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The Role of the Private Sector on Infrastructure Financing and Development in South Africa

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Declaration

I, Buhle Mabuea declare that this research project is my own work. It is submitted to conclude the requirements of the Master in Management of Finance and Investment (MMFI) degree at the Wits Business School. It has not been previously submitted at any other institution or university for any similar qualification.

Signed: …….

Abstract

Like many emerging market countries globally, South Africa is faced with two major infrastructure challenges, namely: major infrastructure backlog and the availability of funding required to reduce this backlog. This study has been set out to achieve two main objectives using an Autoregressive Distributed Lag (ARDL) approach: to examine the relationship between private infrastructure financing and infrastructure development in South Africa and also to examine the relationship between financial development in South Africa and private infrastructure financing through investments. This study is based on the assumption that the two categories of the financial markets i.e the Bank Based and Market Based Financial Development (BBFD and MBFD) have an impact on private infrastructure finance; thus for the purposes of this study financial markets was split into the BBFD and MBFD to identify which sector of the financial markets is more influential in improving private financing of infrastructure so as to establish a guideline in terms of which category is worth exerting more work in the future.

The findings for objective one indicate that private sector infrastructure financing has a fairly strong correlation relationship with infrastructure development in South Africa. The ARDL indicates that in both the long run and the short run the coefficient of private infrastructure financing was found to be positive but statistically insignificant with only episodic infrastructure finance by private financiers in the previous years.

Findings for objective two indicate that Bank Based Financial Development (BBFD) has a statistically significant but negative effect on the level of private infrastructure financing in both the long and the short run. In contrast, Market-based Financial Development (MBFD) was found to have a positive but statistically insignificant effect on the level of private infrastructure financing in both the long and short run. The Gross Domestic Savings (GDS) appeared to be significant in increasing infrastructure finance.

From the results, it is clear that South Africa needs to expand private sector participation in infrastructure financing. Given South Africa's existence of fairly well-developed financial markets, one would expect the country to have significant infrastructure investment flows. However, it is evident that more work is required on further developing the South African financial markets by ensuring that the requirements of the alternative infrastructure financing options are strictly followed and met in order to give the maximum benefits of infrastructure finance in the development of infrastructure.

Furthermore, the study recommends policy changes that will assist in enhancing the private sector's participation in infrastructure finance.

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Table of Contents

Declaration ii
Abstract iii
Acknowledgements iv
List of tables vi
List of Figures vi
CHAPTER ONE: INTRODUCTION ..... - 1 -
1.1 Context of the study ..... - 1 -
1.2 Research Problem ..... - 3 -
1.3 Research Objectives ..... - 4 -
1.5 Significance of the Study ..... - 4 -
1.6 Structure of the Thesis ..... - 5 -
CHAPTER TWO: LITERATURE REVIEW ..... - 6 -
2.1 Infrastructure Development in South Africa ..... - 6 -
2.2 Infrastructure Financing in South Africa ..... - 9 -
2.3 Financial Development role in Infrastructure Financing through Investment ..... - 12 -
CHAPTER 3: EMPIRICAL FRAMEWORK AND DATA ..... - 16 -
3.1 Estimation Approach ..... - 16 -
3.1.1 Private Infrastructure Financing and Infrastructure Development ..... - 16 -
3.1.2 Financial Development and Private Infrastructure Financing ..... - 17 -
3.2 Data ..... - 19 -
3.2.1 Proxy for financial development ..... - 19 -
3.2.2 Infrastructure financing ..... - 20 -
3.2.3 Proxy for infrastructure development ..... - 21 -
3.2.4 Control Variables ..... - 21 -
CHAPTER 4: EMPIRICAL RESULTS ..... - 22 -
4.1 Introduction ..... - 22 -
4.2 Unit Root Tests ..... - 22 -
4.2 Cointegration and ARDL-ECM Results ..... - 22 -
4.4 Diagnostics tests of Coefficients ..... - 28 -

CHAPTER 5 ..... - 30 -
5.1 Conclusion ..... - 30 -
5.2 Recommendations for effective infrastructure finance ..... - 33 -
References ..... - 35 -

List of tables

Table 1: Results of the Unit Root Test..... - 22 -
Table 2: Model (1) Bounds F-test for Cointegration ..... - 23 -
Table 3: Model (2) Bounds F-test for Cointegration ..... - 24 -
Table 4: Model (1) Estimated Long Run Coefficients..... - 24 -
Table 5: Model (2) Estimated Long Run Coefficients..... - 25 -
Table 6: Model (1) Estimated Short Run Coefficients ..... - 26 -
Table 7: Model (2) Estimated Short Run Coefficients ..... - 26 -
Table 8: Correlation Analysis ..... - 28 -
Table 9: Short Run Coefficients Diagnostics Test..... - 28 -

List of Figures

Figure 1:Model(1) Plot of Cumulative Sum of Recurvive Residuals…….. ……... - 41 -
Figure 2:Model(1) Plot of Cumulative Sum of Squares of Recursive Residual……. - 29 -
Figure 3:Model(2) Plot of Cumulative Sum of Recursive Residuals …….. - 41 -
Figure 4:Model(2) Plot of Cumulative Sum of Squares of Recursive Residual……. - 29 -

CHAPTER ONE: INTRODUCTION

1.1 Context of the study

South Africa is faced with a challenge of large infrastructure deficit and lack of funds to bridge this deficit. The 2015 World Bank Logistic and Performance Index report indicates that South Africa was ranked at position 38 out of 160 countries worldwide with regards to infrastructure development. Although this is quite a good rank for a developing country, many citizens are still without housing and education facilities; the country is still faced with limited access to power and potable water as well as underdeveloped transport infrastructure hindering local productivity and international trade (Sithole, 2016).

Infrastructure can be classified under two categories, namely Economic and Social infrastructure. Economic infrastructure includes energy, water, telecommunications, pipelines and transport (railways, roads, airports and ports) systems. Social infrastructure includes hospitals, leisure and sports facilities, schools, prisons and housing. Both these infrastructure categories are equally important in facilitating economic development and also serve as crucial catalysts in achieving maximum potential economic growth levels. However, the quantification and measurement of returns from an investment perspective vary between the two types. Economic infrastructure returns to investment are easily quantified and measured as they come in the form of revenues, cash flows, return on equity and return on assets whereas social infrastructure is difficult to measure because there is no direct monetary return on investment but more focused on satisfying personal or individual needs enhancing the society's standard of living which in turn results to a more productive labor force, an innovative society etc (Sithole, 2016).

Kariuki (2013) identifies an increasing requirement for infrastructure investment around the world. In emerging markets, there is an increasing need for new roads, power stations, schools and water supply systems to satisfy the increasing demand of infrastructure as a result of population growth, urbanization and per capita income. On the other hand developed markets are faced with the increasing demand for refurbishing its ageing transportation infrastructure due to increased levels of travel and movement of goods. The key drivers behind infrastructure upgrades in the developed markets are compliance of transportation infrastructure to the safety and quality requirements as well as the increasing pressures towards renewable-power generation, grid infrastructure, and oil and gas exploration and transport.

ERD, Research team (2015) finds that it is highly improbable to bridge such a gap due to the stagnant growth rate of the development aid, suggesting an urgent need for private financing. A few previously conducted studies evidencing a significant global

infrastructure funding gap; Foster and Briceño-Garmendia (2010) study estimate Africa's current infrastructure financing required to be $93 billion per annum, however, the current investment significantly declines, creating a funding gap of approximately $38billion per annum. According to the African Development Bank Group (2012), Africa's infrastructure upgrading and modernization costs are estimated at $360billion up to the year 2040 to finance projects identified under the Programme for Infrastructure Development in Africa (PIDA).

Various studies have been conducted in contributing to the assessment of South Africa's infrastructure levels. In a study by Teravaninthorn and Raballand (2009) it was estimated that approximately 70% of South Africa rural population are living two kilometers or more from an all-season road; in 2013 Kumo, Omilola and Minsat (2015) found that in rural areas only 2% of South Africa's households had access to fixed-line infrastructure, compared with 9.2% and 16.2% in urban and metropolitan areas respectively.

Taking into consideration the South African current infrastructure deficit and availability of funding, it is important to investigate and analyze alternative sources of infrastructure financing. In the 2018 budget review, the Treasury stated that *"Government and banks alone cannot fund South Africa's infrastructure programme" (Reuters News, 2018).*

Historically the banking sector provided most of the funding; however, this has declined since the Regulatory changes under Basel III restricting commercial banks' capability to provide long term financing. Again looking at South Africa's fiscus and balance sheet it is evident that there is an urgent need for private infrastructure financing (Sithole, 2016).

Tyson (2018), states that in the past ten years, there has been a significant increase in private investment in the developing countries (i.e. middle and low-income countries). However, there are two major challenges still being experienced. The first one is that most funds from private entities have been invested in commercially attractive sectors and countries, creating an imbalance in development needs as a whole. Low-Income Countries are much more in need of development, but in the last decade, they received the least private funding investment. The second challenge is that private finance is still not satisfying the required scale of financing for development needs, even though there is an existence of a large number of interested investors in the sector.

In a study conducted by Ehlers, Packer and Remolona (2014) it is found that among many other barriers to investments in infrastructure, the lack of well-structured projects appears to be one of the major barriers to infrastructure investment. Tyson (2018) is in

agreement with Ehlers et al. (2014) stating that the *"lack of 'bankable' projects"* is one of the major reasons for the low investment in infrastructure by private financiers.

There have been numerous debates among business leaders, policymakers and corporates around reasons for the stagnant economic growth in South Africa and it has been identified that South Africa's under-developed infrastructure is hindering the country's economic growth. Infrastructure is a crucial force in pulling towards economic growth.

Theoretically, financial sector development has an effect on savings and investments as a result affecting economic growth (Schumpeter, 1912). Huang (2010), also affirm that it is much easier to re-administer resources from high to low productive sectors in a well-developed financial sector space, which is a crucial element in the productivity and investment world. As a result, a well-established financial sector is a pre-requisite for mobilizing savings as well as administering investment (which infrastructure investments form part of) and credit.

From the theory above it is clear that there is a link between the level of financial development and investments; which infrastructure investment is part of. With the current government strained balance sheet and the banking sectors increasing restrictions South Africa needs innovative sources of infrastructure funding in the form of investment, and it appears private financers can be the only rescuers at this stage. This study looks into the impact of the level of private financers on infrastructure development and also the effect of the financial development on infrastructure financing by private financiers.

1.2 Research Problem

South Africa is faced with an infrastructure deficit as a result of the imbalance between the demand for infrastructure and the availability of funding to finance this demand. In the past, most of the country's infrastructure was financed with bank loans with the support of the Export Credit Agency. However, since the 'taper tantrums' of 2014 and Regulatory changes under Basel III and Solvency II, it is found that globally there has been a decline of private finance to developing countries (Tyson, 2018).

Developing countries remain to be the ones faced with significant infrastructure deficits estimated at $1.5 trillion annually by the G20. A large portion of the money to cover this deficit will need to come from private sources (Tyson, 2018).

According to Rabinowitz (2008), there are two major infrastructure challenges facing South Africa namely (1) major infrastructure backlog and the lack of funding required to combat this backlog; and (2) the limitations associated with the government and State-Owned Enterprises (SOE) capacity to borrow money. As a result, alternative

funding measures such as off-balance sheet or project finance models have to be used in financing infrastructure; highlighting a need for the private sector involvement in the provision and financing of infrastructure as a form of investment.

Theoretically, it has been demonstrated that the financial development of a country holds a positive impact on the levels of investment injected into a country, which infrastructure investments form part of. In other words, a well-established financial sector is a pre-requisite for mobilizing savings as well as administering investment and credit, consequently determining the level of effectiveness on the investments in a country which tends to attract investors.

In South Africa there is an apparent need for mobilizing private financing of infrastructure in the form of investment to eradicate infrastructure backlog; however, very minimal empirical affirmation has been carried out to examine the impact of our financial development in this regard. South Africa's level of financial development is, in turn, responsible for encouraging private infrastructure finance through various investment portfolios, thus enhancing infrastructure development.

1.3 Research Objectives

In line with the problem statement, the study seeks to achieve the following objectives:

- To examine the relationship between private infrastructure financing and infrastructure development in South Africa.
- To examine the relationship between private infrastructure financing through investments and financial development in South Africa.

1.4 Significance of the Study

This research is being undertaken mainly due to South Africa's significant infrastructure deficit challenge. Despite many ongoing initiatives undertaken with the aim of accelerating infrastructure development, the availability of funding is still a key challenge. In the past South Africa's infrastructure was mainly financed by the Government and the Banks, but looking at the changes to the regulations and the current South Africa's economic challenges it is evident that infrastructure funding will be more constrained in the future calling for the private financers to fill the gap.

Tyson (2018), states that despite the existence of a large pool of investors interested in the sector, there is still an existence of key barriers prohibiting investment growth in the infrastructure development sector. In 2018, the G20 Presidency committed to mobilizing private investments in addressing the infrastructure deficit incurred by developing countries and described the process as a "win-win" that "requires international cooperation".

The level of infrastructure development has been linked to the inefficiency in the available infrastructure finance investment portfolios, which appears to be affected by the financial development of the country. Studies in the past have indicated that financial development has a positive and considerable influence on the levels of investment in a country (which infrastructure investment is also part of). Just to mention a few studies: King & Levine (1993) in their study on 80 countries asserted that financial development indicators have a positive and considerable influence on investment. Rousseau (1999) discovered that the development of the financial superstructure is the driver to the sharp increase of output and investment in Japan.

In South Africa it is clear that there is an urgent need for mobilizing private financing of infrastructure in the form of investment in order to eradicate infrastructure backlog; however, very minimal attempt has been carried out to examine the level of the country's financial development, which is in turn responsible for encouraging private infrastructure finance through various investment portfolios, thus enhancing infrastructure development.

Anecdotally, the level of infrastructure development has been linked to the inefficiency in the available infrastructure finance investment portfolios, which appears to be affected by the financial development of the country.

Empirically it is still not clear whether the private sector participation in infrastructure financing in South Africa will really bring a positive impact on the country's infrastructure development. Also, it is not clear how financial development affects private infrastructure financing in South Africa. Therefore for this study, it is important to examine a relationship between infrastructure finance by the private financers and infrastructure development in South Africa; also to investigate the effect of the financial development on the private infrastructure finance. This study also offers an added advantage as it is splitting the financial market into a bank-based and market-based to establish the relationship of the different aspects of financial development on infrastructure finance through investment. This split will also aid in establishing a guideline in terms of which category of the financial market is worth exerting more work into, to achieve significant private participation in infrastructure finance.

1.6 Structure of the Thesis

The thesis is divided into five main chapters: Chapter 2 presents a logical and critical argument on the subject based on previous similar literature studies that have been conducted on the subject. Chapter 3 presents the research methodology. Chapter 4 presents results and the interpretation of the results. Chapter 5 presents discussion and conclusions.

CHAPTER TWO: LITERATURE REVIEW

2.1 Infrastructure Development in South Africa

Infrastructure development is associated with growth in the economy, creation of jobs, fruitful investments and decline in poverty (World Bank, 2019). Emerging Market Economies (EMEs) are faced with a significant need to fund an estimated $1.3 trillion investment gap annually in order to satisfy Sustainable Development Goals (SDGs) set by the United Nations General Assembly (World Bank, 2019). Historically in most EMEs, the government, banks and international donors were the traditional sources of funding; however, as a result of the stricter international banking regulations and the decreasing fiscal, these sources might contract while on the other hand infrastructure demand increases (World Bank, 2019). The international development community has recorded a significant need for private sector engagement, particularly as a long term financer in infrastructure development. In support of the Maximizing Finance for Development (MFD) strategy the target is to provide infrastructure projects with less dependence on the taxpayer's money and more on the private financing, (World Bank, 2019).

According to Lübbe (2015), in most circumstances the Governments are restricted in sourcing multiple streams of funding due to the lack of skills and expertise required to acquire different sources of funding; for such skills, the government are dependent of the private sector.

Private participation in infrastructure (PPI) is extensively regarded as a strategy to improve coherence in the projects operations, maintenance, and management of its long term asset lifecycle. It can either be in the form of PPPs or using private capital sourced from commercial loans and lastly through the local and international capital markets. Globally the numbers of PPI are relatively low. In 2016 there were 11 infrastructure deals in Sub-Saharan Africa valued at $3.3 billion which equates to approximately 5% of the total PPI investment globally; compared to the 2015 investment deals and the five–year average totalling $6.4 billion there is a fall of 48% in the total PPI investments, (African Economic Outlook 2018).

Private sector participants always look out for profitable business ventures with reasonable risk levels, as they need profits to sustain their business (African Economic Outlook, 2018). Traditionally, services such as water and sanitation as well as electricity are paid for by the end-user allowing the private sector an opportunity to recover its monies through future payments for the service. In contrast, free services will still have to be provided by the Government (Lübbe, 2015).

In encouraging private sector participation in Africa, a variety of financing mechanisms were introduced and implemented. For instance, initiatives undertaken to combat the

infrastructure deficit include the African Union Commission, the NEPAD Planning and Coordinating Agency and the African Development Bank, the G20 Infrastructure Action Plan, Infrastructure Consortium for Africa, EU-Africa Infrastructure Trust Fund and the Africa Infrastructure Country Diagnostic (African Economic Outlook, 2018).In South Africa, the National Treasury introduced the Public-Private Partnership (PPP) model in 1998 with the objective to establish, prepare and close out the PPP project, (Lübbe, 2015).

South Africa is faced with a significant ongoing gap in infrastructure funding; PPP projects permit the government to pass project funding costs onto the private sector it is in partnership with in exchange for operating the asset for a certain period of time while it recovers its cost and profits from them. The 2018/2019 budget indicates that in total, there are 33 completed PPP projects undertaken since the development of this model valued at R89.3 billion. Of the total planned public infrastructure budget estimate of R834.1 billion over the next three years, PPP projects only account for 2.2% of the total budget estimate for public infrastructure (Oxford, PPPs can fund public infrastructure – essential in the African context-Mail & Guardian, 2019).

There has always been a concern regarding the effectiveness of the PPP models in the developing world. According to Lübbe (2015), the PPP model appeared to be undesirable on both the private and public sector; he further states that in South Africa the PPP models have not satisfied the country's expectations on infrastructure development. There is an ongoing perception that PPPs are closely associated with privatization which extends to private finance and project finance; as a result one of the reasons PPP models are unsuccessful in meeting the country's infrastructure development expectations could be that in South Africa there is an existence of strong resistance on private finance for infrastructure (Lübbe, 2015).

PPP model presents the likelihood of using private funding for public infrastructure, which is of paramount importance in the African continent, whereby there is a challenge of restricted government budgets and very high need for investment. PPP projects do not always deliver fruitful results even though the PPP project is useful (Oxford, PPPs can fund public infrastructure – essential in the African context-Mail & Guardian, 2019).

In South Africa regardless of the high prospects for PPPs, the speed at which these projects are implemented is comparatively slow, from 1998 to 2006 there has been an average of 1.5 PPP set up per year (Bruchez, 2014). To date, there has not been a significant change in the implementation momentum of the PPP considering that the 2018/2019 budget indicates that in total there are 33 completed PPP projects

undertaken since the development of this model which results to an average of 1.57 set up annually.

Brandell Turner of TNK Attorneys says, “The success of PPPs is still dependent on the right investor climate, which harvests the right investor confidence,” he says. “As far as investments go, the investor wants to turn a profit more than it wants to ensure some form of service delivery on behalf of government.” (Oxford, PPPs can fund public infrastructure – essential in the African context-Mail & Guardian, 2019).

Pantaelo Rewelamia, Professor of project management and procurement systems at Unisa’s Graduate School of Business Leadership says, unsuccessful PPP projects appear to share a common characteristic that is they were not efficiently managed particularly by the public sector (Oxford, PPPs can fund public infrastructure – essential in the African context-Mail & Guardian, 2019).

Nevertheless, Wikus Kruger, junior research fellow and PhD candidate, UCT Graduate School of Business says, “South Africa’s PPP programme is probably one of the most well-known and successful globally, not just in the African region. Not only was the procurement process transparent, efficient and effective, but more than 90% of the projects have been realised within two to three years of their contracts being signed.” (Oxford, PPPs can fund public infrastructure – essential in the African context-Mail & Guardian, 2019).

Globally over the past ten years, there has been an increase in private infrastructure investments injected into developing countries; however, there are still major challenges experienced. The first key challenge is that private investment is largely injected in commercially attractive sectors and countries. Over the last decade, Low-Income countries which hold the greatest need for infrastructure development have received less than 2% of the total private investment financing, with middle-income countries receiving an estimated 98%. In principle, encouraging private finance transactions in infrastructure should be reached successfully because there is a large pool of potential investors showing interest in the sector, however, the lack of ‘bankable’ projects, management of political and economic risk and the discrepancy between the offered instruments and the investor’s requirements continue to be the main barriers hindering private infrastructure investments (Tyson, 2018).

South Africa is faced with the increasing need for infrastructure. Depending on the government alone to combat the infrastructure deficit through traditional procurements is not enough. As a result, in South Africa, there is a greater challenge to discover the most appropriate alternative models for financing infrastructure development.

2.2 Infrastructure Financing in South Africa

Private infrastructure financing commenced a while back globally with the launch of project finance markets. Esty and Christov (2002), hold that the application of project finance is not a recently introduced phenomenon. One of the oldest noted applications of project financing was recorded in 1299 for the development of the Devon silver mines. In the seventeenth and eighteenth centuries, project finance was implemented in the financing of infrastructure that provided trading services to be paid for by the end-user.

In the early 1990s Esty, Chavich and Sesia (2014) discovered that municipalities started to establish a link between project finance and the public sector activities, which gave birth to the public-private partnerships (PPP). PPP was introduced to extend the streams of funds in situations where the government is faced with limited budgets. The implementation of PPP allows the government to transfer the construction and operating risk to the private sector which in the past they have proved to manage the risk better, while the government manage the market risk (Sithole, 2016).

For many concluded PPP projects in South Africa, limited information has been published, making it a bit of a challenge to conduct an analysis on the efficiency of these models. However, from the information available, it is apparent that the South African PPP and infrastructure project finance market is still underdeveloped, and financing is highly dependent on bank debt. It raises a particular concern that there has been little to no use of other possible financing methods to bank finance (Prüssing, 2015).

Harris (2003) pointed out two key factors in Africa that influenced the lack of investments in infrastructure, namely; excessive staff and lack of efficient management in the public sector. Chege (2001) identified the policy and regulatory framework as an obstacle to the involvement of the private sector in infrastructure finance; consequently leading to weak capital markets and the increased bidding and transaction costs. South Africa has an existence of well-developed financial and utility markets, but still experience difficulties in the preparation of bankable infrastructure projects (Lübbe, 2015).

The partially developed South African capital market could possibly be the reason for the lack of interest in and public reporting of developing infrastructure finance markets which has led to an isolation of the markets. A lot of attention has been on the Western investor's investing and development practices, while less attention has been given to the development of possible investors in the emerging market infrastructure. As a consequence of this, developing countries investors have evolved to be the

project lead sponsors. This was demonstrated between 1998 and 2004 when more than 40% of the investments in the emerging market infrastructure were sourced from the developing markets themselves (Orr, 2007).

The PWC study (2013) analyzing the growth of alternative infrastructure project finance either than the bank across different regions, argues that the lack of interest in and the public reporting of the developing infrastructure finance markets may be an indication that the markets are not fully prepared to accommodate significant participation of international investors. With the use of available funds independent of the banking system, acceptable governance and transparency levels in financial reporting, realistic tax and commercial policies and the credit support for specific project as guideline; the study analyses the current global market conditions by comparing the feasibility and attractiveness of financing infrastructure projects by means of capital markets. From the study it was discovered that Africa, including South Africa, is still faced with challenges prohibiting the development of its infrastructure project bond market. The study indicates that even though South Africa has an established bond and a significant life insurance and pension markets, there is still no sizeable interest for construction risk from the private investors. The limited trend in appetite is also evident in the secondary market with only a small number of private investors involved in purchasing projects post-completion. In South Africa even though there is an existence of PPPs and other projects accommodating private sector participation, the reality is that the overall infrastructure market is still dominated by the state-owned enterprises like Eskom and Transnet who finance infrastructure on balance sheet; the study finds that this may be the main motive behind the lack of participation of the private investors in the infrastructure market (PWC, 2013).

As a result of the level of its financial markets, by comparison South Africa has a fair advantage when it comes to accessing private capital. The South African National Roads Agency (SANRAL) is an internationally recognized expert known for its extensive years of experience in PPP projects particularly for roads. South Africa is also in possession of well advanced hospital schemes in which the private sector enters in a long term contract with public sector to provide and maintain the health facilities infrastructure for the Government. The cessation of the Gautrain Project in 2007 was regarded as the most promising indicator of a rapid increase in the infrastructure PPPs market (Bruchez, 2015).

The financing of Africa's infrastructure is mainly sourced from the Europe, Arab Co-ordination Group, Asia, the Americas, Multilateral development banks, regional development banks, African national governments and the private sector. In overall from 2016 to 2017 there has been an increase in capital flows to African infrastructure; $81.6 billion was injected to Africa's infrastructure in 2017 from $66.9 billion in 2016. The $14.7 billion increase was mainly a result of the increase in Chinese investments

from $6.4 billion in 2016 to $19.4 billion in 2017 and a $3.7 billion spending increase from the African national and some sub-national government (Infrastructure Consortium for Africa (ICA), 2017).

In developing countries, private sector participation in infrastructure has been firm but inadequate. This has been indicated by an estimated $1.5 trillion investments flows into infrastructure by the private sector between 2008 and 2017. Over the last decade financing free of any support from the public policy has been accountable for 78% of the total private financing to infrastructure dominating private co-financing; however these levels are only 10% of the required private finance levels in infrastructure financing thus indicating a significant need for an increased private sector participation (Tyson,2018).

The Infrastructure Consortium 2017 (ICA, 2017) report also demonstrates an improvement in private sector participation for the year 2017. Africa's total infrastructure funding for 2017 was valued at $81.6 billion of which $5.2 billion (6.37%) was financed by the private sector, this reflects an increase from the $3.6 billion (5.38%) reported in 2016.

Infrastructure finance investments to South Africa in the year 2017 were valued at $8.7 billion from the $8.6 billion in 2016. South Africa alone accounted for about 10.7% of the overall investment flows to Africa's infrastructure from funding sources in 2017. Even though there was not a significant change in the commitments to South Africa's infrastructure finance as most of the funding sources either increased or maintained their investments, there was a significant decline in the private sector investment flows in the country. The slight change is probably attributed to a number of events with major ones being the delays in the Renewable Energy Independent Power Producer (REIPPP) programme, significant increase in the Chinese investment particularly for the year 2017, a notable decline in Infrastructure Consortium Africa (ICA) investment commitments -lowest it has been since 2013 and the absence of contributions from the Arab Co-ordination Group (ACG) members or non-ICA European governments (ICA report, 2017).

Calitz and Fourie (2010) observed that South Africa as an upper middle income country was more regarded as a development finance source and a funding donor rather than a country that you can invest in. As a consequence in South Africa private capital will continue to be the main provider of loan and equity finance.

Hulten (1996) proclaimed on the significance of using infrastructure efficiently and demonstrated that the using infrastructure inefficiently results to a negative impact on the investments benefits. In comparing the growth between Africa and East Asia, Hulten (1996) discovered that there is a 25 per cent growth difference between the

two divisions and the efficient utilization of infrastructure resources could be the reason for this. Hulten (1996) further went on to compare low growth economies to high growth economies, from the investigation it was found that there was an existence of more than 40 per cent of the growth difference that could possibly be linked to the inefficient use of infrastructure. From Hulten (1996) observations it was noted that private investments in infrastructure for instance through project finance posed a greater effect on economic growth as compared to public investments in infrastructure.

2.3 Financial Development role in Infrastructure Financing through Investment

Several studies have been conducted to evaluate the effect of financial development on investment. However sensibly there is a generally accepted notion that financial development has a positive influence on investment (flexible accelerator investment model) which infrastructure investment is part of.

According to Sahay, Čihák, N'Diaye and Baraja (2015), a country classified as financially developed should have a fairly considerable and liquid market, its financial institutions should have the capacity to provide low priced financial services and also the bulk of the people should have access to the market.

The majority of theoretical discussions appear to have taken financial development, savings, government spending, monetary policy and many other issues as the underlying factors of the determinants required for achieving economic growth. Investment has been regarded as one of the vital components required for such economic growth. However, in addition to that, a number of theories have transpired to elaborate on the behavior of investments in developed countries. One of the theories established is the acceleration principle of investment; this principle argues that *ceteris paribus,* an increase in the output of the country will require a corresponding amount of increase in its stock or investment. The flexible acceleration principle of investment model is the modification of the accelerator model. The relationship between investment and output growth by the accelerator principle has been established by a number of studies in the economic literature (Greene & Villanveva, 1991; Ndikumana, 2000; 2005).

Improved efficiency, considerable accessibility to the financial sector and growth in deposits and loans all form part of the indicators of an enhanced financial development which improves economic growth. In recent times global economic dissertation on financial development is getting popular for a number of reasons. First,

enhanced financial development encourages saving of funds by enabling efficient allocation of these savings into productive uses as a result securing great returns. Secondly, an advanced financial sector assists in improving the monitoring and risk management processes create easy payment procedures and encourages the invention of new products and services. Thirdly, it aids in the expansion of instruments like the bonds indexed to infrastructure projects, insurance designed to minimize delay risks particularly for big infrastructure projects and also assisting companies with the management of projects with non-recourse financing (IMF,2016).

Muyambiri and Odhiambo (2017) argued that theoretically financial development is explained as a vital determinant of economic growth through its supposedly positive impact on investment; in addition to that it was argued that financial development appears to coincidentally increase allocative efficiency through increased savings, deposits, credit availability and investment.

Schumpeter (1912) and Robinson (1952) attested to the existence of a relationship between economic growth and financial development. The Robinson (1952) study suggests that the demand for financial services as a result of economic growth encourages financial development. Ang, 2008, discovered that financial development is directly related to economic growth as a result of the increasing demand for financial services. According to Bara, Mugano and Roux, 2016 this suggests that economic growth is the leading force to increased demand for financial products and in responding to this increased demand financial markets tend to expand.

Furthermore, McKinnon (1973) and Shaw (1973) also maintain that financial liberalization is the driver of financial development. There is a restricted number of academic work have evaluated the impact of financial development on investment. In his research in Pakistan on the function of financial institutions in financing private investment, Masih (1979) discovered that private investment is positively related to the availability of funds as opposed to the price of funds (interest rates).

From their study of investigating the impact of the financial sector development on domestic private investment in Pakistan Ali, Shamsi, Panhawar & Bashir, R, (2013) discovered that financial development bears a positive impact on domestic private investment in Pakistan. Credit to the private sector and liquid liabilities appeared to be the dominant factors affecting investment, Ali et al. (2013).

King & Levine (1993), in their study of 80 countries, asserted that financial development indicators have a positive and considerable influence on investment. Rousseau (1999) discovered that the development of the financial superstructure is

the driver to the sharp increase of output and investment in Japan. Xu (2000) assessed the investments, financial development as well as economic growth of 41 countries. The study demonstrated the significance of investment as an important indicator of economic growth through financial development.

Valderrama (2003), in his research on establishing the relationship between the investment and the banking structure in Austria, discovered that financial variables particularly the liquid-assets to capital-ratio were the most significant influencers of investments than the user opportunity cost.

Finance (2004), researched the interrelationships between asset-based financing, economic growth and investments in Canada using different financial development indicators, investment indicators, as well as economic growth indicators. From the study, it was established that financial services development, including asset-based financing influenced an increase in investments. Alfaro (2004) verified that countries with well-built financial markets tend to benefit from inflows of foreign direct investments.

Uçan & Öztürk (2011) analyzed the investment financial determinants for Turkey. From the study, it was found that there is a positive relationship between total domestic investment and the financial determinants of investments that is the total gross domestic investment as a percentage of the gross domestic product (GDP), real per capita gross domestic product, private domestic investment as a percentage of GDP, growth rate of GDP deflator and the discount rate (real interest rate). The results also indicate that elevated financial development is a speculator of the levels of domestic investment for the future. Furthermore, it is found that discount rates had a negative impact on total domestic investment.

Hassan (2015) investigated the effectiveness of the monetary policy on private capital emergence in Nigeria. The findings indicate that money supply (measured by M2) and domestic credit to the private sector influenced a positive impact on private investment.

The majority of the reviewed studies demonstrate that financial development holds a positive impact on investment. To an extent, there is no doubt that the financial system development plays a role in infrastructure investment and the development of infrastructure as a whole; even though there is very minimal empirical affirmation on this relationship. Regan, Smith and Love (2011), in their study discovered that in Australia capital markets have an influence on the funding plans for the social and economic infrastructure projects. Ehlers (2014) highlighted that infrastructure finance can be encouraged by fully exploiting the full range of resources offered by capital

markets with the aim of establishing different financial instruments that will cater for the needs of the majority of investors. As a result, this could imply that a well-developed financial system offers a platform for establishing a wide variety of efficient infrastructure financing instruments to suit all the stakeholders.

From the above review, there is still no clear indication of the relationship between: (i) the level of private financers and infrastructure development and (ii) infrastructure financing by private financers and the financial development. From the literature, one could conclude on these relationships, although without any empirical substantiation concluding on such could be deceiving. This study aims to examine these relationships in South Africa.

CHAPTER 3: EMPIRICAL FRAMEWORK AND DATA

3.1 Estimation Approach

The first objective of this study is to examine a relationship between infrastructure financing by private financers and infrastructure development (model 1). With the relationship being established objective two of this study analyses the financial development impact (as it might be one of the key aspects that might have influence) on the private financer's participation in infrastructure financing in South Africa amongst other variables. From the results, one will be able to motivate more practical measures that will introduce better infrastructure financing transactions in South Africa.

The Autoregressive Distributed Lag (ARDL) bounds testing procedure is used to establish a long-term relationship between private infrastructure financing and infrastructure development and also between the level of financial development and private infrastructure financing in South Africa. The ARDL bounds testing method is preferred amongst others as it assumes gradual adjustments of the dependent variables as a result of distributed lags (Munyambiri and Odhiambo, 2017).

In estimating the model for this study, the following procedure is followed. The first step will be to test for unit root of the time series variables using the Phillips Perron (PP) and the Augmented Dickey Fuller (ADF) test in order to eliminate spuriousness influences in the estimation. The ARDL procedure requires all the variables to be stationary at either I(0) and I(1) and none at I(2) thus it is important to conduct the unit root tests (Munyambiri and Odhiambo, 2017). The ARDL expression of the cointegration test equation is represented below.

3.1.1 Private Infrastructure Financing and Infrastructure Development

Specification estimations for private infrastructure financing and infrastructure development will be analyzed through time series data over the periods 2004 to 2018 as infrastructure development data is only available from 2004. The ARDL representation of the cointegration test is specified as follows:

$$\Delta \text{LINF DEV}_t = \rho_0 + \sum_{k=0}^{n} \rho_1 \Delta \text{LINF FIN}_{t-1} + \sum_{k=0}^{n} \rho_2 \Delta \text{LGDP PER CAPITA}_{t-1} + \sigma_1 \text{LINF FIN}_{t-1} + \sigma_2 \text{GDP PER CAPITA}_{t-1} + \mu_t \quad \text{(1)}$$

Where:

Δ is the difference operator

LINF DEV is the annual infrastructure development growth rate

LINF FIN is the annual growth rate of the private infrastructure financing

LGDP PER CAPITA is the annual GDP per capita growth rate

μ is the error term with a confidence interval of 5%

3.1.2 Financial Development and Private Infrastructure Financing

Specification estimations for financial development and private infrastructure financing will be analyzed through time series data over the periods 1995 to 2018. This study offers an added advantage as it is splitting the financial markets into a bank based and market-based to establish the relationship of the different aspects of financial markets on infrastructure finance through investment. The ARDL representation of the cointegration test is specified as follows:

$$\Delta LINF\ FIN_t = \alpha_0 + \sum_{k=0}^{n} \alpha_1\ \Delta BBFD_{t-1} + \sum_{k=0}^{n} \alpha_2\ \Delta MBFD_{t-1} + \sum_{k=0}^{n} \alpha_3\ \Delta RRI_{t-1} + \sum_{k=0}^{n} \alpha_4\ \Delta GDS_{t-1} + \sum_{k=0}^{n} \alpha_5\ \Delta LPINF\ FIN_{t-1} + \delta_1 BBFD_{t-1} + \delta_2\ MBFD_{t-1} + \delta_3\ RRI_{t-1} + \delta_4\ GDS_{t-1} + \delta_5\ LPINF\ FIN_{t-1} + \varepsilon_t \ldots\ldots\ldots (2)$$

Where:

LINF FIN is the annual growth rate of the private infrastructure finance

BBFD is the bank-based financial development

MBFD is the market based financial development

RRI is the real interest rate

GDS is the gross domestic savings; and

PINF FIN is the previous year's growth rate of the private sector

ε is the error term with a confidence interval of 5%

Based on theory, financial development is expected to pose a positive impact on infrastructure developments. However, in this study, financial development was split into bank-based and market-based and GDS; as a result, the coefficient for BBFD ,MBFD and GDS is expected to be positive. To correct for autocorrelation the lag of infrastructure finance is included in the specification because current infrastructure finance depends on previous infrastructure finance.

In following Ndikumana (2000), the expression below is used to estimate the bank based and market-based financial development accelerator terms:

$$BBFD_{t-1} = \left(\frac{1}{m}\sum_{j=1}^{m}\frac{BF_{j,t}}{BF_j}\right) \text{ X } GDP_{t-1}$$

$$MBFD_{t-1} = \left(\frac{1}{m}\sum_{j=1}^{m}\frac{MF_{j,t}}{MF_j}\right) \text{ X } GDP_{t-1}$$

Following the estimation of equation (1) and (2) above, cointergration tests among the variables is performed with the assistance of the Wald test (F-statistic) to determine whether there is long run equilibrium relationship. The specification for the null hypothesis is as follows, suggesting that there is no cointegration relationship:

Model (1):

H0: $\rho_1 = \rho_2 = \rho_3 = \rho_4 = \rho_5 = 0$ (No Long Run relationship)

Alternative hypothesis: H1: $\rho_1 \neq \rho_2 \neq \rho_3 \neq \rho_4 \neq \rho_5 \neq 0$ (Long Run relationship exists)

Model (2):

H0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ (No Long Run relationship)

Alternative hypothesis: H1: $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq 0$ (Long Run relationship exists)

The estimated F-statistic is compared with Pesaran *et al*. (2001) tabulated critical value. The lower bound values assume that the independent variables are integrated of order *I(0)*,whilst the upper bound values assume that the independent variables are integrated at *I(1)*. As a result, if the estimated F-statistic is below the lower bound value *I (0),* the null hypothesis cannot be rejected. Contrary, if the estimated F-statistic is greater that the upper bound value *I (1)*, the results suggest that the variables are cointegrated and there is an existence of a long run relationship. If the results indicate that the F statistic ranges between the upper and the lower bound values, this suggests inconclusive results (Adu and Marbuah, 2011).

The next step which is the final one is to estimate the long-run and short run error correction models. Below is a specification of the models respectively:

Model (1)

$$LINF\ DEV_t = \lambda_0 + \sum_{k=0}^{n}\lambda_1\ LINF\ FIN_{t-1} + \sum_{k=0}^{n}\lambda_2\ LGDP\ PER\ CAPITA_{t-1} + \mu_t \ldots\ldots\ldots (3)$$

$$\Delta LINF\ DEV_t = \lambda_0 + \sum_{k=0}^{n}\lambda_1\ \Delta LINF\ FIN_{t-1} + \sum_{k=0}^{n}\lambda_2\ \Delta LGDP\ PER\ CAPITA_{t-1} + Q_1\ ECT_{t-1} + \mu_t \ldots\ldots\ldots (4)$$

Model (2)

$$LINF\ FIN_t = \Omega_0 + \sum_{k=0}^{n} \Omega_1 BBFD_{t-1} + \sum_{k=0}^{n} \Omega_2 MBFD_{t-1} + \sum_{k=0}^{n} \Omega_3 RRI_{t-1} + \sum_{k=0}^{n} \Omega_4 GDS_{t-1} + \sum_{k=0}^{n} \Omega_5 LPINF\ FIN_{t-1} + \varepsilon_t \ldots\ldots\ldots (5)$$

$$\Delta LINF\ FIN_t = \Omega_0 + \sum_{k=0}^{n} \Omega_1 \Delta BBFD_{t-1} + \sum_{k=0}^{n} \Omega_2 \Delta MBFD_{t-1} + \sum_{k=0}^{n} \Omega_3 \Delta RRI_{t-1} + \sum_{k=0}^{n} \Omega_4 \Delta GDS_{t-1} + \sum_{k=0}^{n} \Omega_5 \Delta LPINF\ FIN_{t-1} + \varphi_t ECT_{t-1} + \varepsilon_t \ldots\ldots\ldots (6)$$

Where all the other variables are previously defined, φ_t is the error correction term (ECT_{t-1}) coefficient measuring the speed of adjustment to long run equilibrium.

3.2 Data

The annual time series data commencing from 1995 to 2018 was used for the purposes of conducting empirical analysis in this study. The following variables were used in determining the influencers of infrastructure finance (INF FIN), namely: financial development split into the Bank and the Market Based Financial Development (BBFD and MBFD), Gross Domestic Savings (GDS) and the Real Interest Rates (RIR). The main data was sourced from the World Bank Development Indicators.

3.2.1 Proxy for financial development

Proxy measures for macroeconomic conditions and financial development were collected from the World Bank's *World Development Indicators (WDI)* database for the period from 1995 to 2018.

Based on the flexible accelerator investment model this study assumes that both the bank-based financial development and the Market based financial developments have an enhancing effect on infrastructure investment, thus financial development was spilt into the Bank Based and the Market Based Financial Development.

For measuring the bank-based financial development, this study employs analyses of four proxies. The first proxy is the domestic credit issued by the banking sector as a percentage of GDP (Px1). A high level of Px1 is an indication that there is a greater dependence for financing lying with the banking sector. This supports Levine (2005) findings that *"banks are more likely to provide the five financial functions".* These five financial functions encourage investments consequently promoting higher economic growth through enhanced risk management, thorough research in investments, efficient allocation of resources, mobilizing savings, advanced exchange techniques, efficient management of resources and application and monitoring of corporate governance (Levine, 2005).

A second related proxy is the domestic credit to private sector as a percentage of GDP (Px2). A high level of domestic credit to GDP is a reflection of both a high ratio of domestic investment and an increasing development of the financial system.

The third proxy is the domestic credit to private sector issued by the banking sector as a percentage of GDP (Px3). Px3 is similar to Px1 and Px2 in a sense that higher levels of Px3 imply high levels of financial development.

In this study, we also use the comprehensive definition of money M3 as a percentage of GDP to measure liquid liabilities in the economy. M3 is preferred over M1 and M2 as these appear to be poor proxies, particularly in economies with underdeveloped financial systems. Economies with underdeveloped financial systems appear to use money as a store of value in cases where there is lack of attractive alternatives this in return tend to reflect a high ratio of money to GDP (Khan and Senhadji,2003).

According to King and Levine (1993b), an increasing level of liquidity suggests a concentrated banking system. The underlying assumption is that the magnitude of the financial sector is positively related to the financial service.

The Gross Domestic Savings to GDP (GDS) ratio is another proxy of financial development. Financial development is expected to be achieved through higher GDS which will result in an increase in investments. Furthermore, financial suppression and controls in credit results to negative interest rates, as a result minimizing the incentive to save. Mckinnon-Shaw (1973) concludes that increases in the levels of GDS are achieved through positive Real Interest Rates (RIR) as a result encouraging investments and growth.

This research also investigates the impact of the market based financial markets (i.e. equity markets vs debt markets) in promoting infrastructure development. For this study, indicators of market-based financial development will be used, i.e. the total stock market capitalization as a percentage of GDP measure as a proxy for equity market development, and also the bond market capitalization as a percentage of GDP measure as a proxy to determine the importance of the bond for infrastructure development and finance.

The implementation of all these proxies is to eliminate any possible biases that would come up from using just one proxy.

3.2.2 Infrastructure financing

Data was sourced from the World Bank PPI database on participation by the private sector in infrastructure: *World Bank Development Indicators (WDI)* database for the period from 1995 to 2018. The database offers information on private participation in infrastructure in both low and middle-income countries by covering the total

investment in all infrastructure sectors (water, telecom, airports, electricity, roads, natural gas, seaports, and railroads) for each country. In light of Gutma, Sy and Chattopadhyay (2015), the study uses the total investment in infrastructure annually as a proxy for infrastructure financing.

3.2.3 Proxy for infrastructure development

A number of studies appear to have established a long-run relationship between infrastructure and economic growth; however, interpretation of these results is always complicated by the infrastructure measurement issues. Calderón and Servèn (2010) discovered that measuring infrastructure as a physical or monetary unit fails in capturing the multidimensional nature of infrastructure and heterogeneous nature over time. It also fails to differentiate between the bulk of infrastructure and the quality or productivity of infrastructure.

For the purposes of this study to avoid criticisms on infrastructure development, the African Infrastructure Development Index (AIDI) developed by AfDB (2013) is used as a proxy for infrastructure development. The AIDI has four main components (Water and Sanitation, information and communications technology (ICT), Transport, Electricity) which are divided into 9 nine infrastructure indicators.

By far the AIDI indicator records the multi-dimensional nature of infrastructure; for an example, the composite index for transport infrastructure quality is composed of total paved roads (km per 10,000 inhabitants) which is a measure of access to road paved network and total road network in Km (Per km2 of exploitable land area); The electricity index is composed of the country's total electricity production inclusive of energy generated from both the private and public. The only limitation about using this index specifically for this study is that data is only available from 2004, and this study was initially intended to analyze data from 1995. Due to data limitations objective one of this study only analyzes data from 2004 to 2018.

3.2.4 Control Variables

For a lot of investors, political and macroeconomic risks appear to be the main risks contributing to the lack of infrastructure investment in developing economies. It will be beneficial to include control variables which appear to affect infrastructure development and finance (Tyson, 2018). All things equal, the economic growth rate is expected to have a positive impact on the infrastructure development growth; as a result in this study, we include a GDP per capita growth rate as a control variable.

CHAPTER 4: EMPIRICAL RESULTS

4.1 Introduction

4.2 Unit Root Tests

This study used both the Augmented Dickey-Fuller (ADF) and the Phillips Perron (PP) tests to establish the stationarity of the variables. The results of the Unit root tests are presented in Table 1 below. The results support that all variables are integrated of order one I (1) and none of them at I (2). As a result, the ARDL method appears to be the most suitable approach to conduct empirical analysis for this study.

Table 1: Results of the Unit Root Test

		ADF Test		PP Test		
Variables		Level	First Difference	Level	First Difference	Decision
BBFD	Intercept	2.69***	5.45	2.67***	8.36	I(1)
	Intercept & Trend	2.89	5.29	2.84	9.39	
	None	2.07**	5.55	1.99***	7.99	
MBFD	Intercept	2.6	5.57	2.63	7.65	I(1)
	Intercept & Trend	2.9	5.43	2.88	8.99	
	None	2.13	5.68	2.04**	7.49	
RIR	Intercept	1.95	6.59	1.92	6.64	I(1)
	Intercept & Trend	2.73	2.73	2.92	7.72	
	None	1.28	1.28	0.86	6.7	
GDS	Intercept	2.54	3.69**	2.05	3.63	I(1)
	Intercept & Trend	1.95	4.47	1.95	3.81	
	None	0.19	3.78	0.19	3.77	
LINF FIN	Intercept	1.28	4.06	1.41	4.1	I(1)
	Intercept & Trend	3.93**	3.63**	1.72	4.06**	
	None	0.69	4.07	0.6	4.11	
LINF DEV	Intercept	0.78	4.4	0.68	4.7	I(1)
	Intercept & Trend	2.53	4.19	2.55	4.44	
	None	1.76***	3.5	2.7**	3.5	
LGDP PER CAPITA	Intercept	1.24	0.98	1.32	3.51***	I(1)
	Intercept & Trend	2.4	ins obs	2.28	7.67	
	None	0.7	0.19	0.58	2.61**	
LPINF FIN	Intercept	1.22	3.97	1.35	4.02	I(1)
	Intercept & Trend	3.28***	3.90**	1.76	3.95	
	None	0.72	3.97	0.64	4.01	

Note *, **, *** indicate significance at 1%, 5% and 10% levels respectively

4.2 Cointegration and ARDL-ECM Results

The long run relationship between the variables in the estimated model was tested using the ARDL bounds method. Table 2 and 3 present the results of the bounds F-test procedure for model (1) and (2) respectively below:

Table 2: Model (1) Bounds F-test for Cointegration

Dependent Variable	Function	F-Statistics	Cointegration Status
LINF DEV	F(LINF DEV| LINF FIN,LGDP PER CAPITA)	10.71	Cointegrated
Asymptotic Critical Values using Pesaran et al 2001:300 Table			

As presented in Table 2 the F test results confirm that there is an existence of a long-run steady relationship between infrastructure development, private financing infrastructure and the real GDP per capita. The computed F-statistic for Model (1) is 10.71, which is higher than the upper bound (7.84) at one percent significance level. Accordingly, the null hypothesis of no cointegration is rejected at one percent level favouring the alternative hypothesis. As a result, private financing of infrastructure and the real GDP per capita are long-run driving determinants of infrastructure development in South Africa. These results attest to Oliver Wyman (2011) findings that infrastructure assets appear to be attractive to institutional investors (pension funds) as their long term investment structure could complement the long time span of pension liabilities.

Also Standard & Poor's (2014) confirms the existence of rapid growth of institutional investors interested in infrastructure investments mainly because of the pension funds nature to match long term assets and liabilities. Infrastructure investment permits for substantial investments with consistent returns over period of time, it is for this specific feature that makes it an attractive asset-liability match with pension funds (Schoenberg, 2015).

Table 3 is a representation of the F test results from the bounds test for cointegration between infrastructure finance and its variables as specified in equation (2). Results indicate that there is also an existence of a long-run relationship between private financing of infrastructure, bank-based and the market based financial development, real interest rate, gross domestic savings and previous private financing of infrastructure. The computed F-statistic for Model (2) is 14.51, which is higher than the upper bound (6.32) at one percent significance level. Accordingly, the null hypothesis of no cointegration is rejected at one percent level favouring the alternative hypothesis. Consequently, it appears that in South Africa the bank based and the market based financial development, real interest rate, gross domestic savings and previous private financing of infrastructure are the driving force variables behind private financing of infrastructure in the long run. These results attest to the literature from the preceding sections of this study.

Table 3: Model (2) Bounds F-test for Cointegration

Dependent Variable	Function	F-Statistics	Cointegration Status
LINF FIN	F(LINF FIN| BBFD,MBFD,RIR,GDS,LPINF FIN)	14.51	Cointegrated
Asymptotic Critical Values using Pesaran et al 2001:300 Table			

Results of the long-run estimated equations are presented in table 4 and 5 below for model (1) and (2) respectively.

The estimation of the ARDL model was carried out using the Schwarz Bayesian Criterion (SIC) guideline in order to select the maximum lag.

Table 4: Model (1) Estimated Long Run Coefficients

Dependent Variable is LINF DEV				
Regressor	**Coeficient**	**Standard Error**	**T-Ratio**	**Pro. Values**
C	-0.20	4.83	-0.04	0.97
LINF_FIN	1.00	1.13	0.89	0.40
LGDP_PER_CAPITA_GROWTH	-0.12	0.06	-2.05	0.08***
Note *, **, *** indicate significance at 1%, 5% and 10% levels respectively				

The long-run coefficients result in Table 4 indicates that the coefficient for the growth rate of GDP per capita is by far the most statistically significant determinant of infrastructure development in the long run. From previous studies it is clear that GDP per capita (measured from country's GDP) is one of the underlying determinants of economic prosperity. This attests to findings by Bara, Mugano and Roux (2016) that as the economy grows there will be an increase in demand for financial products which infrastructure finance is part of, resulting in the expansion of financial markets. From the results it is clear that an increase in the underlying determinant of economic growth i.e GDP per capita will highly contribute to an increase in infrastructure financing as the financial markets increase due to high demand of financial products.Consequently contributing to infrastructure development in the country in the long run.

From the results and theory it is clear that there is no mutual relationship between GDP per capita and Infrastructure development in the long run thus the negative sign, but there is a mutual link between economic growth (measured by GDP and can be used to derive GDP per capita) and demand for financial products resulting in an influence of the financial market expansion.

The coefficient for the private financing of infrastructure was found to be positive but statistically insignificant; this could present the limitations that are posed by the eposidic participation of investors in the private financing in South Africa for the sample period of this study.

Table 5: Model (2) Estimated Long Run Coefficients

Dependent Variable is LINF FIN				
Regressor	**Coeficient**	**Standard Error**	**T-Ratio**	**Pro. Values**
C	0.6487	0.66	0.98	0.34
BBFD	-0.0016	0.00	-2.67	0.02**
MBFD	0.0007	0.00	0.50	0.62
RIR	0.0011	0.00	0.55	0.59
GDS	0.0082	0.00	2.01	0.06***
LPINF_FIN	0.8109	0.14	5.61	0*
Note *, **, *** indicate significance at 1%, 5% and 10% levels respectively				

The estimated long-run coefficients results in Table 5 for model (2) indicate that the previous year's infrastructure financing by the private sector is the most statistically significant estimator of the current private financing of infrastructure. It implies that provided there is availability of fairly attractive infrastructure finance products to the investors in the long run this will aid in sustaining current investors in those products while at the same time attracting more investors in the future.

A number of studies some discussed in the literature section, have been conducted to evaluate the effect financial development on investment (which infrastructure finance is part of). However sensibly there is a generally accepted notion that financial development has a positive influence on investment.

The results on Table 5 suggest that the Bank Based Financial Development (BBFD) and the Gross Domestic Savings (GDS) appear to be the only financial development determinants that are significant in increasing infrastructure finance. This results also attest to the literature above that, financial development is expected to be achieved through higher GDS which will result to an increase in investments; however, financial suppression and controls in credit results to negative interest rates, as a result minimizing the incentive to save. Mckinnon-Shaw (1973) concludes that increases in the levels of GDS are achieved through positive Real Interest Rates (RIR) as a result encouraging investments and growth. Even though one cannot conclude on the impact of RIR on infirastructure finance directly, the above statement demonstrates how RIR have an impact on the infrastructure finance (investments) through the GDS levels.

The coefficient for the BBFD appears to be the only negative coefficient amongst other variables. From the above literature one could also argue that there could be an existence of financial suppression and controls in credit in the BBFD that influence negative interest rates, thus disregarding the motive to save. For the BBFD to be able to finance infrastructure investments there is a need to have considerable levels of savings and this can be achieved through positive Real Interest Rates (RIR).

From the results one cannot conclude on the impact of the Market Based Financial Development (MBFD) on infrastructure finance. This could be the result of the episodic data availability of the MFBD; even though in South Africa some products of infrastructure finance may have been previously introduced in the MBFD. As suggested by literature, this implies that there is quiet a significant amount of work that still needs to be done in ensuring that the requirements for these alternative financing options are strictly followed and met in order to give the maximum benefits.

Table 6 and 7 below is a representation of the Error Correction for the selected ARDL model (1) and (2) respectively.

Table 6: Model (1) Estimated Short Run Coefficients

Dependent Variable: D(LINF_DEV)				
Regressor	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.06	0.04	1.28	0.27
D(LINF_FIN)	0.32	2.61	0.12	0.91
D(LGDP_PER_CAPITA_GROWTH)	0.01	0.09	0.13	0.90
ECT(-1)	-0.64	0.54	-1.18	0.30

From the presentation of results in table 6 all the independent variables coefficients are positive and statistically insignificant. The estimated error correction term coefficient (ECT (-1)) is correctly signed at negative and is found to be statistically insignificant.

Table 7: Model (2) Estimated Short Run Coefficients

Dependent Variable is D(LINF FIN)				
Regressor	**Coeficient**	**Standard Error**	**T-Ratio**	**Pro. Values**
C	0.0018	0.0031	0.59	0.56
D(BBFD)	-0.0011	0.0005	-2.14	0.05*
D(MBFD)	0.0007	0.0010	0.68	0.50
D(RIR)	0.0019	0.0017	1.13	0.28
D(GDS)	-0.0004	0.0042	-0.09	0.93
D(LPINF_FIN)	0.5512	0.1995	2.76	0.01*
ECT(-1)	-0.3196	0.1739	-1.84	0.09***
Note *, **, *** indicate significance at 1%, 5% and 10% levels respectively				

The estimated short-run coefficients in table 7 appear to be consistent with the long run results in table 5. In the short run, the previous year's infrastructure financing by the private sector is the most statistically significant estimator of the current private financing of infrastructure followed by the Bank Based financial development. The gross domestic savings was found to be statistically insignificant in the short run and also bears a negative coefficient together with the bank-based financial development amongst other estimator's coefficients. This model further confirms the existence of the cointegration relationship as the coefficient for the ECT (-1) is negative and statistically significant at 10% level.

Specifically, from the results in both the long and short run an increase in the Bank Based Financial Development (BBFD) results to a decrease in the financing level of infrastructure by the private sector, indicating that a Bank Based Financial Development (BBFD) has a negative effect on the levels of financing infrastructure by the private sector. This could be for the same reasons discussed under Table 5 and In addition to Russ and Valderrama (2012) arguments; stating that more companies prefer bond financing as it is cheaper than bank loans, for instance for the lowest risk borrower the bond yield appears to be lower than the bank interest rate (Russ and Valderrama ,2012).

Hale (2001) also discovered that countries that tend to have liquidity uncertainties pose too much risks to the banks, for banks to safeguard itself against the risk they introduce additional costs which eventually makes the bank borrowing costs expensive pushing the borrowers to borrow on the bond market.

Whereas looking at the coefficients, the Market Based Financial Development (MBFD) seems to have a positive influence on the level of private infrastructure financing in both the long and short-run even though it is statistically insignificant. The absence of a statistically significant relationship between private infrastructure financing and the Market based financial development attest to discussions under Table 5 furthermore to Ehlers, (2014) findings that African capital markets are not really favourable to infrastructure finance suggesting that more work needs to be done on these products to achieve maximum benefits. Previously it has been established that infrastructure finance can be improved by strong capital markets offering a variety of attractive financial instruments to investors however this has only worked in more developed economies like Australia (Regan, Smith and Love, 2011). Our results imply that South Africa's existing bond markets are still in their early stages of development and needs to expand to a stage where they can efficiently finance infrastructure. The Real Interest Rate (RIR) appear to be statistically insignificant in both the long and short run, this could be for the reasons discussed under Table 5.

From the analysis as presented in Table 8 below indicates a strong correlation of 0.78 between infrastructure development and private financing of infrastructure. From the results, it is evident that in South Africa infrastructure development is highly dependent on the level of involvement of the private financiers investing in infrastructure.

Table 8: Correlation Analysis

Correlation	LGDP_PER_CAPITA_GROWTH	LINF_FIN	LINF_DEV
LGDP_PER_CAPITA_GROWTH	1		
LINF_FIN	-0.794574	1	
LINF_DEV	-0.851896	0.778517	1

4.4 Diagnostics tests of Coefficients

To ensure the reliability of the estimated coefficients in the error correction model, a series of diagnostics tests were conducted. As presented in Table 10 the estimated ARDL model passed the entire diagnostics test. The study results show no existence of serial correlation, heteroskedastic errors, and non-normality of residuals with the Prob Chi-Square exceeding 0.05.

Table 9: Short Run Coefficients Diagnostics Test

Model (1)		Model (2)	
Test Statistics	Prob Chi square Values	Test Statistics	Prob Chi square Values
1: Serial Correlation	0.051	1: Serial Correlation	0.42
2: Normality	0.47	2: Normality	0.82
3: Heteroscedasticity	0.38	3: Heteroscedasticity	0.43

Furthermore, a stability test was performed on both models using the Cumulative Sum of Recursive Residuals (CUSUM) and the Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) as presented in Figure 1 and 2 for model (1) and figure 3 and 4 for model (2) respectively. The results indicate that both models are stable and also confirm the stability of the long run coefficients for the variables at the 5% level of significance except in figure 2 where the model shows existence of instability when implementing the Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) test.

Figure 1

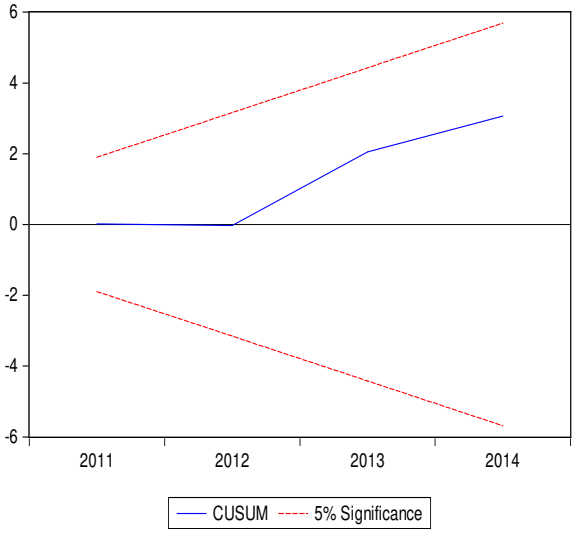


Figure 2

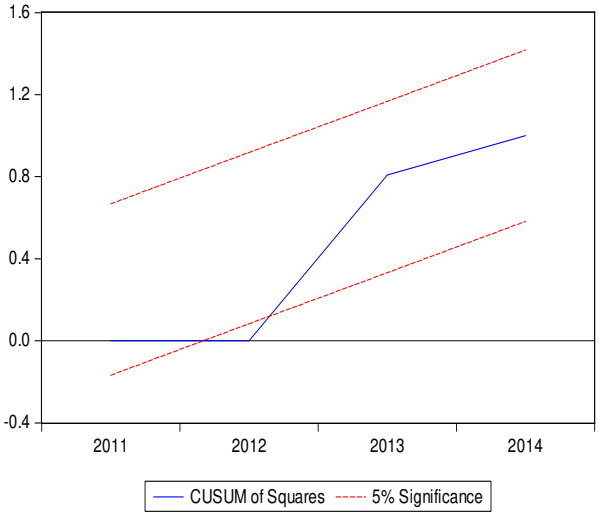


Figure 3

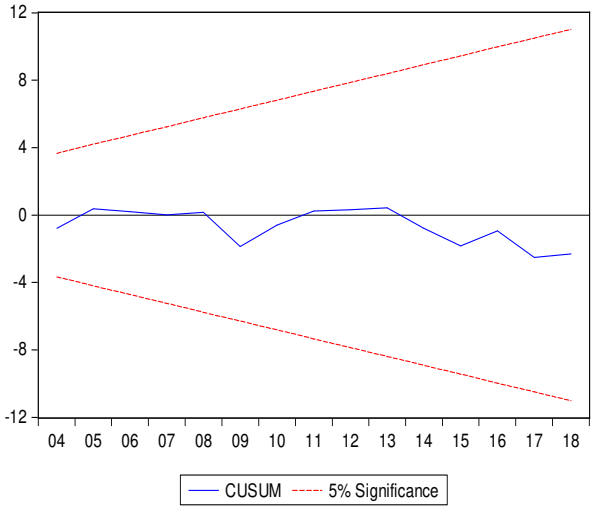
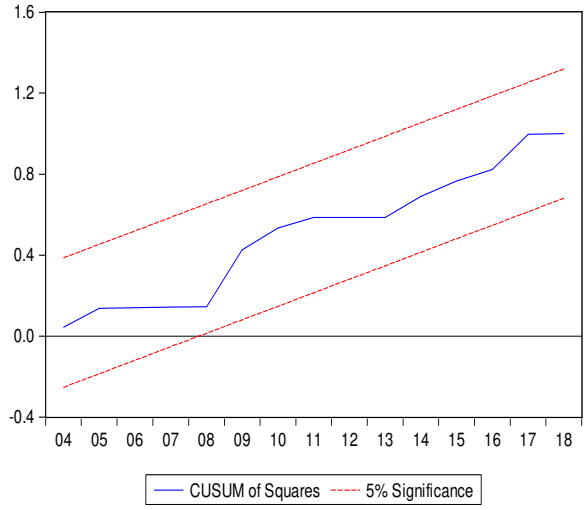


Figure 4



The adjusted-R^2 values indicate that in Model (1) 68% of the variations in infrastructure development are explained by estimated variables. Model (2) adjusted-R^2 implies that 85% of the variations in the levels of privately financed infrastructure are explained by the estimated variables. The results indicate that the data in both model (1) and (2) was fitted appropriately.

CHAPTER 5

5.1 Conclusion

This research study was carried out to achieve the following objectives:

i. To examine a relationship between private infrastructure financing and infrastructure development in South Africa.
ii. To examine a relationship between private infrastructure financing and financial development in South Africa.

Objective one makes use of time series data of South Africa spanning from 2004 to 2018. The Correlation analysis (Table 8) was first employed and the ARDL technique confirmed the results. Correlation results indicated that infrastructure finance has a strong correlation relationship (0.78) with infrastructure development.The ARDL indicates that in both the long run and the short run the coefficient of private infrastructure financing was found to be positive but statistically insignificant (Model1) with only episodic infrastructure finance by private financiers in the previous years. This makes it difficult for one to conclude on the impact of the private infrastructure finance on infrastructure development.

The growth rate of GDP per capita is by far the most statistically significant determinant of infrastructure development in the long run even though its coefficient is negative. The inverse correlation relationship was also proven in Table 8. In the short-run growth rate of GDP per capita coefficient is positive but statistically insignificant. From the results and theory it is clear that there is no mutual relationship between GDP per capita and Infrastructure development in the long run, but there is a mutual link between economic growth (measured by GDP and can be used to derive GDP per capita).GDP per capita is one of the underlying determinants of economic growth. As the economy expands there will be an increase in demand for financial products which infrastructure finance is part of, in responding to the demand financial markets will tend to expand; ultimately improving infrastructure development of the country in the long run. From this scenario one can also conclude on the relationship between infrastructure finance-which is evidenced by expansion of financial markets in responding to the increasing demand of financial products, provided the investors prefer to invest in infrastructure finance products an increase in infrastructure development will be evident.

Objective two of this study empirically analyses the financial development impact on the private financer's participation in infrastructure financing through infrastructure investments. This objective was based on the theory in the preceding sections that the financial development has a positive and considerable influence on the levels of investment in a country (which infrastructure investments is also part of). This study is

based on the assumption that the two categories of the financial markets i.e the Bank Based and Market Based Financial Development (BBFD and MBFD) have an impact on private infrastructure finance; thus for the purposes of this study financial markets was split into the BBFD and MBFD to identify which sector of the financial markets is more influential in improving private financing of infrastructure so as to establish a guideline in terms of which category is worth exerting more work in the future in order to encourage significant participation in infrastructure finance ultimately contributing to infrastructure development as it has been proven in objective 1 that there is an existence of a link between the infrastructure finance and infrastructure development.

The ARDL Bounds testing procedure was carried out to investigate the relationship between private infrastructure investment and financial development, using different parameters for financial development between 1995 and 2018. The estimated long and short-run coefficients results indicate that the previous year's infrastructure financing by the private sector is the most statistically significant estimator of the current and future private financing of infrastructure. For this reason one can conclude that to boost infrastructure finance there is a need to continuously improve infrastructure investment/finance products in order to best suit the requirements of the investors, by doing this South Africa will be retaining its current infrastructure investors and also attracting new investors in the infrastructure finance portfolio, consequently improving on infrastructure development.

In the long run the Gross Domestic Savings (GDS) appeared to be significant in increasing infrastructure finance. From the results it is clear that financial development can be achieved through higher GDS; as this drives the demand of financial products resulting to improvements in the financial development, which ultimately drives investments. The Real Interest Rate (RIR) appeared to be insignificant in both the long and short run. However, in the early stages of this study it was learnt that financial suppression and controls in credit results to negative interest rates thus minimizing the incentive to save which in turn will discourage savings and or investments. From the theory and results one can conclude that increases in the levels of GDS are achieved through positive RIR as a result encouraging investments and growth-which infrastructure finance is also part of.

The coefficient for the BBFD appears to be the only negative coefficient amongst other variables in both the long and short run but significant. The results in both the long and short run suggest that an increase in the Bank Based Financial Development (BBFD) results to a decrease in the financing level of infrastructure by the private sector, indicating that a Bank Based Financial Development (BBFD) has a negative effect on the levels of financing infrastructure by the private sector. From the literature discussed earlier in this study one could argue that there could be an existence of financial

suppression and strict controls in credit in the BBFD that influence negative RIR, thus disregarding the motive to save or invest. In addition to that the nature of Infrastructure investment requres substantial investments with consistent returns over period of time, It is for this specific feature that makes it an attractive asset-liability match with pension funds. Furthermore, the results attest to the arguments of Russ and Valderrama (2012); stating that more companies prefer bond financing as it is cheaper than bank loans, for instance for the lowest risk borrower the bond yield appears to be lower than the bank interest rate (Russ and Valderrama ,2012). The BBFD has somehow appeared to not aligning with the infrastructure investor's requirements thus posing a negative effect on infrastructure finance.

The coefficient for the MBFD appears to be the positive in both the long and short run but insignificant. Based solely on the results one cannot conclude on the impact of the Market Based Financial Development (MBFD) on infrastructure finance. Even though some of the infrastructure finance products have been introduced in the South African markets for a while now.

This could imply that on both the South African MBFD and BBFD there is quiet a significant amount of work that still needs to be done in ensuring that the requirements of the alternative infrastructure financing options are strictly followed and met in order to give the maximum benefits of these infrastructure financer's in the development of infrastructure. However considering the nature of the infrastructure financing this can be a challenge particulary in the BBFD since the Regulatory changes under the Basel III are restricting commercial bank's capacity in the provision of long term financing.

Thus as a recommendation from the results of this study; a discussion of recommendations to attract more private financers and strict critieris to ensure efficiency in the available financing vehicles is conducted based on other's country's experiences.

5.2 Recommendations for effective infrastructure finance

In developing countries mobilizing funds of financing infrastructure remains a challenge, however, it is possible if the community in the developing countries act with imagination and determination and in close partnerships and coordination. For this goal to be achieved, different institutions need to lead and coordinate various critical roles to combat this challenge. From the previous section of this study, we have documented that South Africa is in need of mobilizing private finance in order to combat the challenge of the increasing infrastructure backlog.

According to Tyson (2018), it is with no doubt that Institutional investors have the required capacity to finance the infrastructure backlog, however, their fiduciary and regulatory responsibilities makes their investment requisites complex and entail taking well-balanced risks chances in infrastructure. As a result, it is crucial for International Financial Institutions (IFI), investors and regulators to work together in the development of infrastructure financing vehicles that will satisfy the needs of investors, particularly institutional investors.

International Financial Institutions (IFIs) and the private financial institutions need to work together to create and support innovations in foreign exchange hedging and insurance to political risk amongst others as considerable transformation is needed regarding the financing instruments and hedging measures. Lastly, there is a need for an integrated approach to infrastructure financing that involves the development of domestic financial markets, particularly in developing countries. This involves the modifications of regulations governing the pension and insurance institutions so as to allow funds to invest in infrastructure whilst maintaining the relevant fiduciary standards. The Government and the International Financial Institutions need to carefully monitor the performance of these investments to ensure the safety of the household savings (Tyson 2018).

Strict implementation of these policy recommendations in South Africa could have a positive influence in attracting more private investors to inject funds in infrastructure finance through infrastructure investments. The recommendations could also ensure efficiency in the already available infrastructure financing vehicles like project finance and project bonds.

The majority of municipalities in South Africa are currently faced with increasing lending constraints prohibiting them from providing the required services, thus failing to meet the ever-increasing demand. Even if that is the case in South Africa the municipality remains responsible for providing services such as electricity, water supply, waste removal and sanitation. Looking at the problem Project finance appears to be a solution.

The advantage of project finance is that it can be applied specifically to the user paid services provided by the municipality as mentioned above.

However, in South Africa, even though vehicles like project finance and project bonds are already implemented; there is a need for proper satisfaction of the criterion in order to ensure maximum effectiveness of implementing such. In addition to Tyson (2018) recommendations set above, the criterion listed below needs to be also fulfilled:

- The political willingness to accommodate project finance
- Strict application of the ‘user pay' principle and efficient technique to recover unpaid costs.
- Well calculated subsidization to reach balance between rich and poor
- The willingness to support project finance by organized labour

According to Sithole (2016), considering the institutional, regulatory, economic and market perspective, South Africa should start to employ more project bonds to fund its infrastructure development. Project bonds have been very successful in emerging markets like Brazil, Peru, Malaysia and Mexico which are faced with similar challenges like South Africa due to their unique characteristics that are appealing to both the investor and the issuer such as:

- They are issued for only a particular project at a time,
- They permit access to deep and liquid capital markets
- They are flexible in allowing project sponsors more control in running project company
- They offer the cheapest cost of financing compared to bank loans

However, with project bonds, the expansion of bond financing (i.e. greater participation of international investors) is dependent on the country's credit rating. Majority of the African countries are experiencing difficulties with obtaining investment ratings; thus, a decreasing rate of participation by foreign investors in their bond markets. Vuza (2016) found out that the quality of institutions appear to have an impact on private infrastructure finance and development in Africa in a sense that poor institutional quality results in poor credit ratings. Chege (2001) identified the policy and regulatory framework as an obstacle to the involvement of the private sector in infrastructure finance; consequently leading to weak capital markets and the increased bidding and transaction costs.

Other infrastructure financing options by the private sector include infrastructure indexed bonds, diaspora bonds, loan guarantees and lines of credit provided by the government to the private sector (Kodongo, 2015)

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