THE RELATIONSHIP BETWEEN DOMESTIC SAVINGS AND INVESTMENT IN ZAMBIA: AN ECONOMETRIC ANALYSIS FROM 1980 TO 2016

By

MASAUSO NGULUBE, BA

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DECLARATION

I, **Masauso Ngulube**, declare that this dissertation:

(a) Represents my own work;

(b) Has not previously been submitted for a degree at this or any other University; and

(c) Does not incorporate any published work or material from another dissertation.

Signed……..

Date……..

APPROVAL

This dissertation of **Masauso Ngulube** has been approved as a partial fulfilment of the requirements for the award of the degree of Master of Arts in Economics by the University of Zambia.

Examiner 1: …… Signature: ……. Date: …….....

Examiner 2: …… Signature: ……. Date: …….....

Examiner 3: …… Signature: ……. Date: …….....

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ABSTRACT

The aim of this paper is to investigate the relationship between domestic savings and investment in Zambia. The savings-investment relationship has recently become a subject of intense discussion in as far as policy analysis and formulation is concerned in developed and developing economies alike. The study employs the ARDL bounds testing approach to cointegration and the Granger-causality test of Toda and Yamamoto to test for causality between the two variables. Using annual data captured as a percentage of GDP from 1980 to 2016, empirical findings suggest that there is no existence of a long-run relationship between investment and savings in Zambia. Furthermore, the results report a lack of causality between the two variables in the short-run. The absence of short-run causality running from savings to investment implies a high degree of short-run international capital mobility. This implies that domestic investment in Zambia is financed by foreign saving rather than domestic saving. In light of these results, some policy measures were put forward.

Keywords: Savings, Investment, Granger Causality, ARDL, Toda-Yamamoto

DEDICATION

This study is dedicated to my parents Mr Levy Ngulube and Mrs Elena Zulu Ngulube

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

ADF	Augmented Dickey–Fuller
AFDB	African Development Bank
AIC	Akaike information criterion
AO	Additive Outlier
ARDL	Autoregressive Distributive Lag
CA	Current Account
FDI	Foreign Direct Investment
FH	Feldstein and Horioka Puzzle
FPE	Final Prediction Error
GDP	Gross Domestic Product
GDS	Gross Domestic Investment
GNDI	Gross National Disposable Income
HQ	Hannan-Quinn Information Criterion
IMF	International Monetary Fund
IO	Innovative Outlier
KPSS	Kwiatkowski–Phillips–Schmidt–Shin
LR	Sequential Modified LR Test Statistic
NEPAD	New Partnership for Africa's Development
OECD	Organisation for Economic Co-operation and Development
PADL	Panel Autoregressive Distributive Lag

PP	Phillips–Perron
SAP	Structural Adjustment Program
SC	Schwarz Information Criterion
SME	Small and Medium Scale Enterprises
UEMOA	West African Economic and Monetary Union
UNCTAD	United Nations Conference on Trade and Development
VAR	Vector Autoregression
WEO	World Economic Outlook
ZA	Zivot-Andrew

CHAPTER ONE
INTRODUCTION

1.1. Background

Savings and investment are key requirements for growth and development (Harrod, 1939). Over the years, empirical studies have been undertaken to assess the contribution of savings and investment to economic growth and development. Shiimi and Kadhikwa (1999) observed that countries that were able to accumulate high levels of investment achieved faster rates of economic growth and development. The effects of investment on economic growth are two-fold. Firstly, demand for investment goods forms part of aggregate demand in the economy. Thus a rise in investment demand will, to the extent that this demand is not satisfied by imports, stimulate production of investment goods which in turn will lead to high economic growth and development. Secondly, capital formation improves the productive capacity of the economy in a way that the economy is able to generate more output. Furthermore, investment in new plant and machinery raises productivity growth by introducing new technology, which would also lead to faster economic growth.

However, to finance investment required for economic growth, the economy needs to generate sufficient savings or it should borrow abroad from foreign savings. However, borrowing from abroad may not only have adverse effects on the balance of payments as these loans will have to be serviced in the future but it also carries an exchange rate risk. Therefore, sufficient domestic saving is necessary for economic growth because it provides the domestic resources needed to fund the investment effort of a country. However, lack of savings and investment are common in developing countries including Zambia. This phenomenon is largely attributed to high unemployment levels, low wages, engagement of a large proportion of the population in the informal sector, and poor performance of the economy (Esso and Yaya, 2010).

In light of this, the savings-investment relationship has recently become a subject of intense discussion in as far as policy analysis and formulation is concerned in both developed and developing economies alike. Research in this field has followed the

works of Feldstein and Horioka (1980). In their influential paper, Feldstein and Horioka (1980) (referred as FH hereafter), state that, the presence of a relationship between domestic savings and investment would not be expected under perfect capital mobility. They argue that, in the case of perfect capital mobility, savings follow wherever the highest return is and the relations between domestic savings and investment would be weak or somewhat disappear. However, when FH analysed the corresponding relationships across 16 OECD countries, for the periods 1960–74, contrary to prediction, they found that domestic investment and savings were highly correlated. Their results suggested existence of imperfect capital mobility across the 16 OECD countries. This result has come to be known as the FH puzzle in literature, this is because savings and investment need not to be correlated in countries with relaxed capital controls and liberalised financial systems. The evidence suggesting the existence of a link between the investment and savings in most advanced economies has come to be considered as one of the six major empirical puzzles of contemporary macroeconomics (Obstfeld and Rogoff, 2000).

1.1.1. Zambian Economy at a Glance

At independence in 1964, owing to copper revenues, Zambia inherited a stable economy with one of the highest per-capita incomes in Sub-Saharan Africa (Maimbo and Mavrotas, 2004). Its average annual GDP growth rate between 1965 and 1974 was 3.9 percent, average GDP per capita was US$ 1 595, inflation rate was 8.9 percent, and the current account surplus stood at 3 percent of GDP (World Bank, 2017). The mainstay of the economy was the production and exportation of copper that accounted for over 90 percent of foreign exchange earnings and 40 percent of gross domestic product (GDP) in 1964. Over the first four years of independence, Zambia continued to pursue free market-oriented policies with little public sector participation. However, from 1968 onwards, the government introduced state-led import substituting industrialization strategy (Zombe *et al.*, 2017). This entailed excessive control of the economy through nationalization and protectionist trade policies. The nationalization program saw government's stake in foreign companies rise from 42 percent in 1964 to over 80 percent by 1970. In the financial sector, government ushered in a system of regulation and

controls on prices, interest rates and exchange rates. These reforms were deemed necessary to bring about development in priority areas (Kumwenda, 2003).

However, the oil shock of 1973, which saw a rise in the oil prices by about 400 percent coupled with a fall in the copper prices created problems for the country. The foreign exchange earnings from copper slumped. Maimbo and Mavrotas (2004) notes that, during this period the country faced problems of a kind typical in an inflexible, poorly diversified economy, including: rapid money supply growth, skyrocketing inflation, large and unsustainable fiscal and balance of payments' deficits, low real incomes and declining private investment. Ceilings on interest rates, poor savings mobilisation, inadequate supply of loanable funds and a lack of investment characterised the economy.

In response, government adopted structural and stabilization policies, known as the Economic Reform Program between 1983 and 1986. This was followed by the Structural Adjustment program (SAP) in 1991. Both programs were supported by the World Bank and the International Monetary Fund (IMF). Since the implementation of these reforms, Zambia has affirmed its commitment to foster private sector development and investment promotion. Emphasis was placed on policies which were aimed at creating an enabling environment for private sector investment and growth (UNCTAD, 2006). This commitment was demonstrated by the enactment of the Investment Act of 1993 which was later replaced by the Zambia Development Agency Act of 2006. Over the years, these initiatives have yielded positive results (NEPAD-OECD, 2011). According to the highlights of the Policy Framework for Investment in Zambia (2011), as privatization gained momentum, investment began to increase while real GDP growth averaged 4.8 percent between 1999 and 2009 and reached 6.3 percent in 2009. In terms of investment flows, Zambia received US$1.3 billion in foreign direct investment (FDI) in the first quarter of 2010. This followed an upward trend in investment receipts which began in 2008. The bulk of these investments were in the mining and quarrying sub-sector (NEPAD-OECD, 2011). However, despite these strides, the country still faces the challenge of increasing and sustaining these inflows beyond recent levels, and to reap greater benefits for diversification, industrialization and development.

As part of the Structural reform package, government also implemented a number of reforms in the financial sector. These reforms included the partial liberalisation of interest rates and the removal of sectoral credit ceilings in the late 1980s. However, the most significant reforms took place during 1992/93 with the restructuring of government banks, prudential supervision reforms, and, foreign exchange and interest rates liberalization. Maimbo and Mavrotas (2004), however, note that although the financial reforms resulted in the emergence of new forms and types of financial institutions, they did not boost savings mobilization during the early years of the reform. This was largely attributed to the impact of the collapse in copper price in the early 1970's.

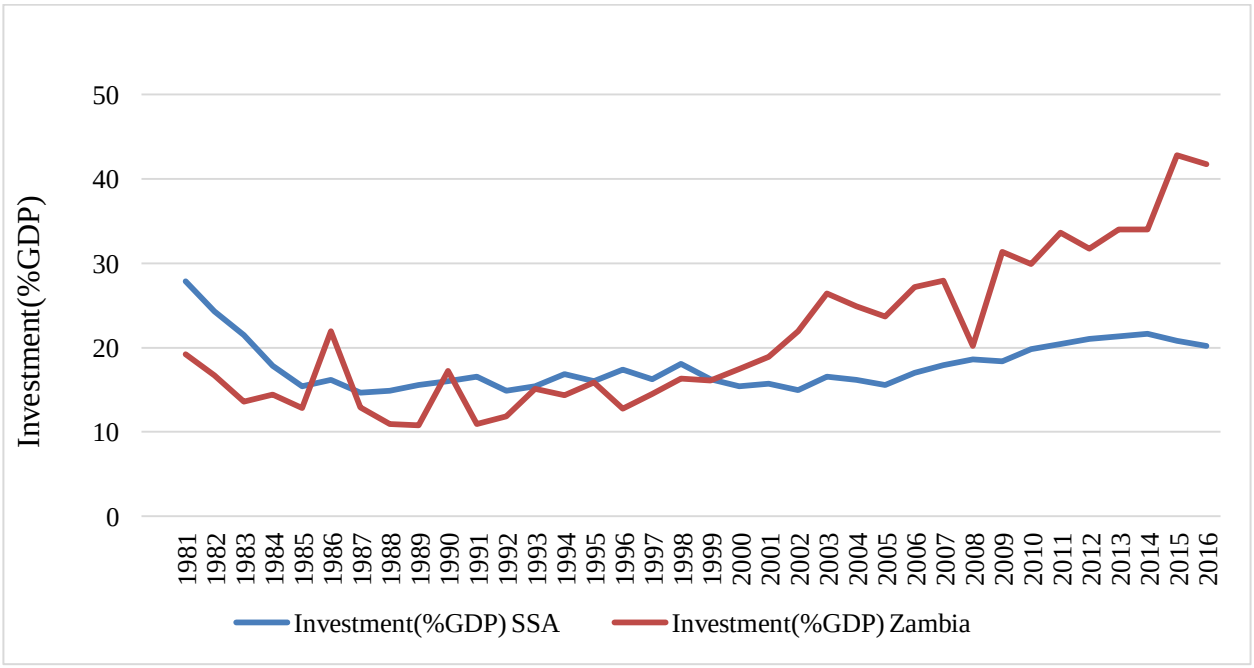
In recent years, however, Zambia's levels savings have recorded major improvements. Between 2006 and 2016 gross domestic savings increased to an average of 35.7 percent, from an average of 7.5 percent between periods 1990 to 2000 (IMF, 2017). Relative to other regions, Zambia's level of savings have been among the highest in Sub-Saharan Africa. According to the International Monetary Fund's Economic Outlook (IMF, 2017), in 2006 Zambia's level savings ranked the highest relative to its Sub-Saharan African peers. Despite these positive strides, Zambia's levels are still considered low when compared to levels achieved by East Asian and Pacific countries during the same period (IMF, 2017). These countries recorded savings accumulation to levels of 46.2 percent as share of GDP over the same period. The low levels of savings in Zambia have been largely attributed to limited access to savings facilities coupled with low-income levels (Mphuka, 2010).

1.1.2 Gross Investment

Investment is an important indicator that measures a country's future development. According to the *System of National Accounts* (2008), investment is measured by the total value of gross capital formation and changes in inventories less disposals of valuables for a unit or sector. As depicted in Figure 1, Zambia suffered a declining rate of investment in the early 1980's up to around 1991. This decline in investment was largely attributed to the impact of the collapse in copper prices coupled with the oil shock that began in 1973 together with the subsequent deterioration in the state of the economy. However, beginning early 1990's, investment began to pick up. The rising

trend in investment persisted reaching its peak in 2015 with investment making up 42 percent of GDP. This outturn partly reflected the favourable macroeconomic performance emanating from the economic reforms together with improvement in copper prices (BOZ, 2012).

Figure 1: Investment as percentage of GDP



Source: Author's adaptation from World Development Index (WDI), World Bank (2017)

Relative to other Sub-Saharan African countries, Zambia has in recent years recorded higher levels of investment. In 2015, for example, gross investment in Zambia constituted 42.7percent of Gross Domestic Product (GDP) compared to 20.8 percent recorded in the region. Over the period 2000 – 2010, investment contributed an average of 33.3 percent to GDP. Most of the investment during this period was within the mining and quarrying, producers of government services, transport and communication sectors (BOZ, 2010).

1.1.3. Gross Savings

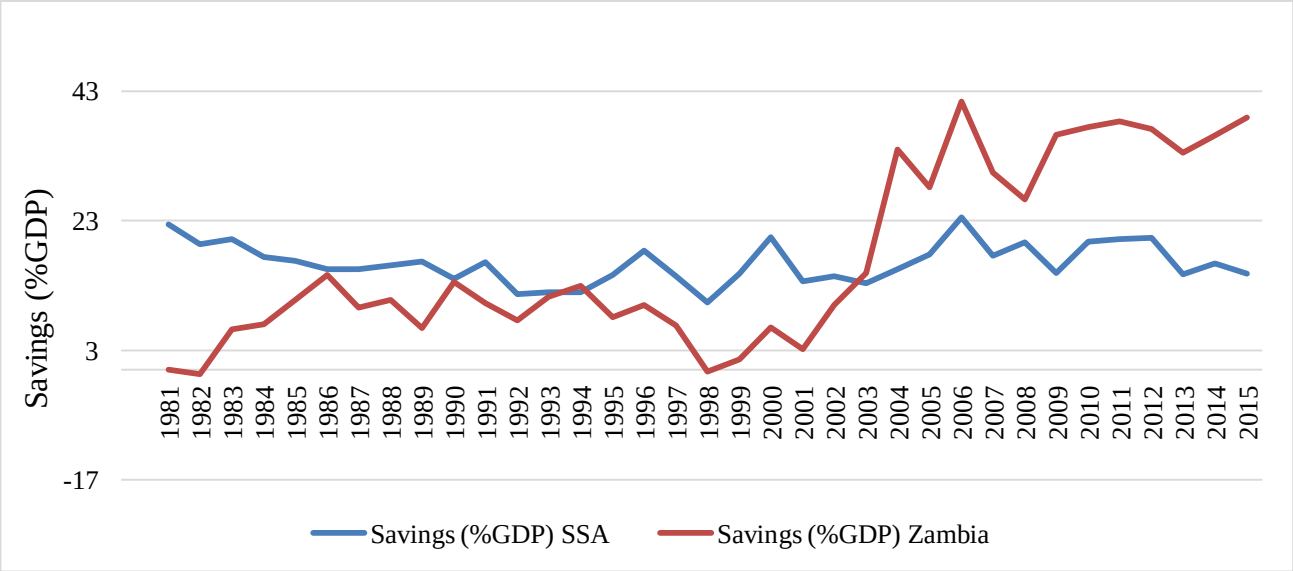
Gross Domestic Savings (GDS) is defined in the national income accounting context as net of gross national disposable income after accounting for consumption (GNDI-C).

These are therefore domestic resources that feed in the monetary system as sources of funds to finance investment. The balance between domestic savings and investment reflects the foreign savings position of the country. Thus, excess savings would lead to foreign lending reflected by an outflow of capital while the deficiency in national savings would lead to an import of capital through foreign borrowing (Shiimi and Kadhikwa, 1999).

The impact of the collapse of the copper prices is clear, in the period preceding the 1991 reforms, Zambia suffered declining rates of savings, reaching -0.65 percent in 1982. However, as the structural adjustment program measures suggested by the IMF began to take effect, Zambia's levels of savings began to rise reaching a peak of 41.1 percent in 2006 (see figure 2). As depicted in figure 2, between 2000-2016, Zambia recorded an average of 28.3 percent compared to 8.5 percent during the preceding period 1980-1995.

In the pre-reform period, Zambia's savings lagged behind most sub-Saharan countries. As depicted in Figure 2, between 1981- 1991, SSA countries recorded an average savings rate of 17 percent compare to Zambia's 8 percent. However, as the reforms began to take effect coupled with increases in copper prices, Zambia's levels of savings began to rise. The upward swing began in 1998 and by 2003; Zambia's savings had surpassed the average level of savings in the SSA region. According to data from the International Monetary Fund's Economic Outlook (IMF, 2017), Zambia ranked among the top developing countries in terms of Gross National Savings (GDS), reaching its peak in 2006. Between 2010 and 2015 savings as a share of GDP stood at an average of 31.7 percent (Figure 2).

Figure 2: Gross Savings as a percentage of GDP



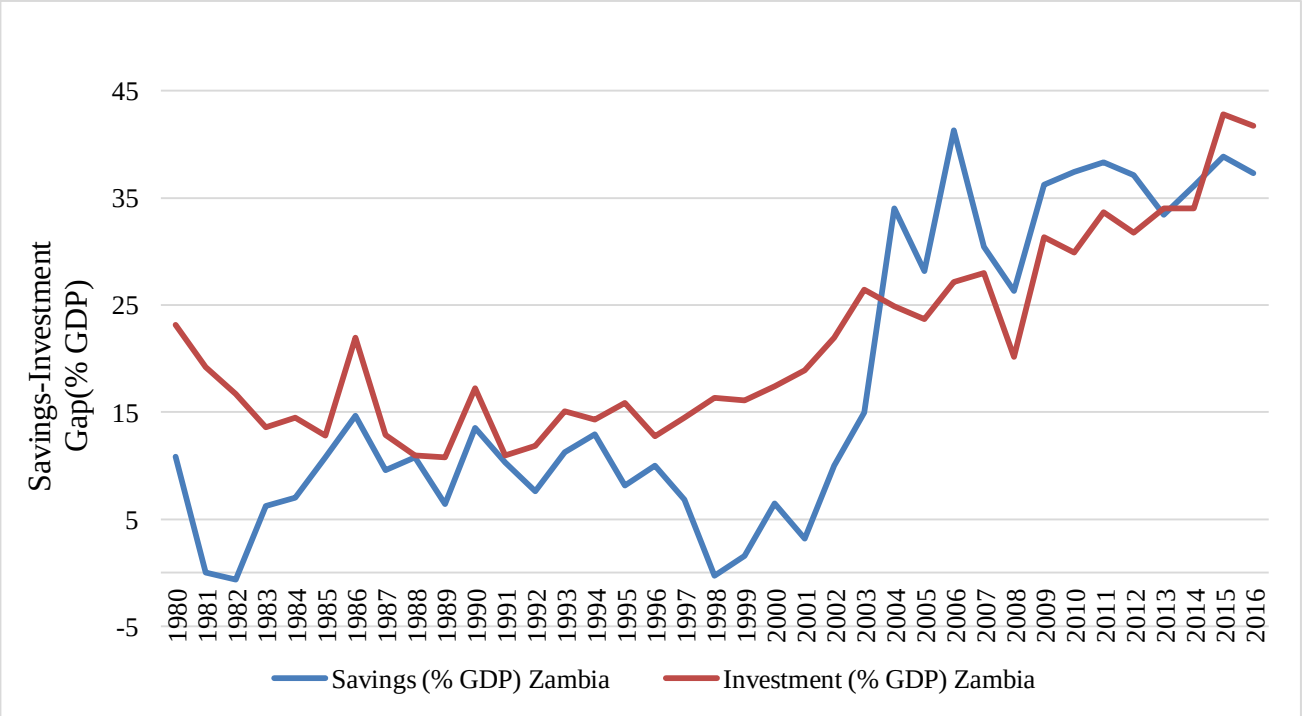
Source: Author's adaptation of data from World Development Indicators (WDI), World Bank (2017)

Despite the improvements in savings in recent years, Zambia's levels of savings still remain lower relative to East Asian and Pacific countries. These countries recorded an average percentage share of 46.2% during the same period. This has been largely attributed to limited access to savings facilities coupled with low levels of income (Mphuka, 2010). Furthermore, (Melzer, 2007) found that only 14% of Zambians save with banks. In most areas, particularly rural ones, the low utilization of banking services is attributed to the lack of banking facilities. However, in areas where there is access to banking facilities, the main problem has been the high cost of opening and maintaining a bank account.

1.1.4. Savings-Investment Gap

Figure 3 depicts the evolution of investment- savings gap (calculated by subtracting savings from investment) for the period 1980-2016. As can be seen from Figure 3, during the period 1980-2004, Zambia recorded a positive gap in investment and savings reaching its peak in the years 1981 and 2004. However, despite the widening of the gap in the early 1980's, Figure 3, shows that after reaching its peak in 1981, the gap started declining reaching its lowest point in 1991.

Figure 3: Investment-Savings Gap as a percentage of GDP



Source: Author's adaptation of data from IMF World Economic Outlook (WEO), IMF (2017)

From Figure 3, we further see that as the fruits of the reforms began to take effect leading to increase in both savings and investment. This resulted in the closing of gap between savings and investment. The declining trend in the gap began in the 2002 reaching its lowest point in 2006 before resuming its upward swing.

This chapter explained the background and historical performance of savings and investment in Zambia. Through the use of charts, it has shown how the two variables have performed over the thirty-six years (1980-2016) period under review. It has also shown the gap between the two variables and their contributions to GDP. The data has also shown us that in recent years, Zambia's levels of savings and investment have been above levels recorded in the SSA region. Therefore, the above analysis sets the foundation for this research. It provides a benchmark for further investigation of the relationship between these two variables in Zambia using data from 1980 to 2016 through the use of econometric techniques.

1.2. Problem Statement

The interaction between savings and investment has become a subject of great interest and debate among macroeconomists (Nasiru and Usman, 2013; Ogbokor and Musilika, 2014; Itoe and Atangana, 2015). The debate has traditionally revolved around two issues. The first relates to whether domestic savings result in domestic investment, and the second relates to how domestic savings affect investment. A growing body of literature has emerged, both at the theoretical and empirical level, attempting to answer these issues. Economic theory holds that savings are an essential element in promoting investment and therefore economic growth. According to this view, low levels of domestic savings in some developing countries condemn them to an uncomfortable choice between low investment and growth on the one hand, and excessive reliance upon foreign capital on the other, which makes them vulnerable to financial crises.

Empirical research, however, does not conclusively support this conventional belief. Empirical findings are mixed and controversial across countries, data and methodologies. Most empirical works are based on panel or cross-country regressions and have been criticized for imposing cross-sectional homogeneity on coefficients that in reality may vary across countries because of differences in institutional, social and economic structures (Esso and Yaya, 2010). Overall results obtained from panel or cross-section regressions represent only an average relationship, which may or may not apply to individual countries in the sample. Therefore, in order to enhance our understanding of the relationship between savings and investment, it is essential to perform studies on individual countries using time series data. For Zambia, such studies are very scarce. In light of this, the study intends to fill this gap in the literature by attempting to investigate the relationship between domestic savings and investment and its implications on policy formulation in Zambia.

1.3. Research Objectives

The fundamental aim of this study is to investigate the relationship between domestic savings and investment in Zambia, thereby making a contribution to the literature on the

savings-investment relationship using time series data for Zambia (also referred to as the empirical testing of the FH-Test using Zambian data). In light of this, the study will specifically aim to achieve two objectives:

1. To investigate if domestic savings and investment have a long-run relationship, co-movement or a tendency of convergence between them.
2. To test for an existence of a causal relationship between domestic savings and investment.

1.4. Research Hypothesis

1.4.1. Hypothesis One

H_0: there no relationship between investment (dependent variable) and domestic savings (independent variable).

H_1: there is a relationship between investment (dependent variable) and domestic savings (independent variable).

1.5. Rationale

The relationship between savings and investment is a crucial indicator of international capital mobility and it has important implications for the development of small economies like Zambia. As is the case with most developing countries, Zambia is in pursuit of sustainable levels of economic growth that can help absorb and address the burden of unemployment, poor infrastructure and high poverty levels. As part of the key growth strategies in the Seventh National Development Plan (MNDP, 2017), the Government of Zambia intends to support economic growth by policy interventions related to increased investments in agriculture, tourism, manufacturing and energy. Government intends to support these sectors by investing in public economic infrastructure such as transport and communication. With such policy goals in place, discussions pertaining to means and sources of investment financing become critical.

Furthermore, an understanding of the causal relationship between savings and investment is of relevance for its policy implications, specifically for a country that intends to pursue policies that aim at supporting economic growth through investment

promotion. The implication is, if savings, for example cause investment, then promoting domestic savings should be prioritized in order to boost investment and economic growth. Alternatively, if causation is from investment to savings, savings-promoting policies are likely to be unsuccessful and economically inefficient. If this is the case, then policy emphasis should concentrate on removing barriers to investment, thereby promoting investment.

1.6. Organization of the Study

The rest of the paper is organized as follows. Section 2 presents the theoretical and empirical review. Section 4 highlights the methodology and data sources. Section 5 presents the empirical results and discussion of results. Finally, section 6 provides a conclusion and policy recommendations.

CHAPTER TWO
LITERATURE REVIEW

This section gives an overview of the existing knowledge in the area of the investment and savings relationship. The main focus of this section is to summarize and synthesis the arguments and ideas of others, which forms the basis of this study.

3.1. Theoretical Framework

Theoretical predictions on the savings and investment nexus draw their foundations from both the neo-classical and Keynesian schools of thoughts. The basic macroeconomic equilibrium condition is that savings equal investment. This relationship has been stated in theory as "Savings-Investment spending identity". According to the identity part of national savings is used to finance domestic investment and the other part is used to support balance of trade (Krugman and Wells, 2009):

$$S=I + CA \quad (1)$$

Where: *S* is domestic savings; *I* is domestic investment; *CA* is current account balance

National/Domestic savings is the sum of private savings and savings by government:

$$S=Spvt + Sgov \quad (2)$$

Where: *S* is domestic savings; *Spvt* is private domestic savings; *Sgov* is savings by government

From Equations (1) and (2), we obtain:

$$Spvt + Sgov=I + CA \quad (3)$$

$$Spvt=I + (-Sgov) + CA \quad (4)$$

$$Spvt=I + BD + CA \text{ (Uses of private savings identity)} \quad (5)$$

Where: BD is budget deficit; other variables as defined earlier

From the above, we can see that in an open economy savings are used to finance domestic investment, finance budget deficit and to support balance of trade. Building upon the basic theory of the uses of savings identity, Keynesians have argued that the savings and investment may be equal at a whole range of potential levels of output and income, only one of which is full employment, whereas the neo-classicists argued that the two may only be equal at full employment. According to Keynes and his proponents, saving is a function of disposable income and thus, the more income is earned the more is available for saving (saving representing unspent income). Similarly, he observed a negative relationship between saving and consumption implying that, in order for saving to increase, consumption needed to be reduced thereby making saving appear as a consequence of expenditure and so of investment.

According to the neoclassical school and classicists like Adam Smith, saving is what causes investment via changes in interest rate; saving determines interest rate which is the cost of investment, which in turn influences the demand for new capital. Keynesians opposed this view arguing that investment is not determined by savings through interest rate, but by supply and demand for money in accordance with Keynesian liquidity preference theory. Thus, whereas according to Keynesians investment is what finances savings through changes in income, according to the neoclassical school savings finance investment through changes in interest rates. In addition, the basic Solow model also cites volumes of domestic savings as the only source of domestic investment. However, as the model is extended to an open economy, capital flows are brought on board and this becomes the most noticeable feature of globalization (Romer, 2012).

Furthermore, following the works of Goldsmith (1969), McKinnon (1973), and Gurley and Shaw (1955), economic development creates demand for particular types of financial arrangements, and the financial system responds automatically to these demands. According to this view, the financial system of a country mobilizes savings and improves the allocation of savings to investment. According to Bencivenga and Smith (1991), the financial system allows altering the composition of saving in a way that is favourable to capital accumulation. However, Robinson (1952) and Kuznets (1955), contends this view, they state that the role of financial development is overstated

and financial development follows expansion of the real economy. This would indicate, in contrast to McKinnon (1973) and the endogenous growth theorists that causality, if it exists, runs from growth to financial development.

This study, therefore, is linked to the endogenous growth literature which stresses the significance of financial development for long-run economic growth through the impact of financial sector services on capital accumulation and technological innovation. These services include mobilizing savings, acquiring information about investments and allocating resources, monitoring managers and exerting corporate control, and facilitating risk amelioration. As shown by Romer (1986), Lucas (1988), and Rebelo (1991) and subsequent endogenous growth studies, finance tends to promote capital investment.

3.2. Empirical Review

Ever since the publication of Feldstein and Horioka' s (1980) paper, the correlation between savings (S) and investment (I) as ratios of gross domestic product (GDP) has been extensively tested in the literature (Evans, Kim and Oh (2008); Eiriksson (2011); Johnson and Lamdin (2014)). Although in a closed economy it necessarily holds that savings equal investment, in open economies, however, the two variables can differ by an amount given by the current account balance (Basher and Fachin, 2013).

According to Feldstein and Horioka (1980), if capital is perfectly mobile, investors care only about the rate of return on their investments and not about which country they invest in. This means that domestic savings need not be related to domestic investment under perfect international capital mobility. On the basis of this idea, Feldstein and Horioka (1980) regressed domestic investment ratio on domestic saving ratio for cross-sectional samples of 16 OECD countries over the period 1960-1974 in order to assess how mobile capital was among them. They found that the estimated regression coefficients, which they termed "saving-retention coefficients", were all close to one, indicating that most incremental saving tends to remain in the country of origin. This finding was surprising since it suggested that capital was closer to being completely

immobile than perfectly mobile internationally. Given the prevailing integration of current financial markets, this finding shows a contradiction, which is currently known as the Feldstein–Horioka puzzle (Ma and Li, 2016).

Since then studies have emerged attempting to contribute to FH-Puzzle debate. In the last decade, studies on the investment-savings relationship have largely come from Organization for Economic Co-operation and Development(OECD) member countries, among them being studies by Evans, Kim and Oh (2008); Eiriksson (2011); Iorio and Fachin (2014); Ma and Li (2016); Drakos *et al.*, (2017). However, in the recent past, studies have also emerged from sub-Saharan African and Asia countries. From sub-Africa, the notable ones being Cooray and Sinha (2007); Esso and Yaya (2010); Nasiru and Usman (2013); Ogbokor and Musilika (2014); Itoe and Atangana (2015) while from Asia studies have been done by Evans, Kim and Oh (2008); Li (2010); Basher and Fachin (2013); Eslamloueyan and Jafari (2014). However, a survey of literature indicates that no specific study has been done on Zambia.

These studies have also varied significantly in terms of the methodology and sample periods. Majority of these studies have replicated the Feldstein and Horioka model using cross-section regressions and panel regression techniques. Studies by Evans, Kim and Oh (2008); Eiriksson (2011); Iorio and Fachin (2014); Ma and Li (2016); Drakos *et al.*, (2017); Khan (2017) employed cross-section techniques while Evans, Kim and Oh (2008); Basher and Fachin (2013); Eslamloueyan and Jafari (2014) used panel data sets to investigate the savings-investment relationship. Country specific studies have also been done using time-series data techniques. These include studies by Esso and Yaya, (2010); AfDB (2012); Nasiru and Usman (2013); Ogbokor and Musilika (2014); Itoe and Atangana (2015).However, results from these studies are mixed.

Khan (2017) revisited the Feldstein and Horioka (FH) puzzle by estimating the time-varying parameter model through the Kalman filtering approach. The paper investigated the existence of the savings and investment relationship for 22 OECD countries. The study found evidence that the time varying saving retention coefficient has gradually declined since mid-70's for most of the countries. The study attributed this decline to a rise in the degree of capital mobility and the increase in world financial markets

integration over time. This study validates the FH puzzle and its findings are consistent with other previous studies by Murphy (1984); Tesar (1991); Ma and Li (2016); Drakos *et al.,* (2017).

In a recent study, Drakos *et al* (2017) also revisited the FH-puzzle by analysing the dynamics of the national saving-investment relationship using data for 14 European Union member countries from 1970 to 2013. Using the Panel Autoregressive Distributive Lag (PADL), their study observed a long-run relationship between savings and investment thereby further validating the Feldstein-Horioka (1980) puzzle. The study also observed that as more recent data is added to the model, the two variables begin to deviate from their long-run equilibrium indicating some degree of capital mobility. The existence of the long-run relationship was attributed to the existence of a solvency constraint. These results are consistent with previous findings by Johnson and Lamdin (2014) in which a strong positive relationship was observed between investment and savings using data from 17 Euro countries and 10 Eurozone countries that do not use the euro.

The FH-Puzzle test for the savings-investment correlation has also been extended to regions outside the OECD. For example, using time-series data from East Asian countries Kim, Kim and Wang (2007) found that between 1980 to 2002, the savings-investment correlation had decreased over time but was still higher than that of OECD countries. The study employed the GLS estimation technique. These results confirm the findings of Boon (2000) using a similar sample and are also consistent with the recent findings by Eslamloueyan and Jafari (2010). These findings also validate the FH-Puzzle by concluding that East Asian countries experience low capital mobility. Country specific studies from Asia have also obtained similar results Li (2010); Basher and Fachin (2013) except for one by Yamori (1995). Using inter regional data for China over the period 1978 to 2006, Li (2010) found savings and investment to be strongly correlated. In line with this finding, (Basher and Fachin, 2013) obtained similar results using data for Jordan from 1971 to 2005. However, these results deviate from the findings by Yamori(1995) in which he found savings to be insignificantly correlated to investment.

Majority of studies, however, have been cross-sectional in nature. The obvious difficulty with such studies has been the homogeneity assumption that is usually made across countries under investigation. In view of this, a number of country specific studies have also emerged over the years. In Turkey, a study was done by Kaya (2010) to investigate the domestic saving-investment relationship using quarterly data from 1981Q1 to 2007Q3 and employing the ARDL bounds testing procedure. The study found a strong long-run relationship between total investment and savings. However, the study found no significant relationship between private savings and investment. These conflicting results were attributed to the balance of payments targeting policies.

Contributing to this debate, studies have also been done using data from sub-Saharan Africa. Using time-series data for Nigeria, Nasiru and Usman (2013) explored the relationship between savings and investment for the period 1980-2011. The study employed the ARDL bounds test procedure. Findings were that savings and investment were cointegrated, suggesting the existence of a long-run relationship between the two variables, similar findings were also obtained by the African Development Bank (AfDB, 2012) using time-series data for Lesotho from 1975 to 2011. However, these results contradict findings by Cooray and Sinha (2007). In a study involving 20 Sub-Saharan African countries including Nigeria, Cooray and Sinha (2005), observed that savings and investment were only cointegrated in Rwanda and South Africa. In the other 18 states he found evidence of capital mobility. These results were confirmed by Ogbokor and Musilika (2014) using data for Namibia in which savings and investment were also found not to be cointegrated. The study found savings and investment not to be cointegrated. This observation was largely attributed to high levels of capital outflows to South Africa.

Similar results were also obtained by (Esso and Yaya, 2010) using data from seven (7) West African Economic and Monetary Union (UEMOA) member states (Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal and Togo). In their study Esso and Keho (2010) observed that savings played a role in financing investment in only three countries (Benin, Côte d'Ivoire and Niger). In the other four countries, domestic savings rate and investment rate were found not to be correlated. In Cameroun, however, a study

to investigate the saving-investment relationship was undertaken by Itoe and Atangana (2015) using a Vector Auto Regressive analysis in which savings was found to be positively related to investment. Savings was found to have a positive but insignificant effect on investment. The insignificant effect in the case of Cameroun was largely attributed to low savings rates.

Evaluating this body of literature, we find that no similar work has been done on Zambia. The closest studies this research came across were studies by Mphuka (2010) on "Savings and growth" and the other study by Maimbo and Mavrotas (2004) on "savings mobilization in Zambia". However, none of these studies have dealt with estimating FH-Test which constitutes one focus of this study of the relationship between domestic savings and investment. Thus, this study intends to fill the gap in literature by investigating the saving-investment correlation and its implication on policy formulation in Zambia.

CHAPTER FOUR

METHODOLOGY

In order to investigate the relationship between savings and investment, the study employs the long-run generic model by Feldstein and Horioka (1980) with this form:

$$I_t = \beta_0 + \beta_1 S_t + \varepsilon_t \quad (1)$$

Where, I_t is the ratio of gross capital formation to GDP at time *t*, S_t is the ratio of gross savings to GDP at time *t*. β_0 is the constant, while β_1 is the regression coefficient for savings and investment. The higher estimate for β_1 would suggest that most savings remain in the economy and are mobilised into investment while the lower estimate for β_1 would suggest either capital mobility or that the economy is poor in mobilising its national saving or that both scenarios are true. The residuals ε_t are assumed to be white noise and spherically distributed. However, the above specification is subject to limitations such as I_t and S_t have unit root hence regressing variables would yield spurious regression results (AfDB, 2012). Also the specification ignores the short-run dynamics between savings and investment and hence some econometric manipulations have to be done.

Econometric literature proposes different methodological alternatives to empirically analyse the long-run relationships and dynamic interactions between two or more time-series variables. The most widely used methods include the two-step procedure of Engle and Granger (1987) and the full information maximum likelihood-based approach due to Johansen(1988) and Johansen and Juselius (1990). All these methods require that the variables under investigation are integrated of order one. This inevitably involves a step of stationarity pre-testing, thus introducing a certain degree of uncertainty into the analysis. In addition, these tests suffer from low power and do not have good small sample properties (Cheung and Lai, 1993). Due to these problems, this study makes use of two subsequently developed approaches to cointegration and causality test procedures that have become popular in recent years. These are the Autoregressive Distributive Lag

and the Toda-Yamamoto approach to Granger causality test. The choice of these two methods was motivated by the works of Esso and Yaya (2010).

4.1. Autoregressive Distributed Lag (ARDL) Bounds testing approach

The bounds testing approach to cointegration was introduced by Pesaran, Shin and Smith (2001). The main advantage of the bounds testing approach is that it can be applied irrespective of whether the regressors are purely I (0), I (1) or mutually cointegrated. Another advantage is that the test is relatively more efficient in small sample data sizes as is the case in most empirical studies on African countries including Zambia. This test is particularly appropriate for small samples in which the order of integration is not known or may not be necessarily the same for all variables of interest.

The bounds test involves estimating the ordinary least squares, following the unrestricted error correction model (UECM) considering each variable in turn as a dependent variable:

$$\Delta I_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta I_{t-i} + \sum_{i=0}^{p} \gamma_{1i} \Delta S_{t-i} + \eta_1 I_{t-1} + \eta_2 S_{t-1} + e_{1t} \qquad (2)$$

Where $\boldsymbol{I_t}$ and $\boldsymbol{S_t}$ denote domestic investment and savings as share of GDP, respectively. The structural lags are determined by using minimum Akaike's information criteria (AIC). To depict the presence of cointegration the estimated coefficients of lagged level variables are restricted equal to zero. Thus the null hypothesis for no cointegration is:

$$H_0: \eta_1 = \eta_2 = 0 \qquad (3)$$

The null hypothesis is tested by the mean of the F-test which has an asymptotic non-standard distribution. Thus, the calculated F-statistic is compared with two asymptotic critical values tabulated by Pesaran, Shin and Smith (2001). The lower critical value assumes that all the regressors are I (0), while the upper critical value assumes that they are I (1). Therefore, if the computed F-statistic is greater than the upper critical value, the null of no cointegration is rejected and we conclude that saving and investment share

a long-run level relationship. If the calculated F-statistic is below the lower critical value, then the null hypothesis of no cointegration cannot be rejected regardless of the orders of integration of the variables. On the other hand, if it falls inside the critical value band, the test is inconclusive unless we know the order of integration of the underlying variables.

If a cointegration relationship is observed between the series, Barden's (1989) method will be used to compute the short and long run coefficients. From the estimation of (1), the long-run coefficient is computed as the coefficient of the one lagged level explanatory variable divided by the coefficient of the one lagged level dependent variable and then multiplied with a negative sign. Thus, under the alternative of interest $\eta_1 \neq 0$ and $\eta_2 \neq 0$, the long-run level relationship between investment and savings is described by:

$$I_t = \theta_0 + \theta_1 S_t + v_t \qquad (4)$$

Where, $\theta_0 = \beta_0 / \eta_1$ and $\theta_1 = -\eta_2 / \eta_1$, and v_t is a zero-mean stationary process.

4.2. The Toda-Yamamoto approach to Granger causality test

The bounds test assumes the dependent variable to be I(1) and the regressors to be either I(0) or I(1). The procedure cannot be applied if the dependent variable of interest is I(0) and would crash in the presence of I(2) variable. To complement the bounds test approach and derive inference regarding the direction of causality between saving and investment, we use the methodology proposed by Toda and Yamamoto (1995). This procedure has the advantage of not requiring pretesting for cointegration properties of the system. Thus it overcomes the pre-test bias associated with unit root and cointegration tests. More importantly, the Granger causality tests can be implemented regardless of the orders of integration of the underlying variables. Performed directly on the coefficients of the levels VAR, Toda and Yamamoto methodology minimizes the risk associated with possibly wrongly identifying the orders of integration of the series, or the presence of cointegration relationship (Mavrotas and Kelly, 2001). The basic idea is to artificially augment the correct VAR order, k, with d_{max} extra lags, where d_{max} is the

maximum likely order of integration of the series in the system. The empirical model to be estimated is specified as follows:

$$I_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} I_{t-i} + \sum_{j=k+1}^{k+d_{max}} \alpha_{2j} I_{t-j} + \sum_{i=1}^{k} \beta_{1i} S_{t-i} + \sum_{j=k+1}^{k+d_{max}} \beta_{2j} S_{t-j} + e_{1t} \quad (5)$$

$$S_t = \emptyset_0 + \sum_{i=1}^{k} \emptyset_{1i} S_{t-i} + \sum_{j=k+1}^{k+d_{max}} \emptyset_{2j} S_{t-j} + \sum_{i=1}^{k} \delta_{1i} I_{t-i} + \sum_{j=k+1}^{k+d_{max}} \delta_{2j} I_{t-j} + e_{2t} \quad (6)$$

The null hypothesis that saving does not *Granger-Cause* investment is formulated as follows:

$$\beta_{11} = \beta_{12} = \ldots = 0 \quad (7)$$

The system given by equations (5) and (6) is estimated using the Seemingly Unrelated Regression technique (Rambaldi and Doran, 1996). A Wald test is then carried out to test the hypothesis (7). The computed Wald-statistic has an asymptotic chi-square distribution with k degrees of freedom.

4.3. The Extended Model

Furthermore, in order the deal with problem of omitted variable bias and to check for robustness, the study re-estimates the model by extending the model to include other variables that may have an influence on the savings and investment nexus. The variables included are Commercial Bank's average lending rates (*lr*), Kwacha US Dollar exchange rate (*fx*) and Gross Domestic Product (*gdp*). The choice of these variables is guided by the theories articulated above and data availability.

$$\Delta I_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta I_{t-i} + \sum_{i=1}^{p} \gamma_{1i} \Delta S_{t-i} + \sum_{i=1}^{p} \gamma_{2i} \Delta lr_{t-i} \ldots\ldots\ldots\ldots\ldots + \sum_{i=1}^{p} \gamma_{3i} \Delta fx_{t-i} \sum_{i=1}^{p} \gamma_{4i} \Delta gdp_{t-i} + \eta_1 I_{t-1} + \eta_2 S_{t-1} + \eta_3 lr_{t-1} + \eta_4 fx_{t-1} + \eta_4 gdp_{t-1} e_{1t} \quad (2)$$

Where: $\boldsymbol{I_t}$ and $\boldsymbol{S_t}$ denote domestic investment and savings as share of GDP while ***lr, fx gdp*** represent lending rates, exchange rate and output, respectively.

4.4. Unit root test in the presence of structural breaks

Since the study is using time-series data from 1980 to 2016, in the case for Zambia, the data is likely to have structural breaks. In the years before 1991, the country implemented a series of reforms with the support from the International Monetary Fund. As result, the economy swung from controlled regime to a more liberalized economic system (Zombe *et al.*, 2017). Therefore, in order to ascertain the order of integration the takes into account the existence structural breaks.

To test for stationarity, the study uses four conventional unit root tests: ADF Augmented Dickey Fuller test by Dickey and Fuller(1979), ADF-GLS, PP by Phillips and Perron and KPSS by (Kwiatkowski *et al.*, 1992). This is to ensure that the series are either are $I(0)$ or $I(1)$ since the use of bounds testing is only applicable for series either $I(0)$ or $I(1)$ whereas it is inapplicable if they are $I(2)$. The use of multiple unit root test is to complement the short comings of traditional unit root tests (i.e. ADF and PP), which have been found to be unreliable because of their power and size as suggested by (Rapach and Weber, 2004) and hence the use of GLS transformed ADF and the KPSS (Kwiatkowski *et al.*, 1992).

However, even these tests might be misleading in the presence of structural breaks in the series by failing to reject the hypothesis that series have unit root in the presence of structural break. In other words, they may erroneously assert that series are $I(1)$ while in fact series are stationary around structural breaks and thus $I(0)$ as stated (Perron, 1989). To complement for this limitation, the study further employs the Zivot and Andrews (Zivot and Andrews, 1992) unit root tests in the presence of structural breaks. There are three versions of ZA test for endogenous structural breaks. The model that allows for break in intercept, the model that allows for break in trend of the series as well as the model which allows for break in the intercept and slope, their specification looks thus:

Intercept: $\Delta y_t = k + \alpha y_{t-1} + \beta t + \theta_1 DU1_t + \sum_{i=0}^{k} d_i \, \Delta y_{t-1} + \varepsilon_t$ (8)

Slope: $\Delta y_t = k + \alpha y_{t-1} + \beta t + \gamma_1 DT1_t + \sum_{i=0}^{k} d_i \Delta y_{t-1} + \varepsilon_t$ (9)

Intercept and slope:

$$\Delta y_t = k + \alpha y_{t-1} + \beta t + \theta_1 DU1_t + \gamma_1 DT1_t + \sum_{i=0}^{k} d_i \Delta y_{t-1} + \varepsilon_t \quad (10)$$

Where, D is the first difference operator, the error term □□ is assumed to be normally distributed and white noise. While *DU*1 and *DT*1 are dummy variables for break in intercept and trend shift respectively both at time *TB*1 where,

$$DU1_t = \begin{cases} 1 & t > TB1 \\ 0 & otherwise \end{cases}$$

$$DT1_t = \begin{cases} 1 - TB1 & t > TB1 \\ 0 & otherwise \end{cases}$$

The optimal lag length *k* is determined by the significant "*t* - significant "method and the breakpoint is determined where ADF *t-statistics* is maximised in absolute terms.

However, to assume the series have one break is too big an assumption to make that is why Lumsdaine and Papell (1997) extended ZA test by proposing that the series have two breaks (Lumsdaine and Papell, 1997). However, their approach has come under criticism that it tends to suggest stationarity in breaks under null hypothesis of unit root (John, Nelson and Reetu, 2007). Hence, The Perron-Vogelsang and Clemte-Montanes-Reyes unit root tests by (Clemente, Montañés and Reyes, 1998) are more preferable. These two tests offer two models which are:

a) An additive outliers (AO) model, which captures sudden change in the mean of the series; and

b) An innovational outliers (IO) model, which captures a gradual change in the mean of the series.

These models test the null hypothesis H_0 against the alternative hypothesis H_1:

$$H_0: y_t = y_{t-1} + \delta_1 DTB_{1t} + \delta_2 DBT_{2t} + \mu_t \quad (11)$$

$$H_{1:}\, y_t = \mu + d_1 DTB_{1t} + d_2 DBT_{2t} + e_t \qquad (12)$$

In these equations DTB_{1t} is a dummy variable that assumes the value of one if 1 t = TB_1+ 1 for (i = 1, 2) and zero otherwise. Also DU_{it}= 1 if t>TB for (i = 1, 2) and zero otherwise.

4.5. Determining the optimal lag length (p)

Another important aspect in the estimation of both the ARDL and the Toda Yamamoto Test to Granger causality models is the selection of an appropriate lag length that ensures the absence of serial correlation in the estimated models and ensuring that residuals are well-behaved (Hamilton, 1994). Before determining the optimal lag-length (p), this study uses the Bai and Bai-Perron approach to structural break testing developed by (Bai, 1997) and (Bai and Perron, 1998) to determine the exact date(s) of the structural break(s) in the model. The structural break or breaks determined are then incorporated when determining the optimal lag length (p). The optimal lag length is determined by first estimating the VAR in levels and then using the well-known information criteria such as the Akaike information criterion (AIC), and Schwarz information criterion (SIC) among others. The VAR estimated in this section is then subjected to diagnostic tests; namely, normality of residuals, serial correlation, and model stability.

4.6. Data Analysis and Sources

This study employs annual data spanning from 1980 to 2016 of gross national savings and total investment as a percentage of gross domestic product (GDP) for Zambia. The choice of savings and investment as a share of GDP is justified following the work of Feldstein and Horioka (1980). Data on savings was obtained from the International Monetary Fund's World Economic Outlook (IMF, 2017) while data on investment was obtained from African Development Bank (AfDB, 2018) database. In this context, investment or gross capital formation is measured by the total value of the gross fixed capital formation and changes in inventories and acquisitions less disposals of valuables

for a unit or sector (*System of National Accounts*, 2008). Gross national saving is gross disposable income less final consumption expenditure after taking account of an adjustment for pension funds. For many countries, the estimates of national saving are built up from national accounts data on gross domestic investment and from balance of payments-based data on net foreign investment. Data for the extended model was also sourced from the International Monetary Fund's World Economic Outlook (IMF, 2017). The summary statistics for the variables under consideration is presented in Table 16A at the appendix section.

CHAPTER FIVE

EMPIRICAL RESULTS AND DISCUSSION

Empirical analysis was carried out using Eviews version (10) econometric software. The empirical analysis proceeded in the following manner. Firstly, the econometric characteristics of the variables were analysed in terms of stationarity in the presence of structure breaks. The econometric characteristics of the variables provide the basis and justification for subsequent estimation procedures. Autoregressive Distributive Lag (ARDL) and Toda-Yamamoto approach to Granger Causality were then employed to analyse the relationship between savings and investment. Results from the extended model are presented in the appendix section in tables 13A and 14A.

5.1. Unit Root test

Before we proceed with the bounds test, we perform tests for unit root in order to determine the order of integration of each variable using conventional test (ADF, PP, ADF-GLS and KPSS). This is to ensure that none of the variables is I(2) so as to avoid spurious results in bounds test. The results reported in Table 1 below.

Table 1: The Classical unit root tests results

Unit Root Tests				
Variables	**ADF**	**PP**	**DF-GLS**	**KPSS#**
I_t	-1.243	-2.989	-1.321	0.220
ΔI_t	-8.934***	-26.004***	-9.846***	0.220***
Critical Values				
1%	-4.262735	-4.234972	-3.770000	0.216000
5%	-3.552973	-3.540328	-3.190000	0.146000
10%	-3.209642	-3.202445	-2.890000	0.119000
	ADF	**PP**	**DF-GLS**	**KPSS#**
S_t	-2.621	-2.652	-2.423	0.143***
ΔS_t	-7.600***	-7.600***	-6.824***	0.061***

Critical Values				
1%	-4.262735	-4.243644	-3.770000	0.216000
5%	-3.552973	-3.544284	-3.190000	0.146000
10%	-3.209642	-3.204699	-2.890000	0.119000

Note: *The asterisks ***, ** and * denote significance level at 1%, 5% and 10% for the four tests of unit root. The null hypothesis is that the series are* ***non-stationary*** *for ADF, PP and ADF-GLS. The critical values used for DF-GLS are obtained from Elliott, Rothenberg, and Stock (1996). # the null hypothesis for KPSS test is that the series are* ***stationary****, against the alternative hypothesis that they are non-stationary. Both trend and intercept were included in all the tests.*

As can be seen from table one all tests except from the KPSS suggests that the two series have a unit root and only become stationary after first difference. The KPSS, however, reports that savings is stationery in levels and investment is I (1). To complement the results from the traditional unit root test in the presence of structural breaks additional tests were undertaken and the results are presented in Tables 2 and 3.

Table 2: The Zivot and Andrews's unit root test results with one structural break

	Investment	**Savings**
	Trend Intercept	Intercept
Break Date	1997	2004
t-Statistic	-2.725	-5.764***
Critical Values		
1%	-5.57	-5.34
5%	-5.08	-4.93
10%	-4.82	-4.58

Note: the null hypothesis is that the series are unit root.

Table 3: Results of the PV unit root tests on data in level and first difference forms

	Investment		**Savings**		
	Additive Outliers (AO)	**Innovative Outlier (IO)**	**Additive Outliers (AO)**		**Innovative Outlier (IO)**
	I_t	I_t	S_t	ΔS_t	S_t
Specification	Intercept		Intercept		
Optimal	1986	1986	2004	1983	2003

breakpoints					
Min. t-statistics	-9.436***	-9.436***	-3.587	-7.836***	-5.944***
Critical values					
1%	-4.949	-4.949	-4.949	-4.949	-4.949
5%	-4.443	-4.443	-4.443	-4.443	-4.443
10%	-4.193	-4.193	-4.193	-4.193	-4.193

Note: the null hypothesis is that the series are unit root.

From Table 3, the results from the Zivot and Andrew's (1992) test suggest that investment is non-stationary in levels with a break in 1997 while savings is reported to be stationery in levels with a break in 2004. Results from the Perron and Vogelsang (1992) test report that savings has a unit root with breaks in 2004 with additive outliers and only becomes stationery after first difference, however, after taking into account the innovative outliers savings is reported to be stationery. With regards to investment, the PV test report that investment is stationary in levels with a break in 1986. Overall, the unit root tests for presence of structural breaks find no further information against presence of breaks in the series. Hence, the use of ARDL bounds testing approach to cointegration is justified since the classical unit root tests have confirmed that the series are either *I* (0) or *I* (1) while on the other hand there is enough evidence to support presence of breaks.

5.2. Determining Break(s) in the entire model

Having confirmed the existence of structural breaks in our data from both the Zivot and Andrew's (1992) and the Perron and Vogelsang (1992) tests, it is therefore important to determine the break date for the entire model. Once identified, this is the break that will be integrated in the ARDL model. In this study, we employ the Bai (1997) and Bai and Perron (1998, 2003a) sequential testing procedures to check for the break dates in our entire model; that is, taking all the variables together. Results from the Bai-Peron test are presented in Table 4 below.

Table 4: The Bai-Perron Test

Break test	F-Statistic	Scaled F-Statistic	Critical Values	Break dates
0 vs. 1 *	48.87087	97.74174	11.47	1987
1 vs. 2	3.798956	7.597911	12.95	

** Significant at the 0.05 level.* *** Bai-Perron (Econometric Journal, 2003) critical values.*

The Bai-Perron sequential test results in table 4 indicate that we rejected the null hypotheses that there are 0 breakpoints in favour of the alternatives of 1 breakpoint at 5% level of significance, but the null hypothesis of 1 versus 2 breakpoints was not rejected. Furthermore, the test indicated that the breakpoint for the entire model was in 1987.

5.3. Lag Selection Criteria

Now, that the break dates for the model have been determined, another important aspect in the estimation of both the ARDL and the Toda Yamamoto Test to Granger causality models is the selection of an appropriate lag length that ensures the absence of serial correlation in the estimated models and ensuring that residuals are well-behaved. Lag length selection criteria results are presented in Table 5. In the selection of the optimal lag length, the study relies on the principle of parsimony which entails that if two or more models explain the same phenomena but have different lag lengths; choose the model with lower lags in order to preserve degrees of freedom (Hamilton, 1994). As can be seen from Table 5 below, all the selection criteria are recommending a lag length of one. Therefore, based on the recommendations a lag of one was selected (refer to Tables 5)

Table 5: Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-231.6466	NA	13733.73	15.20301	15.38804	15.26332
1	-202.6972	50.42789*	2753.174*	13.59337*	13.96343*	13.71400*
2	-200.0450	4.277822	3024.372	13.68032	14.23541	13.86127

3	-197.5876	3.646471	3387.905	13.77984	14.51997	14.02111
4	-197.1003	0.660219	4352.443	14.00647	14.93162	14.30805
5	-195.8777	1.498678	5404.773	14.18566	15.29584	14.54755
6	-193.9408	2.124342	6525.367	14.31876	15.61397	14.74097

** indicates lag order selected by the criterion*

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

5.4. Auto Regressive Distributive Lag (ARDL) Bounds Test

Having determined the order of integration under investigation and the break dates for the model, we can now proceed to examine the long-run relationship using the bounds test procedure. Table 6 reports the results of the F-statistic test when each variable is considered as a dependent variable. As can be seen from Table 3, the computed F-statistic when investment is the dependent variable appears to be smaller than the lower critical value at 5% level of significance. Similarly, when savings is taken as the dependent variable the F-statistic is smaller than the lower bound critical value (it is worth noting that due to signs of serial correlation, lag adjustments were made and the model that passed all diagnostics has two lags on investment and three lags on savings(refer to Appendix A10).

Table 6: Bounds Test Results

Dependent Variable	F-statistic	Lower Bound	Upper Bound	Cointegration
I_t	1.332270	4.94	5.73	No
S_t	2.748541	4.94	5.73	No

** Source: Author's computations*

*Notes: * denote the rejection of the null hypothesis at 5% significance level. Critical values for the F-statistic are from Pesaran et al. (2001)*

Based on Table 6 above, the results suggest a lack of cointegration between investment and savings in Zambia. This finding implies the absence of a long-run relation, co-movement or tendency of convergence between the two variables. Furthermore, the long-run coefficients were found to be insignificant suggesting that capital is mobile, meaning investment is independent of savings.

5.5. Diagnostic Tests

Once the ARDL is specified, it is important to perform diagnostic tests to ensure that results are credible. Hence, this study performs the LM auto-correlation and the Breusch-Pagan-Godfrey test for Heteroskedasticity. Results in Table 7 and 8, shows that the null-hypothesis is rejected for both tests indicating that the residuals are not serially correlated at 5%. The results also indicate that the residuals have constant variance.

Table 7: Serial Correlation LM-Test

Null hypothesis: no serial-correlation			p-value
F-statistic	0.161133	Prob. F(1,25)	0.6915
Obs*R-squared	0.217738	Prob. Chi-Square(1)	0.6408

Source: Author's Computations

Table 8 : Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: no Heteroskedasticity	p-value		
F-statistic	0.675321	Prob. F(7,26)	0.6911
Obs*R-squared	5.230743	Prob. Chi-Square(7)	0.6318
Scaled explained SS	2.162928	Prob. Chi-Square(7)	0.9503

Source: Author's Computations

5.6. Toda-Yamamoto Test for Causality

To complement the above findings, the study proceeded to test for causality using the Toda and Yamamoto (1995)procedure. As the maximum order of integration is one, the Toda and Yamamoto test involves the addition of one extra lag of each of the variables to control for potential cointegration. The results of the causality test are presented in Table 4 below. As can be seen from the p-values of the Wald statistic, there is no evidence of causality detected between savings and investment.

Table 9: Results of Toda Yamamoto Granger non-causality tests

Null Hypothesis:	Lag length	Wald Stat	P-value	Causality
SAV does not Granger Cause INV	2	1.421175	0.4914	No
INV does not Granger Cause SAV	2	0.371717	0.8304	No

Source: Author's Calculations

5.7. Results from the Extended Model

In order to check for robustness and address the problem of omitted variable bias, the study proceeded to re-estimate the extended model. The first step was to check for the order of integration of the variables to be included (lending rate, exchange rate, gross domestic product). From table 13A, the results from the classical unit root tests (ADF and PP) indicate that the variables are non-stationary and only become stationary after first difference. The results justified the inclusion of these in the ARDL estimation.

The results from the re-estimated ARDL as presented in Table 14A shows that the calculated F-statistic is lower than the lower bound critical value at 5% level of significance. This means that we fail to reject the null hypothesis of no-cointegration. These results confirm the results of the main model which found no existence of a long-run relationship between savings and investment. Furthermore, the results also show that commercial bank's average lending rates do not play a role investment financing in Zambia. Also note that variables of exchange rate and gross domestic product were dropped due to the problem of serial correlation which was observed when the two variables were included.

5.8. Discussion of Results

In order to determine the order of integration of the variables conventional tests were employed. This was to ensure that none of the variables is I(2) so as to avoid spurious results in bounds test. In order to take into account presence of structural breaks two additional test for unit root were employed. These were the Zivot and Andrew's (1992) and the Perron and Vogelsang (1992) tests. All results from the tests except from the KPSS suggest that the two series have a unit root and only become stationary after first difference. The KPSS, however, reports that savings is stationery in levels and investment is I(1). In addition, the results from the Zivot and Andrew's (1992) test suggest that investment is non-stationary in levels with a break in 1997 while savings is reported to be stationery in levels with a break in 2004. Results from the Perron and Vogelsang (1992) test report that savings has a unit root with breaks in 2004 with additive outliers and only becomes stationery after first difference, however, after taking into account the innovative outliers savings is reported to be stationery. With regards to investment, the PV test report that investment is stationary in levels with a break in 2003.

Overall, the unit root tests for presence of structural breaks found no further information against presence of breaks in the series. Hence, the use of ARDL bounds testing approach to cointegration was justified since all the tests confirmed that the two series were either $I(0)$ or $I(1)$ while on the other hand there was enough evidence to support presence of structural breaks. Furthermore, break date for the entire model was found to be in 1987. These were determined by employing the Bai and Perron (1998, 2003a) sequential testing procedure.

Having determined the order of integration of the variables under investigation and the break dates for the model, the study proceeded to examining the long-run relationship using the bounds test procedure. Results from the test revealed that when investment is taken as the dependent variable, the F-Statistic is smaller than the lower critical value at 5% level of significance. Similarly, when savings was taken as the dependent variable the F-statistic was smaller than the lower bound critical value. These results suggest a lack of cointegration between investment and savings in Zambia. This finding implies

the absence of a long-run relationship, co-movement or tendency of convergence between the two variables. These results suggest that capital is mobile, meaning investment is independent of savings in Zambia. Complementary to this, results from the Toda Yamamoto test for Granger Causality indicate that in the short-run the two variables are also independent of each other. This means that in the short-run domestic savings do not influence investment in Zambia. This is in line with findings by Ogbokor and Musilika (2014) who observed similar results using data for Namibia and Esso and Yaya (2010) using data from UEMOA countries, as well as Cooray and Sinha(2007) using data of 20 African countries. These results are also confirmed by the results from the extended model which included Commercial Bank's average lending rates in the estimations.

These findings indicate that, Zambia experiences high levels of capital mobility. This implies that domestic investment is financed by foreign saving rather than domestic saving. These findings therefore, confirms the assertion by Feldstein and Horioka (1980) that a lack of cointegration suggests a high degree of capital mobility, a situation that is more likely to prevail in developing countries like Zambia.

5.7.1. Limitations of study

The limitation of this study is that savings and investment data for Zambia is reported in aggregates. Disaggregated data such as private savings, public savings, private investment and public investment would have made the analysis more comprehensive. However, due to non-availability of such data, the aforementioned variables could not be included.

CHAPTER SIX

CONCLUSION AND POLICY RECOMMENDATIONS

6.1. General Conclusions

The objective of this paper was to empirically investigate the relationship between saving and investment using time series data for Zambia running from 1980 to 2016. The aim was to first investigate if savings and investment are cointegrated (have a long run relationship), and the other is to identify the existence of causality between the two variables. Since it is recognized that inferences based on standard approaches of unit root and cointegration tests may yield misleading results, we followed the bounds testing approach to cointegration proposed by Pesaran *et al* (2001) and the Granger causality test of Toda and Yamamoto (1995).

The empirical findings suggest a lack cointegration between investment and savings, meaning the two variables do not share a long-run relationship. In addition, the test for causality suggests that in the short-run investment and savings are independent of each other, implying that domestic savings does not play an active role in financing investment in Zambia. This can further be interpreted as an indication of high levels of capital mobility with domestic investment being financed by foreign savings rather than domestic savings. These findings therefore, confirms the assertion by Feldstein and Horioka (1980) that a lack of cointegration suggests a high degree of capital mobility, a situation that is more likely to prevail in developing countries like Zambia.

Furthermore, the absence of short-run causality running from savings to investment, as indicated by the estimated results of this study, implies a high degree of short-run international capital mobility, an indication that a bulk of investment in Zambia is financed by foreign capital. This is in line with the findings in (Ogbokor and Musilika, 2014) using data for Namibia, (Esso and Yaya, 2010) using data from UEMOA countries and (Cooray and Sinha, 2007) using a sample of 20 African countries. The findings of this paper attest the view of other empirical studies that the relationship between saving and investment cannot be generalized across countries because these

results are country-specific (Esso and Yaya, 2010; Nasiru and Usman, 2013; Ogbokor and Musilika, 2014).

6.2. Policy Recommendations

Therefore, given the findings of this study, investment in Zambia cannot be raised by promoting domestic savings. Given this situation, if investment has to be promoted, other measures would have to be adopted. Such measures could include the following:

I. Government's economic policy should emphasise more on removing barriers to investment, hence promoting investment. This is because any policy aimed at promoting savings will likely be economically inefficient and ineffective.
II. Furthermore, in order to increase investment (capital formation), there is need for government to put in place policies aimed at increasing access to financial services by enhancing financial deepening. This initiative has also been identified as one of the strategic objective in the Seventh National Development Plan (MNDP, 2017).
III. There is also need for government to put in place measures that should address the problem of high cost of financing as this could be a major hindrance in transforming the countries savings into investment. At the same time, government should work towards putting in place measures to improve credit provision to small and medium scale enterprises (SMEs).

6.3. Direction for future research

Given the findings of this study, it is advisable for future research to focus attention on the effects of fiscal deficits on savings mobilisation and investment in Zambia. Furthermore, future studies should also attempt to investigate other factors hindering investment financing from domestic savings such as cost of funds and access to financial services.

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APPENDIX

Appendix A: Auto Regressive Distributive Lag (ARDL) Bounds Test Model

ARDL Long Run Form and Bounds Test
Dependent Variable: D(INVADDB)
Selected Model: ARDL(2, 3)
Case 3: Unrestricted Constant and No Trend
Date: 10/24/18 Time: 13:37
Sample: 1980 2016
Included observations: 34

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.529098	3.071342	0.172269	0.8646
INVADDB(-1)*	-0.163240	0.197433	-0.826808	0.4159
SAV(-1)	0.164882	0.119687	1.377604	0.1801
D(INVADDB(-1))	-0.395836	0.206188	-1.919782	0.0659
D(SAV)	0.323018	0.122443	2.638108	0.0139
D(SAV(-1))	0.046962	0.133294	0.352318	0.7274
D(SAV(-2))	-0.191483	0.109473	-1.749132	0.0921
D1987	0.782670	2.196899	0.356261	0.7245

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SAV	1.010059	0.660020	1.530347	0.1380

EC = INVADDB - (1.0101*SAV)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	1.332270	10%	4.04	4.78
k	1	5%	4.94	5.73
		2.5%	5.77	6.68
		1%	6.84	7.84
Actual Sample Size	34	Finite Sample: n=35		
		10%	4.225	5.05
		5%	5.29	6.175
		1%	7.87	8.96
		Finite Sample: n=30		
		10%	4.29	5.08
		5%	5.395	6.35
		1%	8.17	9.285

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-0.826808	10%	-2.57	-2.91
		5%	-2.86	-3.22
		2.5%	-3.13	-3.5
		1%	-3.43	-3.82

Appendix B: Serial Correlation LM-Test

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	0.161133	Prob. F(1,25)	0.6915
Obs*R-squared	0.217738	Prob. Chi-Square(1)	0.6408

Appendix C: Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.675321	Prob. F(7,26)	0.6911
Obs*R-squared	5.230743	Prob. Chi-Square(7)	0.6318
Scaled explained SS	2.162928	Prob. Chi-Square(7)	0.9503

Appendix D: Test for Unit Root for the Extended Model

Variables	**ADF**	**PP**
lr_t	-2.198	-2.144
Δlr_t	-6.337***	-6.337***
	ADF	**PP**
fx_t	1.617	1.976
Δfx_t	-2.983***	-2.983***
	ADF	**PP**
gdp_t	-2.088	0.284
Δgdp_t	-4.429***	-4.449***

Appendix E: Auto Regressive Distributive Lag(ARDL) Bounds Test(Extended Model)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(INV)
Selected Model: ARDL(4, 4, 3)
Case 5: Unrestricted Constant and Unrestricted Trend
Date: 05/04/19 Time: 17:51
Sample: 1980 2016
Included observations: 33

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.522917	4.591178	-0.767323	0.4528
@TREND	0.404835	0.168466	2.403072	0.0273
INV(-1)*	-0.034418	0.325317	-0.105798	0.9169
SAV(-1)	-0.121197	0.123442	-0.981815	0.3392
LR(-1)	-0.007753	0.051917	-0.149331	0.8830
D(INV(-1))	-0.743613	0.296821	-2.505260	0.0221
D(INV(-2))	-0.592414	0.253828	-2.333920	0.0314
D(INV(-3))	-0.538356	0.188618	-2.854205	0.0105
D(SAV)	0.230271	0.104714	2.199045	0.0412
D(SAV(-1))	0.170833	0.108680	1.571894	0.1334
D(SAV(-2))	-0.056664	0.118100	-0.479795	0.6372
D(SAV(-3))	0.169169	0.108073	1.565327	0.1349
D(LR)	0.034001	0.042705	0.796189	0.4363
D(LR(-1))	-0.002193	0.045420	-0.048272	0.9620
D(LR(-2))	0.091672	0.040091	2.286599	0.0346

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SAV	-3.521335	35.51361	-0.099155	0.9221
LR	-0.225256	1.556576	-0.144713	0.8865

EC = INV - (-3.5213*SAV -0.2253*LR)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	0.750366	10%	4.19	5.06
k	2	5%	4.87	5.85
		2.5%	5.79	6.59
		1%	6.34	7.52
Actual Sample Size	33	Finite Sample: n=35		
		10%	4.517	5.48
		5%	5.457	6.57
		1%	7.643	9.063
		Finite Sample: n=30		
		10%	4.577	5.6
		5%	5.55	6.747
		1%	7.977	9.413

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-0.105798	10%	-3.13	-3.63
		5%	-3.41	-3.95
		2.5%	-3.65	-4.2
		1%	-3.96	-4.53

Appendix F: Summary Statistics

Variable	Notation	Sources	Obs	Mean	st. dev.	Min	Max
Savings (% GDP)	*S*	IMF, WEO	36	17.5	13.80	-0.66	10.75
Investment (% GDP)	*I*	AfDB	36	21.33	8.79	41.34	42.79