Quinn criteria. The SBC uses the smallest possible lag length and is considered as most parsimonious model whereas the AIC chooses the maximum necessary lag length (Shrestha & Chowdhury, 2005).

In the next stage of the ARDL bounds approach, once cointegration is established, the conditional ARDL (p, q1, q2, q3, q4, q5, q6, q7 q8), the long-run model of an expression of the relationship between remittances and infrastructure (REMINFRA) interaction and private investment (PINV) from equation (25) is expressed in an ARDL model in equation (37)

$$\Delta lnPINV_t = \varphi_0 + \emptyset lnPINV_{t-1} + \alpha_1 lnINFRA_{t-1} + \alpha_2 TO_{t-1} + \alpha_3 REM_{t-i} + \alpha_4 lnEXDEBT_{t-1} + \alpha_5 GDPG_{t-1} + \alpha_6 RIR_{t-1} + \alpha_7 REMINFRA_{t-1} + \alpha_8 lnDS_{t-1} + \sum_{i=0}^{\rho} \beta_1 \Delta lnPINV_{t-i} + \sum_{i=0}^{\rho} \beta_2 \Delta lnINFRA_{t-i} + \sum_{i=0}^{\rho} \beta_3 \Delta TO_{t-i} + \sum_{i=0}^{\rho} \beta_4 \Delta lnREM_{t-i} + \sum_{i=0}^{\rho} \beta_5 \Delta lnEXDEBT_{t-i} + \sum_{i=0}^{\rho} \beta_6 \Delta GDPG_{t-i} + \sum_{i=0}^{\rho} \beta_7 \Delta RIR_{t-i} + \sum_{i=0}^{\rho} \beta_8 \Delta REMINFRA_{t-i} + \sum_{i=0}^{\rho} \beta_9 \Delta lnDS_{t-i} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (37)$$

This is followed by the estimation of the short-run parameters of the variables with the error correction representation of the ARDL model. The speed of adjustment is determined by the application of the error correction model. The unrestricted ARDL error correction representation is estimated when there exists a long-run relationship as:

$$\Delta lnPINV_t = \varphi_0 + \sum_{i=0}^{\rho} \beta_1 \Delta lnPINV_{t-i} + \sum_{i=0}^{\rho} \beta_2 \Delta lnINFRA_{t-i} + \sum_{i=0}^{\rho} \beta_3 \Delta TO_{t-i} + + \sum_{i=0}^{\rho} \beta_4 \Delta lnREM_{t-i} + \sum_{i=0}^{\rho} \beta_5 \Delta lnEXDEBT_{t-i} + \sum_{i=0}^{\rho} \beta_6 \Delta GDPG_{t-i} + \sum_{i=0}^{\rho} \beta_7 \Delta RIR_{t-i} + \sum_{i=0}^{\rho} \beta_8 \Delta REMINFRA_{t-i} + \sum_{i=0}^{\rho} \beta_9 \Delta lnDS_{t-i} + \gamma ECT_{t-1} + v_t \quad (38)$$

Where the short-run dynamics are the coefficients, while γ is the speed of adjustment to long-run equilibrium following a shock to the system and ECT_{t-1} is the error-correction term, the residuals from the cointegration equation lagged one period is given by:

$$ECT_t = lnPINV_t - \varphi_0 - \sum_{i=0}^{\rho} \beta_1 \Delta lnPINV_{t-i} - \sum_{i=0}^{\rho} \beta_2 \Delta lnINFRA_{t-i} - \sum_{i=0}^{\rho} \beta_3 \Delta TO_{t-i} - \sum_{i=0}^{\rho} \beta_4 \Delta lnREM_{t-i} - \sum_{i=0}^{\rho} \beta_5 \Delta lnEXDEBT_{t-i} - \sum_{i=0}^{\rho} \beta_6 \Delta GDPG_{t-i} - \sum_{i=0}^{\rho} \beta_7 \Delta RIR_{t-i} - \sum_{i=0}^{\rho} \beta_8 \Delta REMINFRA_{t-i} - \sum_{i=0}^{\rho} \beta_9 \Delta lnDS_{t-i} \quad (39)$$

Once the variables are cointegrated, their dynamic relationship can be specified by an error correction representation as argued by Engle and Granger (1987) in which an error correction term (ECT) computed from the long-run equation must be incorporated in order to capture both the short-run and long-run relationships. The error correction term indicates the speed of adjustment to long-run equilibrium in the dynamic model. In other words, the magnitude of the ECT shows how quick the variables converge to equilibrium when they are disturbed. The ECT is expected to be statistically significant with a negative sign. The negative sign indicates that any shock that occurs in the short run will be corrected in the long-run. The larger the coefficients of the error correction term in absolute terms, the faster the convergence to equilibrium.

To ascertain the appropriateness of the ARDL model, diagnostic and stability tests are conducted. The diagnostic test examines the serial correlation, functional form, normality and heteroskedasticity associated with the selected model. It is important to conduct a stability test as opined by Pesaran and Pesaran (1997), we employed the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) to test the stability of the parameters. The CUSUM and CUSUMSQ statistics are updated recursively and plotted against the break points. The null hypothesis of stable coefficients in a given regression cannot be rejected if the plots of the CUSUM and CUSUMSQ statistics stay within the critical bounds of 5 % significance level.

Data Source

The data used in the study were mainly secondary data collected for the period 1984 to 2017 consisting of 34 annual observations for each

variable. Annual time-series data on GDPG, trade openness, remittances, domestic savings, external debt, gross fixed capital formation (private sector) were obtained from the World Development Indicators and the IMF's International Financial Statistics. Government capital expenditure, as a proxy for infrastructure, and real interest rate were sourced from Institute of Statistical, Social and Economic Research (ISSER) of Ghana and Bank of Ghana respectively.

Summary

The methodological framework suitable for the study was developed and presented in this chapter. The model was developed from the accelerator principle of investment and follows earlier empirical works. The study employed annual data from 1984 to 2017 on gross fixed capital formation (private sector), remittances, infrastructure, external debt, Gross Domestic Product growth, domestic savings and real interest rate, trade openness. The stationarity test was carried out using the ADF and PP. Moreover, the study adopted ARDL econometric methodology for cointegration introduced and popularized by Pesaran et al., (2001) to obtain both the short and long-run estimates of the variables involved.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

The estimated results of the study are presented in this chapter. The results of the descriptive statistics of the relevant variables, both Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests, Granger-causality test and Autoregressive Distributed Lag (ARDL) approach to cointegration test are presented and discussed. These results are discussed in relation to the various hypotheses of the study.

Descriptive statistics

The study computed the descriptive statistics of all the relevant variables involved. These descriptive statistics include, the mean, median, maximum value, minimum value, standard deviation, skewness, kurtosis, sum, sum squared deviation and number of observations. Generally, the descriptive statistics of variables are done to check for the distribution of the variables or data. A vivid illustration of this statistics is presented in Table 1.

Table 1- *Summary Statistics of the Variable*

	PINV	REM	INFRA	EXDEBT	RIR	T0	GDPG	REMINFRA	DS
Mean	5.12E+09	5.72E+08	1.55E+09	7.07E+08	24.45	0.36	2.72	3.04E+18	1.83E+09
Median	3.97E+08	37958400	1.46E+08	2.71E+08	23.83	0.37	2.01	5.78E+15	5.52E+08
Maximum	2.63E+10	4.98E+09	7.68E+09	3.83E+09	45.00	0.58	11.28	3.28E+19	8.11E+09
Minimum	1029600.	600000.0	399100.0	32000000	12.500	0.09	0.543	5.90E+11	80707094
Std. Dev.	8.59E+09	1.16E+09	2.25E+09	1.11E+09	9.17	0.13	2.14	6.97E+18	2.49E+09
Skewness	1.52	2.25	1.33	1.90	0.83	-0.31	2.30	2.77	1.42
Kurtosis	3.66	7.72	3.52	5.11	3.02	2.16	8.92	11.10	3.35
Jar-Bera	13.73	60.28	10.38	26.85	3.95	1.53	79.51	136.43	11.58
Probability	0.00	0.00	0.01	0.00	0.138	0.47	0.00	0.00	0.00
Sum-sq.dev	1.74E+11	1.94E+10	5.25E+10	2.40E+10	831.17	12.16	92.37	1.03E+20	6.22E+10
Dev.	2.43E+21	4.41E+19	1.67E+20	4.05E+19	2773.26	0.52	150.74	1.61E+39	2.05E+20
Observations	34	34	34	34	34	34	34	34	34

Note: Std. Dev. represents Standard Deviation while Sum Sq. De. represents Sum of Squared Deviation.
Source: Author's estimate using Eviews 9.0.

A total number of 34 observations was used in conducting the descriptive statistics of the relevant variables employed in the study as depicted in Table 1. It was found that all the variables have positive average values (means). It can also be observed from Table 1 that remittances (REM), Gross Domestic Product growth (GDPG), domestic savings (DS), the interaction term between remittances and infrastructure (REMINFRA), private investment (PINV), infrastructure (INFRA) and External debt (EXDEBT) are positively skewed implying that the majority of the values are less than their means but only trade openness (TO) was found to be negatively skewed. All the variables are measured in US$ dollars.

The results indicate that the mean of private investment is 5.12E+09 with a median of 3.97E+08. The maximum level of investment is 2.63E+10 with a minimum of 1029600. The standard deviation suggests that the deviation from the mean by the variables is 8.59E+09. Infrastructure denoted by INFRA has a mean of 1.55E+09 with a median of 1.46E+08. The maximum and the minimum level of INFRA are 7.68E+09 and 399100.0 respectively for the estimation period. The standard deviation which indicates on the average, the deviation of the observed value from the mean by 2.25E+09.

Remittances (REM) has a mean of 5.72E+08 and ranges from 600000 to 4.98E+09 which implies that remittances has been on the increase relatively from 1984 to 2017 with a median of 37958400. However, it has standard deviation of 1.16E+09, which indicates that the observed values deviate on average from the mean by 1.16E+09.

The mean of REMINFRA (the interaction between remittances and infrastructure) is 3.04E+18 and a median of 5.78E+15. The maximum and %minimum value of REMINFRA are 3.28E+19 and 6.97E+18 respectively. It is 6.97E+18 dispersed from its mean. The skewness suggests that the variables are skewed to the right. Thus, most of the observation fall above the mean.

Domestic savings has a mean of 1.83E+09 with a median of 5.52E+08 for the study period. The lowest value of domestic savings is 80707094 while the maximum value is 8.11E+09. However, it has a standard deviation of 2.49E+09 implying that, on the average, the observed values of the index deviate from the mean by 2.49E+09 and it is positively skewed. Moreover, trade openness (TO) average about 0.36 for the period of study with a median of 0.37. Trade openness ranged from 0.09 to 0.58. The spread of trade openness is however, not too wide with about 0.13 standard deviation from the mean and is normally distributed considering the Jarque-Bera statistics.

External debt has its highest value of 3.83E+09 and least value of 32000000 for the study period. The statistics also show that, the mean of external debt is 7.07E+08 and a median of 2.71E+08. It deviates from its mean by 1.11E+09 and it is positively skewed.

Real interest rate has it maximum value of 45.00 and a minimum of 12.50 for the study period. The mean and the median of real interest rate are 24.45 and 23.83 respectively. Real interest rate is dispersed from its mean of about 9.17 standard deviation and is normally distributed considering the Jarque-Bera statistics.

Finally, Gross Domestic Product growth, which is represented by (GDPG) has a mean of 2.72. Gross Domestic Product ranges from 0.54 to

11.23 with a median of 2.00 and is positively skewed. It is evident from the summary statistics displayed in Table 1 that most of the variables under estimation are positively skewed based on the skewness.

Unit Root Test Results

The study employed the ADF and the PP test with intercept option only and intercept and trend option to test the stationarity of each variable. It is however important to perform this test to verify that the variables are not integrated of an order higher than one. The purpose is to ascertain the absence or otherwise of I (2) variables to extricate the results from spurious regression. Thus, in order to ensure that some of the variables are not integrated at higher order, there is the need to complement the estimated process with unit root tests. For this reason, before applying the ARDL approach, unit root tests will be conducted in order to investigate the stationarity properties of the data although the ARDL approach does not require the pretesting of the variables for unit roots. As a result, the ADF and PP tests were applied to all the variables in levels and in first difference in order to formally establish their order of integration. To be certain of the order of integration of the variables, the test was conducted with intercept and time trend in the model.

The optimal number of lags included in the test was based on automatic selection by Schawrtz-Bayesian Criteria (SBC), Akaike Information Criteria (AIC) the criteria or the Hannan and Quinn (H-Q) criteria. The results of ADF and PP test for unit root with intercept and trend in the model for all the variables are presented in Table 2 and Table 3 respectively. The null hypothesis is that the series is non-stationary or contains a unit root.

Table 2- *Results of Unit Root Test: ADF Test*

Variables	Levels		First Difference	
	Intercept	Intercept + Trend	Intercept	Intercept +Trend
LNDS	-0.51	-3.06	-8.43***	-8.38***
INFRA	-1.93	-2.63	-4.10***	-4.10***
LNREM	-0.35	-3.67**	-5.87***	-4.12***
REMINFRA	-0.39	4.01**	-5.64***	-5.54**
GDPG	-3.34**	3.69**	-7.87***	-7.74***
LPINV	-1.17	-3.15	-8.37***	-8.43***
RIR	-.65	-1.96.	-5.78***	-5.72***
EXDEBT	-0.73	-2.20	-5.60***	-5.53**
TO	-2.10	-2.60	-5.49***	-5.49***

Note: ***, **, * indicates the rejection of the null hypothesis of non- stationary at 1%, 5%, 10% level of significance respectively.

Table 3- *Results of Unit Root Test: PP Test*

Variables	Levels		First Difference	
	Intercept	Intercept + Trend	Intercept	Intercept +Trend
LNDS	-0.98	-3.07	-9.32***	-9.32***
INFRA	-1.84	-2.47	-3.91***	-3.89***
LNREM	0.433	-3.71**	-8.67***	-12.39**
REMINFRA	-0.09	-3.34*	9.82***	9.54***
GDPG	-3.45**	-3.72**	-8.31***	-8.19***
LPINV	-4.04	-0.10	-6.31***	-8.40***
RIR	-1.79	-2.07	5.78***	5.72***
EXDEBT	-0.71	-2.20	-5.66***	-5.84***
TO	-2.10	-2.00	-5.49***	-5.53***

Note: ***, **, * indicates the acceptance of the null hypothesis of stationarity at 1%, 5%, 10% level of significance respectively.

Source: Author's estimate using Eviews 9.0

From the unit root test results in Table 2, the null hypothesis of the presence of unit root for most of the variables in their levels can be rejected

since the P-values of the ADF statistics are statistically significant at any of the three conventional levels of significance with the exception of foreign direct investment and trade openness at 5% significance level with intercept and trend. However, at first difference, the variables become stationary. This is because the null hypothesis of the presence of unit root is rejected at 1 % significant level for all the estimates**.**

The PP test results for the presence of unit root with intercept and time trend in the model for all the variables are presented in Table 3. From the unit root test results in Table 3, the null hypothesis of the presence of unit root for majority of the variables in their levels can be rejected since the P-values of the PP statistics are statistically significant at any of the three conventional levels of significance with the exception of foreign direct investment and trade openness which were stationary at 5 % significant levels.

However, at first difference, the variables become stationary. This is because the null hypothesis of the presence of unit root is rejected at 1 % significant levels for all the estimates. The PP unit root test results in Table 3 are in line with the ADF test in Table 2, suggesting that most of the variables are integrated of order one, I(1), when intercept and time trend are in the model.

It is therefore clear from the unit root results discussed above that all the variables are integrated of order zero, I(0), or order one, I(1). Since the test results have confirmed the absence of I (2) variables, the ARDL methodology is used for estimation.

Cointegration analysis

It is important to test for the existence of long-run equilibrium relationship between these variables within the framework of bounds test for cointegration. From a statistical point of view, a long-run relationship between variables means that those variables move together over time so that short-term disturbances arising from the long-term trend are corrected. When there is a cointegrating relationship between two or more variables, theoretically, the implication is that, there exists an error correction mechanism. The error correction is the lagged residual of the cointegrating regression. This provides information about the speed with which the model returns to equilibrium following an exogenous shock. Due to this reason, a significant negative coefficient is expected for the error correction term.

The F-test which tests the joint null hypothesis that the coefficients of the lagged levels are equal to zero was used to determine the long run relationship. The essence of the F-test is to determine the existence or otherwise of cointegration among the variables in the long run. The F-statistics is compared with the lower and upper critical values in Pesaran et al., (2001). The lower bound critical value assumes that the explanatory variables are integrated of order zero while that of the upper bound assumes that the explanatory variables are integrated of order one

The results of the computed F-statistics when LPINV is normalized (that is, considered as dependent variable) in the ARDL-OLS regression are presented in Table 4.

Table 4-*Bounds test results for cointegration*

Critical Value Bound of the F-statistic: intercept and no trend (case II)						
K	90% Level		95% Level		99% Level	
	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
7	1.85	2.85	2.11	3.15	2.62	3.77
Calculated F-Statistics:						
FLPINV (LRPINV|LREM,LINFRA,LDS,GDPG,REMINFRA,RIR,LNEXDEBT,TO) 6.12(0.00)						

*** Note: Critical values are obtained from Narayan (2004), Appendix A1-A3, pp.26-28; ** denotes statistical significance at the 5% level and K is the number of regressors in equations (25).

The joint null hypothesis of lagged level variables (i.e. variable addition test) of the coefficients is zero is rejected at 5 % significance level as depicted in Table 4. This is because the calculated F-statistics for FLPINV (.) = 6.12 exceeds the upper bound of the critical value of band (3.15). Therefore, the null hypothesis of no cointegration (i.e. long run relationship) between investment in Ghana and its determinants is rejected. Hence, there is a long-run relationship among the variables employed in the study.

Granger Causality Tests

In achieving the first and second objectives of the study, Granger causality test was carried out to determine the direction of causality between remittances and private investment and between infrastructure and private investment. The importance of this test is that if it appears that remittances Granger cause private investment then it means that remittances are useful in predicting private investment (Stock & Watson, 2007). We employed the Pairwise Granger causality test attributed to Engel and Granger (1987) and the following results were obtained as depicted in Table 6: In testing for causality

between variables, the following outcomes can be expected: a test concludes that a variable Granger causes the other when the set of coefficients for the two variables are statistically significant. The Akaike information criterion (AIC), Hannan-Quinon as well as Final Predictor Error (FPE) determined the optimal lag as the residuals derived from the Granger causality test may be sensitive to the selection of the lag length. The results for the lag selection is displayed below:

Table 5-*VAR lag selection criteria*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-456.7539	NA	569.2172	29.04712	29.41355	29.16858
1	-267.8402	271.5634*	0.262270	21.24001	24.53792*	22.33317
2	-180.9541	81.45572	0.146135*	19.80963*	26.03901	21.87449*

*indicates lag order selected by the criterion

LR: Sequential modified LR test statistics (each test at 5% level)

FPE: Final prediction error, AIC: Akaike information criterion

SC: Schwarz information criterion, HQ: Hanna-Quinn information criterion

Source: Author's estimate using Eviews 9.0

From the results displayed in the table, lag length 2 was chosen.

Table 6-*Results of Pair-wise Granger Causality Tests*

Null hypothesis	F-Statistics	Obs	Probability
REM does not granger cause PINV	30.9976	32	1.E-07***
PINV does not granger cause REM	32.566		6.E-08***
INFRA does not granger cause PINV	4.01473	32	0.0298**
PINV does not granger cause INFRA	1.02989		0.3707

Note: ***, **, and * denote significance level at 1%, 5% and 10% respectively.

Source: Author's estimate using Eviews 9.0

Table 6 reports the results for the Granger causality between the variable of interest in the study. The null hypothesis of remittances (REM) not Granger causing private investment (PINV) is rejected at 1% level of significance. This suggests that remittances Granger cause private investment in Ghana for the study period; meaning that remittances provide a useful ingredient in estimating private investment in Ghana. This confirms the assertion that remittance inflows can be viewed as a source of investible funds and help to alleviate credit constraints especially in countries where there is limited access to credit. The relaxation of credit constraints would stimulate private investment thus economic growth as argued by Dustmann and Kirchamp (2001). Paolo-Giuliano and Ruiz-Arranz (2005) also opine that remittances can bridge the gap caused by the inadequate access to credit thereby promoting investment. The findings further confirmed Adams and Cuecuecha's (2010) view that remittances have the capacity to enhance human

and capital investment levels in the recipient economies in their study in Indonesia between the period of 2000 and 2007.

Similarly, the null hypothesis that private investment (PINV) does not Granger cause remittances (REM) is also rejected at any of the levels of significance. Which means that there is a feedback effect between remittances and private investment in Ghana. Hence, there is a bidirectional causality from remittances to private investment in Ghana. The bidirectional causality supports the claims by Buggren, Dzansi and Shukur (2010) and Bjuggren et al., (2010) that it is theoretically plausible that a rise in investment could influence migrants to increase their inflows to finance investment opportunity which is confirmed in a study by Iqbal and Sattar (2005). Narayan, Ojapinwa and Odekunle (2013) also considered the potential reverse causality in analyzing the link between remittances and fixed capital formation in Nigeria. Moreover, the findings is consistent with the findings of Abrar Ul Haq, Mahtab and Ullah (2015) in a study in Bangladesh that found a bidirectional causality from between remittances and FDI and remittances and trade. The existence of bidirectional causality results in endogeneity problem, hence, the Ordinary Least Squares regression gives biased parameter estimates.

However, the findings contradict the study by Cherono (2013). He found a unidirectional causality between remittances and investment where the causality from investment to remittances was rejected in his study. In the case of Najibullah and Masih (2015), their empirical findings clearly suggested that remittances cause investments in Malaysia and not vice versa. To them, there was a unidirectional causality running from remittances to investment not the other way round. The results also contradict the findings of Bayar (2017) who

found a unidirectional causality from remittances and to foreign direct investment.

Subsequently, the results from Table 6 revealed that the null hypothesis that infrastructure (INFRA) does not Granger cause private investment is rejected but the null hypothesis that private investment (PINV) does not granger cause infrastructure (INFRA) cannot be rejected. This is because the coefficient resulting from the test is statistically significant at 5 % leading the study to conclude the existence of a unidirectional causality running from infrastructure to private investment in Ghana. This means that government provision of infrastructure is complementary to investment in Ghana, thus infrastructure provision acts as a crowding-in catalyst to investment in Ghana. This contradicts the findings of Frimpong and Marbuah (2010). In the case of India, analyzing the short run dynamics between infrastructure and Foreign Direct Investment using Granger Block Exogeneity Wald test found a bidirectional causality between infrastructure and foreign direct investment. The study, however, contradicts the study by (Pradhan, Norman, Badir, & Samadhan, 2013) who examined causal effects between transport infrastructure, foreign direct investment and economic growth interactions in India. The results found a significant unidirectional causality from transport infrastructure to foreign direct investment. Also, it supports studies by Al, Deger and Genc (2013). In the case of Achour and Belloumi (2016), their empirical findings clearly suggested that infrastructure (transport value added, road transport, energy) causes gross capital formation and not vice versa. To them, there was a unidirectional long run causality running from railway infrastructure, the transport value added to gross capital

formation not the other way round.

Long-run results (log of Private Investment is dependent variable)

Once the variables have been found to be cointegrated, that is exhibiting a long-run relationship among the variables, we estimated equation (25) on chapter three using the ARDL approach to achieve the second objective of the study by determining the interactive effect of remittances and infrastructure on private investment. Table 7 shows results of the long run estimate based on the Schwartz Bayesian Criteria (SBC) since SBC produce parsimonious estimate. The selected ARDL passes the standard diagnostic test (serial correlation, functional form, normality and heteroscedasticity) as can be seen at Table 9. The coefficients indicate the long run elasticities.

Table 7- *Estimated long-run results*

Dependent variable: LNPINV

Selected Model: ARDL (1, 1, 0, 1, 0, 0, 0, 0, 1)

Variable	Coefficient	Std. Error	T-Ratio	Prob.
LNREM	-0.389279	0.155242	-2.507559	0.0209**
LNINFRA	0.343465	0.093708	3.665261	0.0015***
REMINFRA	0.036231	0.004000	9.056614	0.0000***
RIR	-0.023025	0.008729	-2.637734	0.0158**
TO	0.019821	0.003902	5.080072	0.0001***
LNEXDEBT	-0.335859	0.141060	-2.380962	0.0273**
GDPG	0.019064	0.026471	0.720164	0.4798
LNDS	-0.070025	0.180419	-0.388122	0.7020
CONS	14.545463	2.231764	6.517473	0.0000***

Source: Author's estimate (2018) using Eviews 9.0,*, **, *** indicates 10%, 5% and 1% significance level

From Table 7, the estimated results show that remittances, real interest rate and external debt exerted a negative and statistically significant effect on private investment. However, after taking the net effect (Appendix B), the interactive term between remittances and infrastructure, trade openness and infrastructure exerted a positive and statistically significant effect on private investment in Ghana. The results also show that, Gross Domestic Product growth though insignificant within the study period positively affects private investment in Ghana. Finally, domestic savings exerted negative and insignificant effects on private investment.

From the results, the coefficient of remittances had an adverse effect on private investment and is statistically significant at 5 % significance level. The coefficient (-0.39) of remittances indicates that a 1% increase in remittances decreases private investment by 0.39%. This is consistent with the findings of Hrushikesh (2012), Henry (2013) and Kondogo (2016) who indicated that remittances negatively affect investment in their studies. Similarly, in the case of Pakistan, Bangladesh, Nepal, Sri-lanka and India, Khan et al., (2017) found that remittances crowd out investment with low business freedom. The decline in private investment may be attributed to the influence of inflation which discourages investment since most of the remittances translate into increases in domestic liquidity that eventually results in inflationary pressures (Kaijage, 2008). The result confirms the argument by Încalțărău (2012) that remittances inflows are not sufficient conditions for the accomplishment of investment. Directing remittances to investment needs an appropriate business environment in terms of infrastructure for investment within the recipient's country. Taylor (1999) also opines that remittances are

only channeled into productive investment when there is existence of appropriate environment for investment.

Moreover, Chami et al., (2005) doubted that remittances can be seen as a source of capital for investment just like foreign direct investment unless certain conditions are in place. Matuzeviciute and Butkus (2016) further supported the argument that the effect of remittances hinges on government policy in creating the enabling environment for the allocation of remittances into productive investment without which such remittances cannot be utilized for investment activities since they will be spent on consumption. The results, however, contradict the findings of Balde (2011), Bjugyren et al., (2010), Calderon (2008), Cherono (2013), Griffith et al., (2008), Malik (2013) and Singh and Mehra (2014). These studies found a positive and statistically significant effect of remittances on private investment. Interestingly, the positive effect of remittances found in these studies were conditioned on government policies, conducive investment climate and a host of other factors including infrastructure which reduces the cost of doing business and maximizes the return on investment. For instance, Calderon (2008) indicated that remittance enhances investment given the improvement of the investment climate by the government. All this support the argument that remittances alone cannot influence private investment decision unless certain conditions such as availability of infrastructure that provides attractive investment climate, are in place.

The coefficient of infrastructure is statistically significant at 1% significance level indicating that if the government increases provision of infrastructure by 1%, private investment will increase by approximately

0.34%. This explains that government provision of infrastructure complement private investment in Ghana. The public sector is seen as crowding-in catalyst to the growth of investment in an economy. When government increases its expenditure in the provision of infrastructure such as roads and bridges, communication, hospitals, energy among others, private investment receives a boost. The provision of these facilities reduces the cost of doing business, increase production efficiency and maximizes returns on investment to the domestic investors (Aromdee, Rattananubal, & Chai-Anant 2005). This findings support earlier findings by Asante (2000), Damane (2015), Debele (2015), Githaiga (2014), Marbuah and Frimpong (2010) and Molapo and Hailu who asserted that government extensive investments in basic infrastructures such as roads, energy and telecommunication creates conducive environment for private investment.

However, the findings contradict other empirical studies such as Akpalu (2002), Kanu (2015), Konor (2014) and Volkov (2015), who argued that government expenditures on infrastructure negatively and significantly affect investment especially when they are solely financed through borrowing. This explains the crowding-out effect where the government and investors compete for the same resources in the economy. The borrowing by the government raises the cost of financing investment as there remains insufficient investible funds available to investors leading to a high rate of interest and rationing of credits by the financial institutions. Agenor and Montiel (1996), however, casted doubt on complete crowding out by the government especially in the case of developing countries. According to him,

the effect of government borrowing on the rate of interest is minimal and hence has little crowding-out effects.

The results of the study further indicated that the coefficient of the combine effect of REMINFRA (how remittances can affect private investment through infrastructure) was positive and statistically significant at 1% (Appendix B). Therefore, the null hypothesis that there is no joint significant effect of remittances and infrastructure on private investment is rejected. It can be inferred from the calculation of the net effect of the interaction between remittances and infrastructure that a 1% increase in remittances given the existence of infrastructure in the Ghanaian economy, will stimulate private investment by 0.40%. Calculations for the net effect can be seen in Appendix B(a). It can be argued that existence of infrastructure signals the presence of attractive investment opportunities at home with remittances; such opportunities encourage recipient of remittances to undertake more private investment.

The remittances and infrastructure interaction buttress the argument that remittances alone cannot influence private investment. However, in a situation where there is presence of infrastructure, remittances promoted private investment. It is not surprising that this joint effect of remittances and infrastructure has enhanced private investment more than the separate effect of remittance. This result support the recommendation by Owiafe (2008) that appropriate infrastructure should be developed to generate favorable investment climate and to complement investments out of remittances. Indeed, the major role of the government in remittance receiving countries should be the creation of attractive environment for doing business. The existence of

enabling economic environment, transparency, sound regulatory systems, information and low costs of doing business in remittance receiving countries are crucial factors which influence investment decisions by remittance recipients, returning migrants or migrants working abroad. Providing the needed infrastructure that are aimed at improving the investment climate in migrants' home countries could greatly attract a group of potential investors to put their remittances in productive investment activities.

Poor infrastructure seems to be a major frustration for remittance receivers trying to direct remittances into private investment activities even after satisfying basic needs and there remains a substantial amount. While the confidence of putting remittances into productive activities is low, increases in infrastructure will be essential to give remittance receivers the confidence to direct remittances into private investment. Availability of infrastructure by reducing the costs of doing business may help direct remittances to private investment activities that maximize investment returns and therefore stimulate economic growth and development. Again, this study confirms that of Githaiga (2014), Kaijage (2008) that we consider economic, political and social factors of remittance recipient countries regarding the use of remittances for investment.

Recent studies (Balde, 2010; Mallick, 2012; Narayan, Ojapinwa, & Odekunle, 2013) have only looked at the effect of remittances on gross investment and ignore the joint effect of remittances and infrastructure on private investment but the results of the study confirm that there is a strong correlation between remittances, infrastructure and private investment.

Contrary to our expectation, domestic savings was found to have a negative effect on private investment. The negative coefficient of 0.07% means that a 1% increase in domestic savings will decrease private investment by 0.07% but it is insignificant. This confirms the Keynesian consumption function that as income increases over time, people will consume a smaller share of this additional income. This means that people would save too much and there would-be no-good investment opportunities for which to use the funds. If this process persists, investment will eventually decline but the effect is insignificant which means that domestic savings do not influence private investment in Ghana. The insignificant results confirm the assertion by Bernanke that domestic savings is not a prerequisite for investment in an open economy due to the mobility of domestic savings across borders of open economies (Bernanke, 2005).

The result of the study is in line with our theoretical model, the flexible Accelerator, which indicates that GDPG positively affects private investment although it is insignificant. From the results, a 1% increase in GDPG will enhance private investment by 1.90% but it is statistically insignificant. The growth of the GDP is a signal to investors that the economy is experiencing growth and as such, optimal profit could be achieved by potential investors. The insignificant coefficient could imply that usually in Ghana, businesses operate below full capacity, hence, rising aggregate demand does not necessitate expansion of capital stock (Akpalu, 2002). This empirical result supports the findings by Akpalu (2002) and Marbuah and Frimpong (2010) for Ghana, who had a positive and insignificant effect.

Furthermore, the results show that the coefficient of trade openness (TO) is positive and statistically significant signaling a positive influence on private investment. The coefficient of trade openness indicates that a 1% increase in trade openness leads to approximately 1.98% increase in private investment. The coefficient of trade openness is statistically significant at 1% significance level. The finding is in line with the findings of Ouattara (2004) and Naa-Idar et al., (2012) who found positive relationship between trade openness and investment. They believed that openness to trade stimulates private investment by making import and export procedures easier so as to successively encourage producers to increase and improve their production and investment in the country. However, this result do not support the findings of Asante (2000) and Bibi (2012) that trade openness negatively affects investment in Ghana and Pakistan respectively. They argued that trade openness leads to more outflow of capital from a country which adversely affects private investment.

As expected, real interest rate was found to exert a significant negative effect on private investment in Ghana. The coefficient of real interest rate indicates that a 1% increase in real interest rate will decrease private investment by 2.30% but it is insignificant. The results confirm our theoretical model (Neoclassical Flexible Accelerator model). The theory postulates that the real interest rate acts as the user cost of capital. When the user cost of capital rises, it means the cost of capital has gone up and this becomes a disincentive to the private sector to invest. Hence, private investment is expected to decline. The result concurs with the findings of Akpalu (2002), Kaputo (2011), Marbuah and Frimpong (2010), Ucan and Ozturk (2011) who

found a negative effect of real interest rate on private investment. The results also contradict the McKinnon-Shaw hypothesis in the theoretical review which argued that a rise in real interest rate stimulates investment.

Finally, external debt exhibited a significantly negative effect on private investment. The coefficient specifically indicates that a 1% increase in external debt will decrease private investment by 0.34% and it is significant at 5% significant level. This result supports the assertion of the Classical theory of investment in the theoretical literature as well as studies by Naa-Idar et al., (2012) in Ghana and Ezeabasili and Nwakoby (2013) that external debt operations by government adversely affects private investment. Akram (2012) also found that a rise in external debt implies that the government would have to pay more interest for the debt. This prevents private investors from investing because of the fear of high taxes by the government to pay for the interest payment on the debt. However, the result contrasts with the findings of Frimpong and Marbuah (2010) who had a positive and statistically significant effect on private investment.

Short Run results

Once the long-run cointegrating model has been estimated, thus, after establishing the long-run relationship between private investment and the independent variables, the next step in the ARDL approach is to model the short-run dynamic parameters among the variables employed in the study within the ARDL framework. Thus, the lagged values of all variables (a linear combination is represented by the error correction term (ECM_{t-1}) are retained in the ARDL model. The estimated model was selected based on the SBC since SBC produced parsimonious results.

The results in Table 8 also revealed that the coefficient of the lagged error correction term ECT (-1) exhibits the expected negative sign (-0.84) and is statistically significant at 1%. The significant error correction term indicates that approximately 84% of the disequilibrium caused by previous year's shocks converges back to the long-run equilibrium in the current year. The rule of thumb is that the larger the error correction coefficient (in absolute terms), the faster the variables equilibrate in the long-run when shocked (Acheampong, 2007). It is clear from the results that any disequilibrium in the short-run will take about ten months to be restored in the long-run representing a faster adjustment to long-run equilibrium after any shock to the system in the short-run. According to Bahmani-Oskooee (2004), a relatively more efficient way of establishing cointegration is through the error correction term. The negative and significant coefficient of the error correction term confirm the existence of the co-integration relationship among the dependent variable (private investment) and its independent variables employed in the study**.**

Table 8- *Estimated Short-Run Error Correction Model*
Dependent variable: LNPINV

Selected Model: ARDL (1, 1, 0, 1, 0, 0, 0, 0, 1)

Variable	Coefficient	Std. Error	T-Ratio	Prob.
D(LNREM)	0.107959	0.157177	0.686865	0.5001
D(LNINFRA)	0.354636	0.110391	3.212539	0.0044***
D(REMINFRA)	-0.000723	0.007565	-0.095578	0.9248
D(RIR)	-0.023574	0.009908	-2.379219	0.0274**
D(TO)	0.018266	0.004876	3.746260	0.0013***
D(LNEXDEBT)	-0.362587	0.098892	-3.666507	0.0015***
D(GDPG)	0.031424	0.023324	1.347267	0.1930
D(LNDS)	0.318051	0.076314	4.167645	0.0005***
CONS	12.50715	2.216118	5.643718	0.0000***
ECT(-1)	-0.840583	0.112756	-7.454899	0.0000***

Source: Author's estimate (2018) using Eviews 9.0*, **, *** indicates 10%, 5% and 1% significance level.

From Table 8, it can be observed that infrastructure exerts a positive influence on private investment. Its coefficient of (0.35) suggests that a 1% increase in provision of infrastructure leads to approximately 0.34% increase in private investment at 1% significance level. This explains the crowding-in effect, a situation where government's provision of social and physical infrastructure in the form of roads and electricity complements private investment. This result supports the findings of Erden (2005) and Lesotlho (2006) for developing countries and it is consistent with the long-run result but inconsistent with the findings of Akpalu (2002) and Marbuah and Frimpong (2010).

Domestic savings have the expected sign exhibiting a significant positive influence on private investment in the short run. Thus, with a positive value of 0.32, it can be explained that a 1% increase in domestic savings leads to approximately 0.32% increase in private investment. The result is consistent with the Classical theory that asserted that savings equal investment. This implies that any time savings rise, there is an automatic rise in investment. These savings that are accumulated in financial institutions are made available to private investors to undertake business. The results concur with the findings of Ang (2008) and King'ori (2007) who found a positive and statistically significant influence of savings on private investment. This findings is inconsistent with the long-run results.

The short-run estimate of the interactive term between infrastructure and remittances is consistent with long-run results but it is insignificant. The net effect calculation in Appendix B indicates that 1% increase in remittance inflows, given the presence of infrastructure, will stimulate private investment

by 0.09% in the short-run but it is insignificant. The reason behind the statistically insignificant influence is that, initially, remittances were mainly utilized for consumption purposes and to satisfy basic needs. Thus, recipients of remittances hardly manage to save money to invest. This confirms the study by Khan et al., (2017).

Furthermore, the coefficient of trade openness also maintained its positive sign and it is statistically significant at 1% significance level which is consistent with the long run results. The result, therefore, suggests that as openness to trade goes up by 1%, private investment will increase by approximately 1.83% in the short run. Thus, the short run and long run results indicate that trade openness has stimulated private investment in Ghana and it is consistent with the findings of Marbuah and Frimpong (2010).

Inconsistent with the long-run estimate, remittances had positive coefficient but it is statistically insignificant in the short-run. This implies that remittance inflow does not influence private investment in the short-run and confirms the earlier argument that remittances alone do not induce investment but require appropriate investment climate such as existence of infrastructure which reduces the cost of investment and maximize investment returns. The findings concur with the findings of Griffith, Boucher, and Mccaskie (2008) and Manic (2017). Another reason behind the statistically insignificant influence is that initially, remittances were mainly utilized for consumption purposes and to satisfy basic needs. Thus, recipients of remittances hardly manage to save money to invest. This confirms the study by Khan et al., (2017).

Consistent with the long-run results, external debt exhibited a statistical negative effect on private investment. The coefficient implies that 1% increase in external debt will decrease private investment by 0.36% in the short-run. This is consistent with the findings of Kiptui (2005), who found that government debt servicing problem crowded-out private investment in Kenya.

As in the long-run, real interest rate is negative and significant. The short-run coefficient showed that real interest rate adversely affects private investment as it confirms the theoretical underpinning by the neoclassical theory on user cost of capital. The coefficient indicates that a 1% increase in real interest rate will decrease private investment by 2.34% in the short-run and it is significant at 5%. This result supports the Keynesian theory of investment in the theoretical literature that higher investment is realized when the real interest rate is low as capital appears to be financially viable and vice versa as well as study by Konor (2014) who found a negative relationship between real interest rate and private investment in Ghana.

Finally, the short run estimate of gross domestic product growth is consistent with the long run as it also indicates a positively insignificant effect of growth domestic product growth on private investment in Ghana. The result concurs with the findings by Akpalu (2002) and Marbuah and Frimpong (2010), and for Ghana, it is inconsistent with the findings of Dapaah (2016) and Konor (2014).

Post estimation results

The estimated regression post estimation results indicated that the ARDL model was correctly fit. The significance of the variables and other

diagnostic tests including serial correlation, normality, heteroscedasticity, functional form and stability test were conducted as displayed in Table 9. The null hypothesis of a normal distribution was accepted indicating that the entire model was normally distributed. The F-statistic of the Breusch-Godfrey test was insignificant failing to reject the null hypothesis of no serial correlation. The model was correctly specified based on the Regression Specification Error Test (RESET) implying there are no omitted variables. Also, the null hypothesis of a constant variance cannot be rejected per the heteroscedasticity test which means the variance of the error term is constant.

Model Diagnostics

Table 9-*Regression Diagnostics and Stability Tests (ARDL)*

Test Statistics		F-statistics	Probability
Functional form	X^2_{Reset}	2.184	0.126
Serial Correlation	X^2_{auto}	2.534	0.128
Heteroscedasticity	X^2_{BP}	0.392	0.950
Normality Test	X^2_{Norm}	Not Applicable	0.526

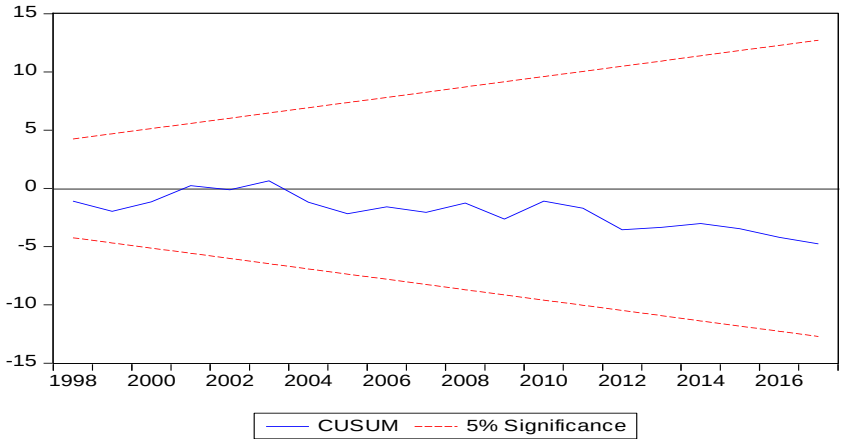
Source: Authors Estimate (2018) Eviews 9.0

Stability test

The cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) were employed to check the stability of the model. From the graph, it is evident that the model is stable since the residual plots are within the critical bounds of 5%. The results for CUSUM and CUSUMSQ are depicted in figure 1 and figure 2 respectively. The null hypothesis is that coefficient vector is the same in every period and the alternative is that it is

not. The CUSUM and CUSUMSQ statistics are plotted against the critical bound of 5% significance level. According to Bahmani-Oskooee and Nasir (2004), the null hypothesis that all coefficients are stable cannot be rejected if the plot of these statistics remains within the critical bound of the 5% significance level. The plot of the CUSUM for the estimated model is shown in figure 1. The plot suggests the presence of stability of the coefficients since the plots of all coefficients fall within the critical bounds at 5% significance level. Therefore, all the coefficients of the estimated model are stable over the period of the study.

The plot of the CUSUMSQ for the estimated ARDL model is also depicted in figure 2. The plot also suggests the presence of stability of the coefficients since the plots of all coefficients fall within the critical bounds at 5% significance level. Hence, all the coefficients of the estimated model are stable over the period employed in the study.

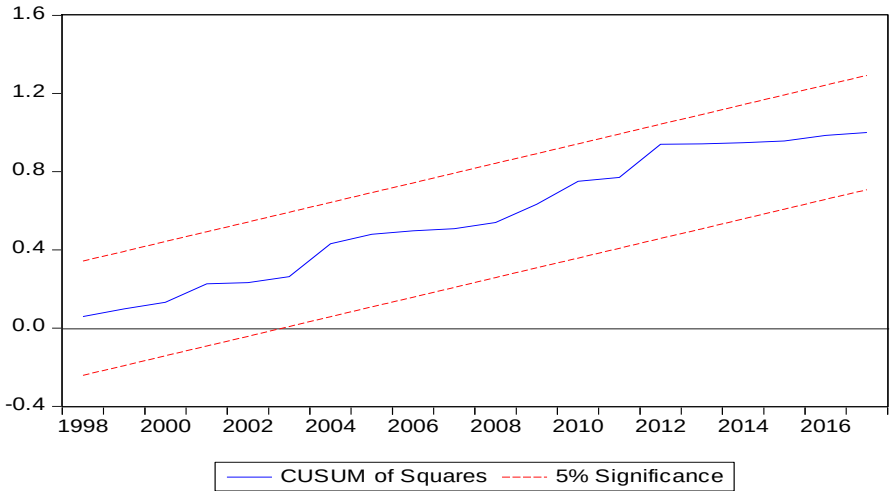


The straight line represent critical bounds at 5% significance level.

Figure 1: Plot of Cumulative Sum of Recursive Residuals

Note: the variable on the vertical axis is residuals while the variable on the horizontal axis is years.

Source: Generated by Author



The straight line represents critical bounds at 5% significance level.

Figure 2 : Plot of Cumulative Sum of Recursive Residuals

Note: the variable on the vertical axis is residuals while the variable on the horizontal axis is years.

Source: Generated by Author

Summary

The primary focus of this chapter was the estimation of the ARDL model and the presentation and apparent discussion of its results. Specifically, the chapter began with presentation of the descriptive statistics and then proceeded with the tests for unit roots in the series by employing the ADF and PP unit root tests. The tests were conducted with intercept only and intercept with trend at levels and in first difference of all the variables used. The results of the tests confirmed a mixture of I (0) and I (1) variables. The study further tested for the existence of a cointegration relationship among the variables and was found that there exists a long-run relationship among the variables based on the Bounds test for cointegration.

The results revealed that remittances alone do not influence private investment but remittances and infrastructure interaction were investment

inducing. The combined effect of remittance flows on private investment given infrastructure enhances private investment. The net effect of remittances and infrastructure exerted a positive and statistical effect on private investment. This result indicates that remittances and infrastructure have been used jointly to promote private investment in a number of conceivable ways. The study also found a positive and statistically significant effect of trade openness and infrastructure on private investment. However, real interest rate and external debt exerted a negative and statistically significant effect on private investment. Also, Gross Domestic Product growth exerted a positive but insignificant influence on private investment in the study period. Finally, domestic savings exerted negative and statistical insignificant effects on private investment in the long-run but positive and statistical effects on private investment in the short-run.

The ARDL selected based on the SBC revealed that the error correction term (ECT_{t-1}) had its expected negative sign and it was significant at 1% which confirmed the cointegration test. The model selected passed the parameter stability tests of serial correlation, functional form misspecification, non-normal errors, heteroscedasticity, CUSUM and CUSUMSQ.

Finally, the study revealed a bidirectional causality between remittances and private investment necessitating the use of the ARDL approach.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

The summary, conclusions and recommendations of the study are presented in this chapter. The overview of the research problem, objectives, methodology and the findings of the study are presented in this chapter. The conclusions contain all outcomes regarding the findings of the study based on the hypotheses. Also, policy recommendations to be implemented, limitations and directions for future research are presented in this chapter.

Summary

The role of private investment in the growth and development strategy of every economy cannot be overemphasized. It leads to the growth of incomes, employment generation and GDP growth. Nevertheless, due to the availability of seed capital and credit constraints, the expected role of private investment as the main engine of growth has not materialized in the Ghanaian economy. This is as a result of the country's inability to increase private investment to an appreciable level. However, remittances to Ghana has soared in recent times. Hence, in Ghana, where access to credit is limited, individuals might use remittances to relax such constraints to stimulate private investment. However, an inevitable question that arises is whether these inflows have aided private investment in Ghana.

As argued by Încalțărău (2012), remittance inflow is not a sufficient condition for the accomplishments of investment. Directing remittances to investment needs an appropriate environment in terms of existence of infrastructure which reduces the cost of investment and maximizes returns.

Therefore, there is the need to look at the combined effect of remittances and infrastructure in stimulating private investment in Ghana. This will ensure that private investment is enhanced through policies that target remittances and infrastructure simultaneously. Also, most empirical researches have yielded mixture of results and are based on cross-country analysis making it difficult to provide specific conclusions and policy recommendations on individual countries. Despite this, in Ghana, quantitative empirical studies are yet to be taken to examine the combined effect of remittances and infrastructure on private investment.

The study sought to examine, as the main objective, the combined effect of remittances and infrastructure on private investment in Ghana, using annual time series dataset from 1984 to 2017. The study, in addition, sought to examine the possibility of a causal relationship between the variables and also to examine the direction of causality.

To achieve the objectives, the study employed the Autoregressive Distributed Lagged Model (ARDL) approach to bounds testing developed by Pesaran and Shin (1999) so as to determine the net effect of remittances and infrastructure on private investment. The model combined effect on private investment was modelled based on the flexible accelerator principle of investment, which is found to be most appropriate for developing countries as a result of institutional and structural factors present in most developing countries such as less developed financial markets, foreign exchange constraints and other market imperfections (Blejer & Khan, 1984). The study began with the descriptive statistics then with the tests for unit roots in the variables used in the study. This was done to check for the stationarity

properties of the variables used in the study. Thus, the study employed Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests for unit roots testing. The unit root test suggested that all variables were stationary but it was made of a mixture of variables integrated at order zero I (0) and order one I (1). The tests for the presence of unit roots were done in levels and in first difference with constant and trend. The following are the main findings of the study in relation to the objectives:

The findings of the study revealed that the interaction between remittances and infrastructure exerted a positive influence on private investment in the long-run. Therefore, where there is existence of infrastructure, remittances can stimulate private investment. This emphasizes the crucial role that infrastructure can play in directing remittances into productive investment in Ghana. Moreover, remittances and infrastructure interaction proved private investment inducing, hence, the net effect of remittance flows on private investment given infrastructure is private investment enhancing.

The Granger causality test showed a bidirectional causality between private investment and remittances confirming the reverse causality between remittances and private investment necessitating the use of the ARDL approach which provides an unbiased and efficient estimate in the presence of endogeneity. However, there was unidirectional causality between infrastructure and private investment.

The study found that remittances exerted a negatively and significant effect on private investment which supports the earlier argument that remittances alone do not influence private investment.

Also, the long-run results revealed that infrastructure and trade openness exhibited positive and significant effect on private investment but Gross Domestic Product growth was positive but it was insignificant. The results further indicated that domestic savings, real interest rate and external debt exerted a negative effect on private investment but domestic savings were statistically insignificant.

In the short run dynamics, remittances exerted positive effects on private investment but it was insignificant since such inflows are normally used to satisfy basic needs by recipient in the short-run.

Again, trade openness and infrastructure maintained their positive and statistical effect on private investment in the short-run but real interest rate and external debt maintained their statistically negative effect on private investment.

The study also sought to establish a long run relationship among the variables employed and this was determined by the error term. The results indicated that:

The negative and statistically significant coefficient of the error term further supported the existence of a long run relationship among private investment, trade openness, domestic savings, GDP growth, remittances, infrastructure, external debt, interaction between remittances and infrastructure and real interest rate.

The size of the coefficient suggests that about 84% of disequilibrium caused by shocks to the system in the previous year converges back to the long-run equilibrium in the current year. The diagnostic tests for the model

revealed that model is free from serial correlation, functional form misspecification, non-normal errors, and heteroscedasticity.

Finally, the plots of the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares recursive residuals (CUSUMSQ) also revealed the existence of a stable relationship for the model as they were found to be within the 5% critical bounds level.

Conclusions

The study revealed that remittances alone cannot influence private investment, however, in the presence of infrastructure, remittances exerted a positive and statistical significant effect on private investment. This gives an indication that a well-developed infrastructure which increases the returns on investment and raises the opportunity cost on consumption of remittance may help direct remittances to projects that yield the highest return and therefore promote economic growth. Therefore, the study validates the hypothesis that there is joint significant effect of remittances and infrastructure on private investment in Ghana.

The results of the Granger causality test indicated that there is a bidirectional causality between remittances and private investment but unidirectional between infrastructure and private investment. Hence, the findings of the study have confirmed the endogeneity between remittances and private investment resulting from the reverse causality between remittances and private investment.

Finally, it was revealed in the study that infrastructure and trade openness exhibited positive and statistical significant effect on private

investment in Ghana. However, as expected, real interest rate and external debt exhibited a statistical negative effect on private investment.

Recommendations

The following recommendations are proposed based on the findings from the study:

Firstly, the study recommends that Ministry of Roads and Ministry of Power and Energy should provide more infrastructure to create and ensure favorable investment climate for remittances to be invested.

Secondly, as matter of urgency, the Ministry of Power and Energy should expand existing infrastructural projects such as the rural electrification project by extending it to places not covered so far in the country.

Thirdly, incentives such as tax incentives should be given to returning migrants or remittance recipients who will utilize their remittances for private investment activities.

Moreover, the Bank of Ghana should assist money transfer institutions to develop reliable, rapid and reduced cost remittance transaction support. This support should endeavor to be easily accessible not only from centralized commercial areas but also in the rural areas. This would maximize remittances through formal channels.

Finally, factors that reduce the real interest rate and external debt should be adhered to. The Bank of Ghana can use moral suasion to encourage financial institutions to reduce their real interest rate. Agencies should be set up by the government to implement and evaluate government policies on external debt. This can be complemented with fiscal discipline by the government.

Direction for Future Research

Firstly, future research should be undertaken to consider any possible non-linearity in the relationship between remittances, infrastructure and private investment. Also, given that a small sample size was used in the study as a results of limited data, future research should consider using large sample size as more data becomes available.

Secondly, even though the study disaggregated gross investment into private and public investment, only the effects on private investment was investigated. Future research can also investigate the effects on both private and public investment.

Finally, the study considered infrastructure as the only avenue through which remittances may affect investment, however, institutional factors such as laws and government policies may also help explain the effect of remittances on investment. Future research can investigate this area.

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APPENDICES

APPENDIX A

Summary statistics of the variables in log form

	LNPINV	LNREM	LNINFRA	REMINFRA	RIR	T0	LNEXDEBT	GDPG	LNDS
Mean	19.54	17.80	19.87	340.86	24.45	0.36	19.41	2.72	20.50
Median	19.79	17.44	20.26	328.39	23.83	0.37	19.42	2.01	20.13
Maximum	23.99	22.33	22.76	504.82	45.00	0.58	22.07	11.28	22.82
Minimum	13.84	13.30	15.38	183.57	12.50	0.09	17.28	0.54	18.21
Std. Dev.	3.29	2.39	2.05	96.95	9.16	0.13	1.38	2.14	1.27
Skewness	-0.23	0.32	-0.44	0.15	0.83	-0.31	0.51	2.30	0.60
Kurtosis	1.82	2.41	2.24	1.91	3.02	2.16	2.334	8.92	2.21
Jar-Bera	2.28	1.07	1.90	1.83	3.95	1.53	2.089	79.54	2.91
Probability	0.32	0.58	0.37	0.40	0.14	0.47	0.35	0.00	0.23
Sum-Sq.de	664.27	605.15	675.62	11589.44	831.17	12.16	659.69	92.37	696.86
Dev.	357.97	189.01	138.98	310185.4	2773.26	0.52	62.94	150.74	53.25
Observations	34	34	34	34	34	34	34	34	34

Note: Std. Dev. represents Standard Deviation while Sum Sq. De. represents Sum of Squared Deviation.
Source: Author's estimate using Eviews 9.0.

APPENDIX B

Net Effect Calculation

a) Long-run net effect

$$LNPINV = 14.55 - 0.39^{*}LNREM + 0.34^{*}LNINFRA + 0.04^{*}REMINFRA - 0.07^{*}LNDS - 0.02^{*}RIR + 0.02^{*}TO + 0.02^{*}GDPG - 0.34^{*}LNEXDEBT$$

$$\frac{\partial LNPINV}{\partial LNREM} = -0.39 + 0.04(\overline{LNINFRA})$$

$$= -0.39 + 0.04(19.87)$$

$$= -0.39 + 0.79$$

$$= 0.40\%$$

b) Short-run-net effect

$$LNPINV = 12.50715 + 0.107959^{*}LNREM + 0.354636^{*}LNINFRA - 0.000723^{*}REMINFRA + 0.318051^{*}LNDS - 0.023574^{*}RIR + 0.018266^{*}TO + 0.031424^{*}GDPG - 0.362587^{*}LNEXDEBT$$

$$\frac{\partial LNPINV}{\partial LNREM} = 0.107959 - 0.000723(\overline{LNINFRA})$$

$$= 0.107959 - 0.000723(19.87)$$

$$= 0.107959 - 0.01436601$$

$$= 0.09\%$$

(c) Test of long-run joint significance

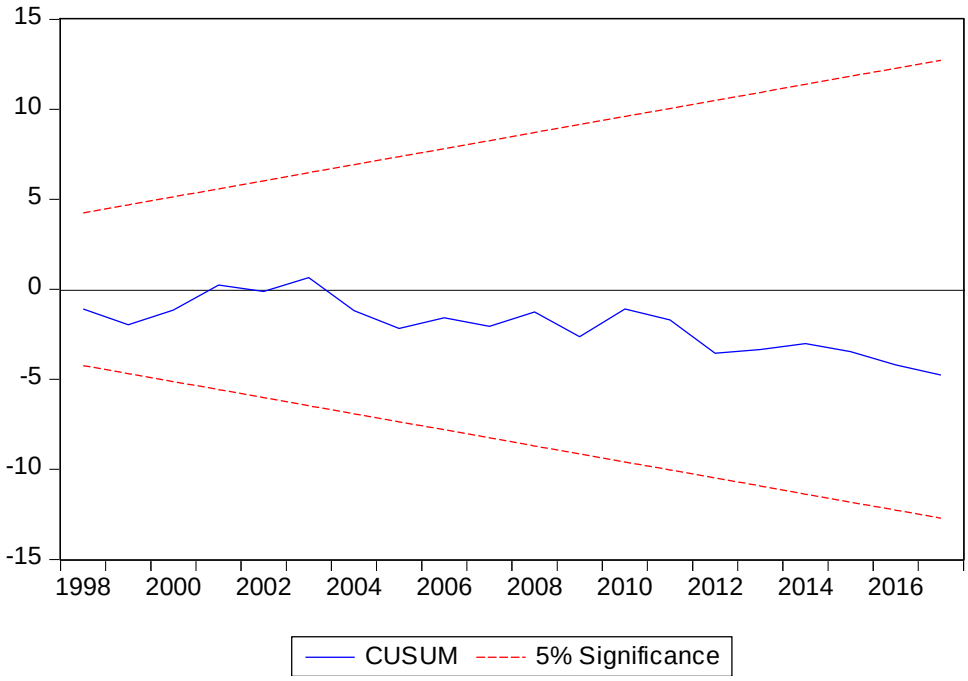
Parameter	Probability
$\beta_8 = 0$	0.0058

(d) Test of short-run joint significance

Parameter	Probability
$\beta_8 = 0$	0.2340

APPENDIX C

Plot of Cumulative Sum of Recursive Residual

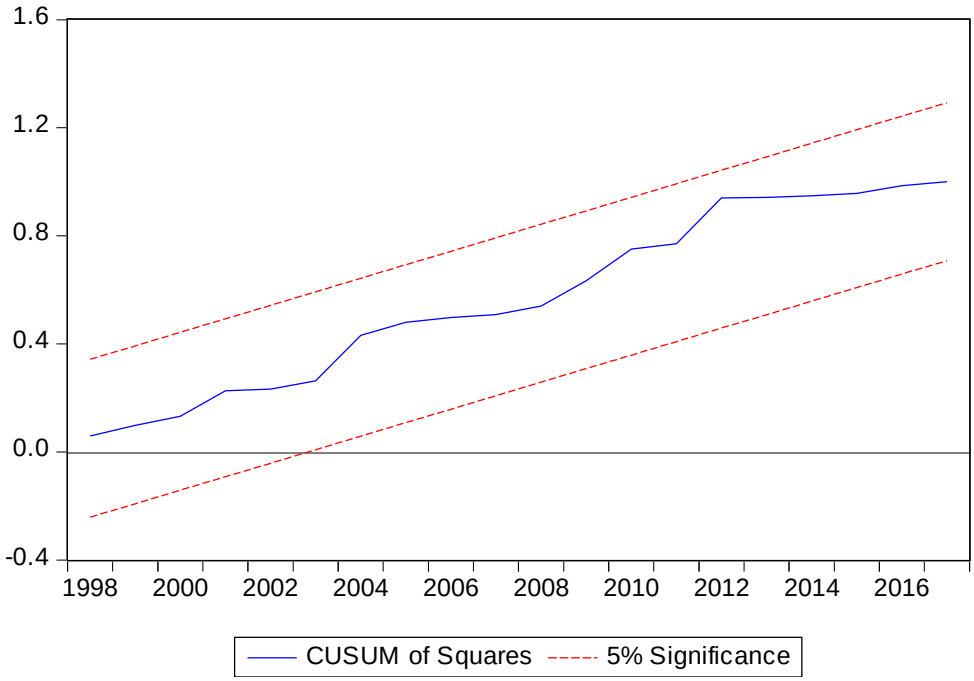


Plot of Cumulative Sum of Recursive Residuals. The straight lines represent critical bounds at 5 % significance level

Source: Author's construct (2018)

APPENDIX D

Plot of Cumulative Sum of Squares of Recursive Residual



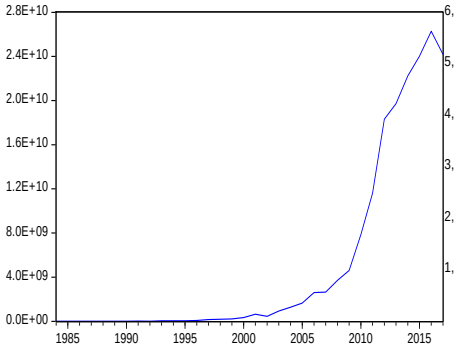
Plot of Cumulative Sum of squares of Recursive Residuals.

The straight lines represent critical bounds at 5 % significance level

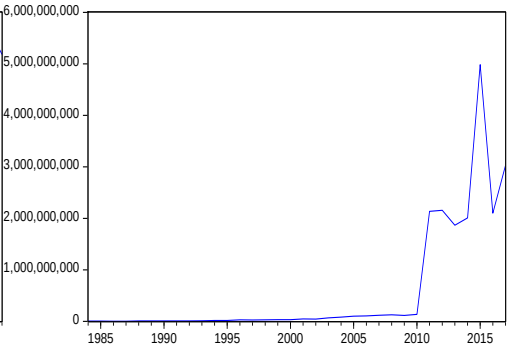
Source: Computed by Author using Eviews 9.0

APPENDIX E-1

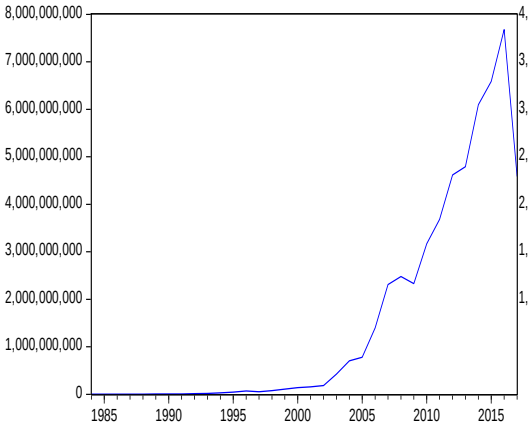
Graph of Variables at Levels



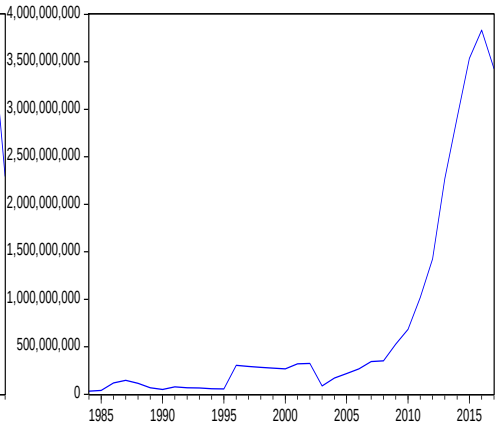
PINV



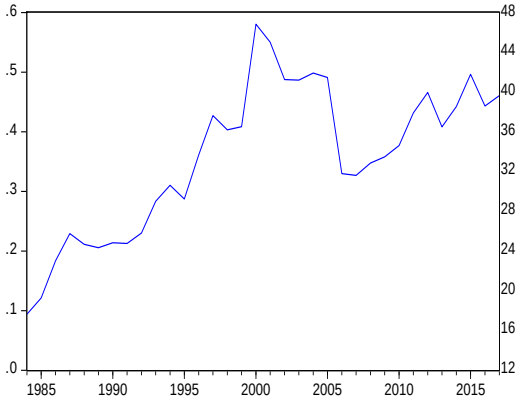
REM



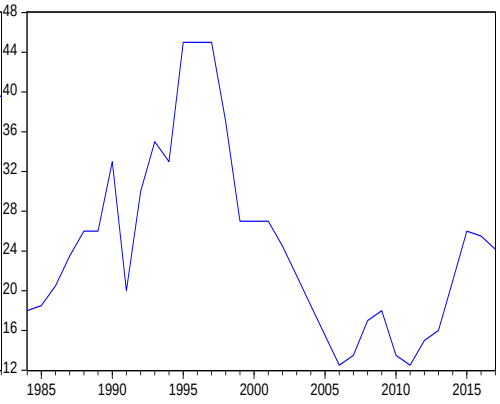
INFRA



EXDEBT



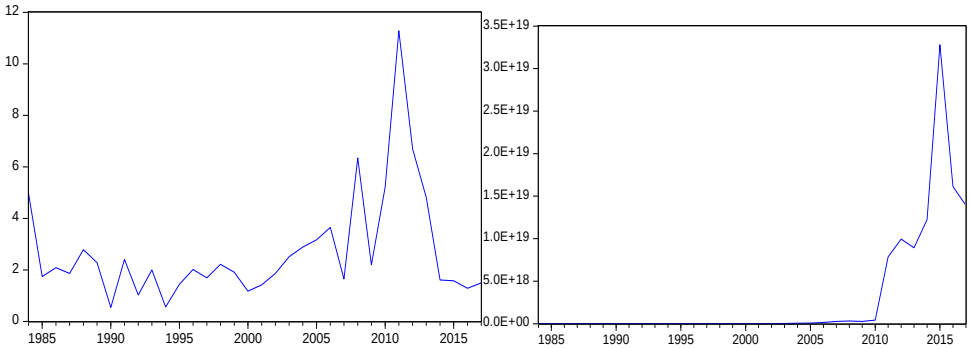
TO



RIR

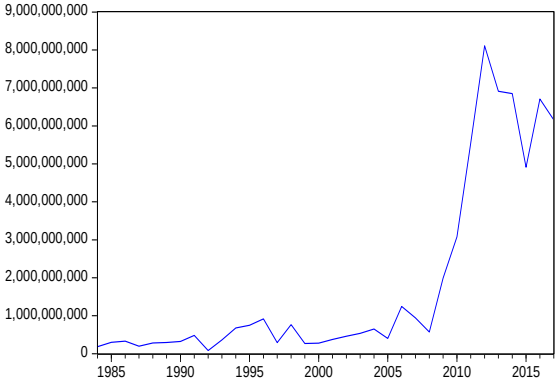
APPENDIX E-2

Plot of variables in levels



GDPG

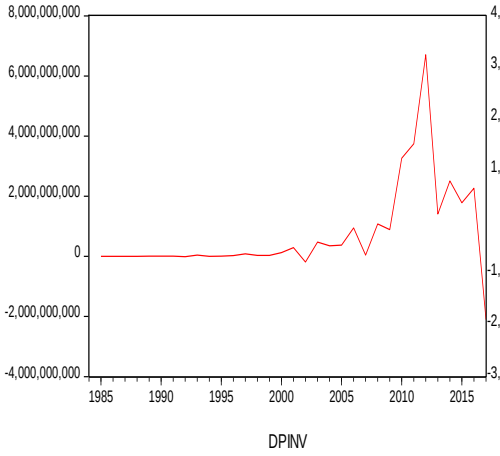
REMINFRA



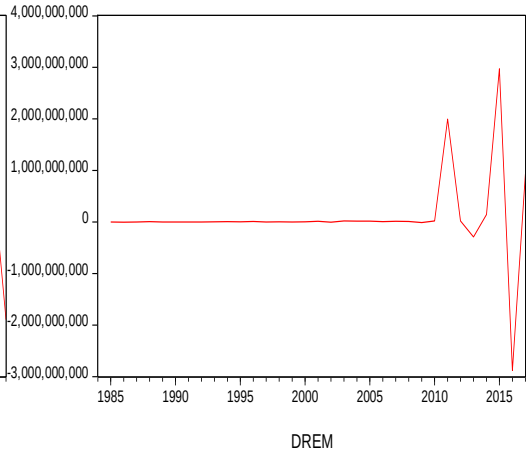
DS

APPENDIX F-1

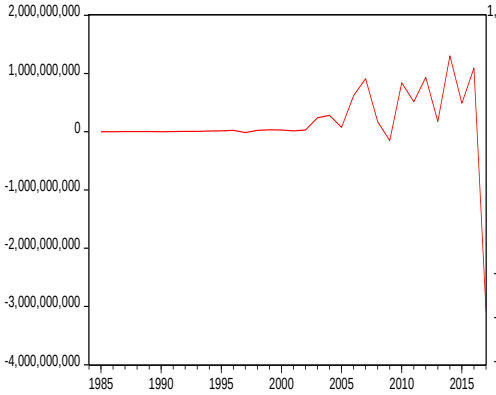
Graph of Variables at First Difference



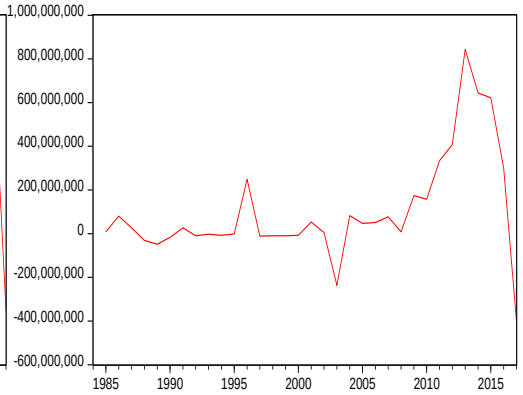
DPINV



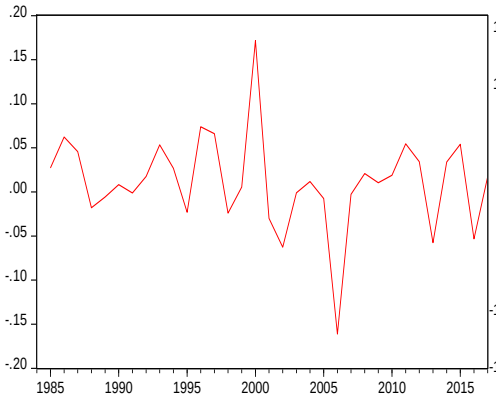
DREM



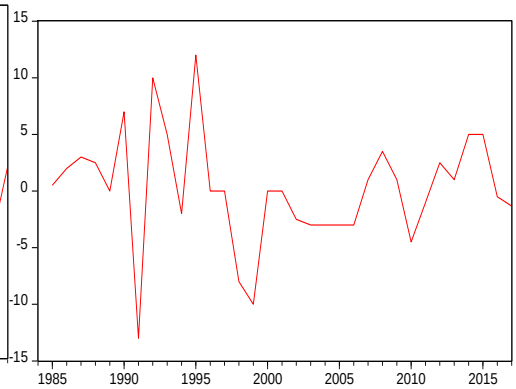
DINFRA



DEXDEBT



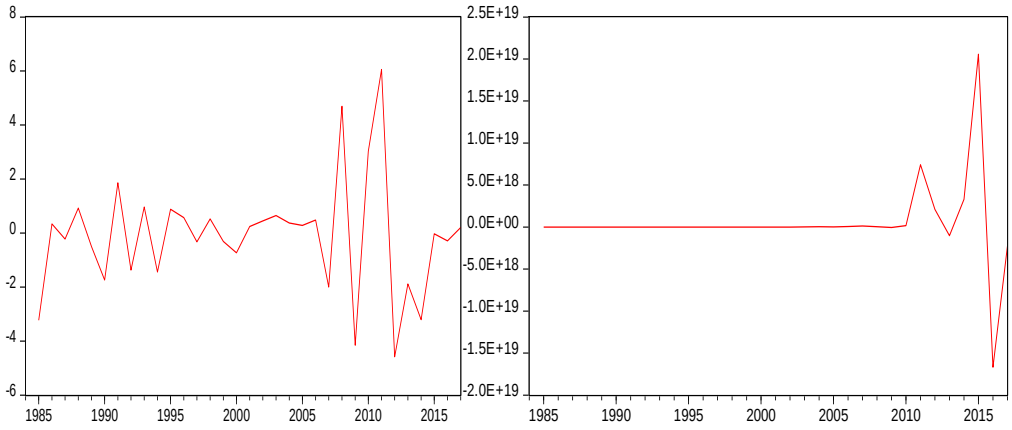
DTO



DRIR

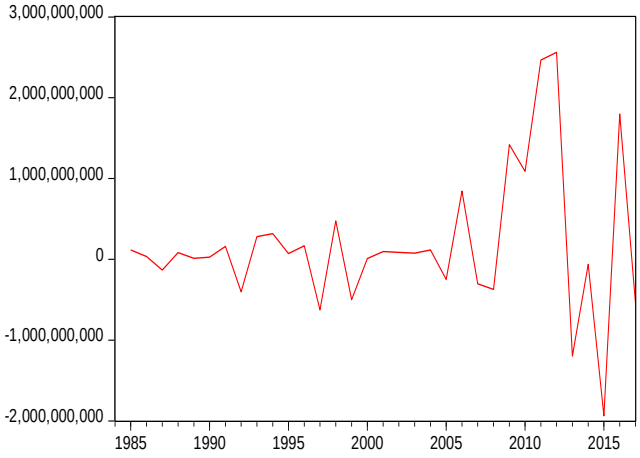
APPENDIX F-2

Plot of variables in first difference



DGDPG

DREMINFRA



DS