AN INVESTIGATION OF THE DETERMINANTS OF PUBLIC INVESTMENTS IN NAMIBIA

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Abstract

This study investigated the determinants of public investment in Namibia. Time-series techniques such as unit root test, cointegration, and Autoregressive Distributed Lag (ARDL) approach were applied on quarterly data for the period 1990: Q1 to 2017: Q4. The results based on the unit root test showed that the variables are integrated of order zero and one, meaning that they are stationary in a level and first difference. The empirical results showed that real interest rate, unemployment rate, and real GDP are significant in explaining the percentage of public investment to GDP. Whereas, inflation and foreign direct investment are insignificant in explaining the percentage of public investment to GDP. The real gross domestic products lag 4 as well as unemployment rate lag 4 were all found to be significant in explaining the percentage of public investment to GDP in Namibia. The results also indicated that there is a negative relationship between unemployment and the percentage of public investment to GDP. In this regard, the study recommends that it would be a good idea to include investment policy incentives as part and parcel of the strategies that are used in the promotion of the country's public investments.

Keywords: *Error Correction Model, public investment, long run, unit root and cointegration*

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List of Abbreviations and/or Acronyms

ADF	Augmented Dickey Fuller
ARDL	Autoregression Distributed Lag
ECM	Error Correction Model
CMA	Common Monetary Area
MSS	Marginal Social Sacrifice
RGDP	Real Gross Domestic Product
FDI	Foreign Direct Investment
GDE	Gross Domestic Expenditure
GDP	Gross Domestic Product
LDCs	Less Developing Countries
NSA	Namibia Statistics Agency
PP	Phillip-Perron
SADC	Southern African Development Countries
WB	World Bank

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- Above all, my greatest thanks go to the Almighty God who guided me and gave me the strength to carry out this research.

Declaration

I, Kashiliminonika Derefina Ngenokesho, hereby declare that this study is my own work and is a true reflection of my research, and that this work, or any part thereof has not been submitted for a degree at any other institution.

Kashiliminonika Derefina Ngenokesho …… …..……

Name of Student Signature Date

CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.1 Background of the study

Public investment has become the backbone of every country`s economy. It drives economic growth in most economies. Public investment is an economic activity where the government spends on public services such as education and health. Indeed, the public sector includes all government bodies that fall directly under the central, regional and local governments (Mostern, Oosthuizen, Smit and Vyver, 2002).

In a study conducted by Sherbourne (2009), it was explained that the gross domestic expenditure (GDE) is made up of private consumption expenditure, government consumption expenditure, private investment expenditure, and government investment expenditure. Over the years, there has been a slow change from private-public consumption to fixed investment. Fixed investment as a share of GDP has risen significantly since 2003 but this rise has been the result of investment spending by private companies rather than by the government.

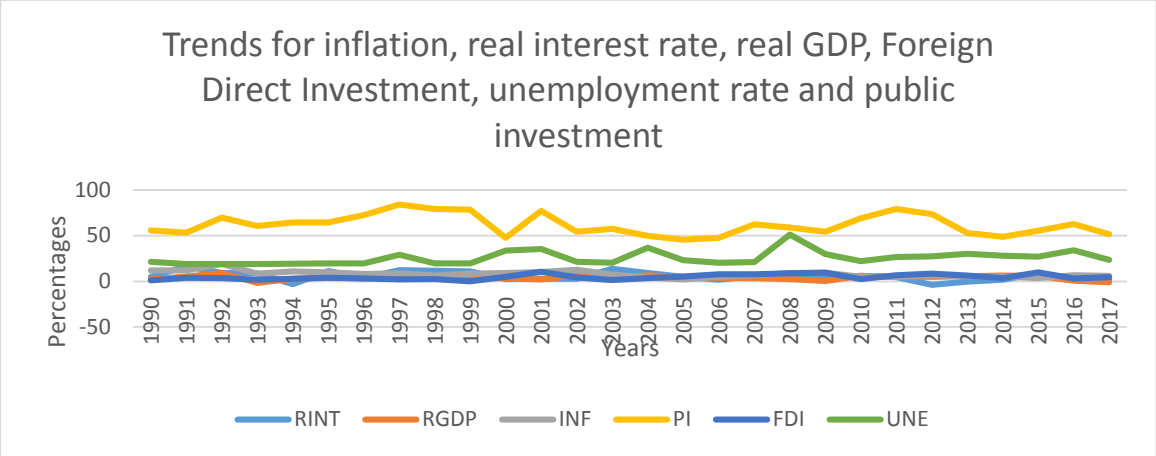
Zaaruka, Biwa and Kalenga (2001) noted that in 2001 government spending in Namibia was high in regional and international terms. For instance, in 2000/01, total public expenditure was 46.33 percent. This figure is high compared to the average for developing countries of 19 percent. It is generally argued that the high level and growth rate of total

government expenditure has resulted in increasing levels of budget deficits (Zaaruka, Biwa and Kalenga, 2001).

Allain-Dupré, Hulbert and Vammalle (2012) survey in 2012 found that public investment is also volatile in other countries, just like in Namibia. The volatility also makes it important to understand the determinants of public investment. Public investment is recognised to be one of the most variable items in government spending. Governments tend to cut capital spending by much larger percentages than the cuts in current expenditures during fiscal adjustment periods.

The Bank of Namibia Annual Report (2008) indicated that the lowest public investment growth rate to GDP was 47.6 percent while the highest public investment growth rate of 84.2 percent was recorded in 1997. The average public investment growth rate for 2014 was -0.67 percent, 2015 was -0.85 percentage, in 2016 was -0.7 and -1.23 percent as recorded in 2017. The main contributors to the slow public investment rate were found to be economic crisis and corruption (Aziri, 2017).

Figure 1: Trends for inflation, real interest rate, real GDP, Foreign Direct Investment, unemployment and percentage of Public Investment to GDP



Data source: Bank of Namibia (2017)

Figure 1 shows the overview of the changes of inflation, real interest rate, real GDP, Foreign Direct Investment, unemployment and percentage of public investment to GDP over time in Namibia from 1990 to 2017. As can be seen from the graph, the trend of unemployment and percentage of public investment to GDP in the Namibian economy has always been above the trends of inflation, FDI real GDP and real interest rate, except for 1992 when inflation and unemployment were equal to 19.1 percent. Also, the chart shows that the trends of inflation, real interest rate, and real GDP slightly follow a similar, although fluctuating, pattern. Therefore, three variables moved in the same direction for the entire period. This can be explained by the fact that inflation discourages the purchasing power and inflation can have the same effect on real economic growth. If real interest rates are low, more people can borrow more money and as a result, the consumers have more money to expend, causing the economy to grow and inflation to increase.

On the other hand, the chart shows an increasing trend of unemployment over the period under study. The increase has been constant from 1996 to 2008; however, from 2009 to 2015 there was a slight decrease in unemployment from 29.7 percent to 26.9 percent, respectively. From 1991 to 1996, unemployment remained in a stable range of between 19.1 percent and 19.5 percent. As seen in figure 1, the 51.2 percent for unemployment in 2008 was the highest since the 1990s due to the global financial crisis which caused labourers to lose their jobs, high levels of retrenchment, closure of corporations and social instability due to a reduction in international demand for commodities (Mwinga, 2012). In 2014-2017, unemployment declined from 27.9 percent to 23.33 percent since the government encouraged Small-Medium Enterprises and promoted vocational schools for dropouts to gain skills.

1.2 Statement of the problem

The Namibian economy is experiencing declining levels of public investment growth rate. However, public investment matters for growth as investment constitutes an important element that determines long-term economic growth and the development of any economy. Over the years, public investment in Namibia underwent periods of turmoil, which were characterised by cyclical fluctuations over time (Nghifenwa, 2009). It was also found that low public investment increases vulnerability in the economy because it encourages poverty and unemployment as there is no one to invest domestic and job opportunities are not created. Hence, understanding factors that have long term influence on public investment are vital for planning and policy management. Numerous studies have been conducted to investigate the determinants of investment in Namibia but there have been no

studies that have been conducted on the determinants of public investment in Namibia for the period from 1990 to 2017 using time series data.

1.3 Objectives of the study

The main objective of this study was:

- To study the determinants of public investment in Namibia.

The specific objective was:

- To examine the impact of inflation, real interest rate, real GDP, Foreign Direct Investment and unemployment rate on public investment during the period of 1990: Quarter 1 (Q1) to 2017: Quarter 4 (Q4).

1.4 Hypotheses of the study

To achieve research outcomes, the researcher conducted data analysis in order to test the following hypotheses:

1. **H_{0a}:** There is no impact of inflation on public investment.

   H_{1a}: There is an impact of inflation on public investment during the period of 1990: Q1 to 2017: Q4.

2. **H_{0b}:** There is no impact of real interest rate on public investment.

   H_{1b}: There is an impact of inflation on public investment during the period of 1990: Q1 to 2017: Q4.

3. **H_{0c}:** There is no impact on real GDP on public investment.

   H_{1c}: There is an impact of real GDP on public investment during the period of 1990: Q1 to 2017: Q4.

4. **H_{0d}:** There is no impact of Foreign Direct Investment on public investment.

   H_{1d}: There is an impact of Foreign Direct Investment on public investment during the period of 1990: Q1 to 2017: Q4.

5. **H_{0e}:** There is no impact on the unemployment rate on public investment.

   H_{1e}: There is an impact on the unemployment rate on public investment during the period of 1990: Q1 to 2017: Q4.

1.5 Significance of the study

A key challenge facing the country is to come up with policies that can help to raise public investment in order to stimulate and sustain economic growth (Mlambo and Oshikoya, 2011). Therefore, the findings of the study add to the existing knowledge and benefits policy decision-makers to implement better policies for the future.

1.6 Limitations of the study

The study was limited by the unavailability of data for some variables. Therefore, the study employed a method which includes variables with available data.

1.7 Delimitations of the study

This study concentrated on determining public investment in Namibia and the choice of explanatory variables will focus on macroeconomic variables.

1.8 Research ethics

The data are sourced from the Bank of Namibia, government reports, World Bank (WB) statistics and Namibia Statistic Agency (NSA) and they are in their original form. The data are not manipulated. The work from other researchers has been acknowledged by means of citations and referencing.

CHAPTER TWO

OVERVIEW OF INFLATION, REAL INTEREST RATE, REAL GDP, FOREIGN DIRECT INFLATION, UNEMPLOYMENT AND PERCENTAGE OF PUBLIC INVESTMENT TO GDP IN NAMIBIA

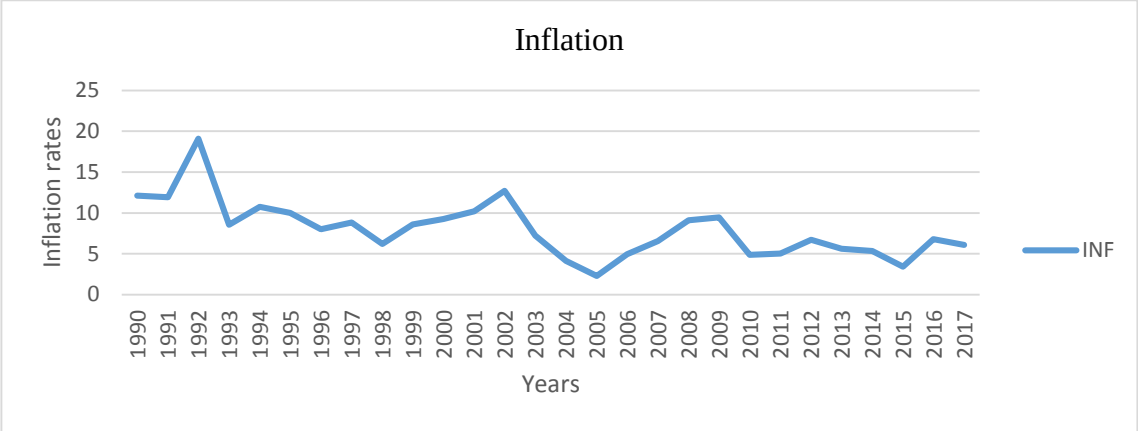
2.1 Introduction

This chapter provides a historical overview of the trends and behaviour of inflation, real interest rate, real GDP, foreign direct investment, unemployment and percentage of public investment to GDP in Namibia from 1991 to 2017. It also provides a general description of the six (6) variables used in the study.

2.2 Inflation

Inflation can be defined as the sustained increase in the general price of goods and services. Inflation is also a determinant of public investment because it affects public investment. The relationship between the two variables is negative in a developing economy such as Namibia. When an economy is experiencing high inflation, it discourages investment in that specific economy. The Namibian economy relies on exporting raw materials, which makes the prices of commodities to be instable (Bank of Namibia Annual Report, 2003).

Figure 2: Inflation trends for Namibia 1991 - 2017



Data source: Bank of Namibia (2017)

Figure 2 indicates the trend of inflation from 1990 to 2017. The graph indicates that the inflation trend in Namibia has been fluctuating over the past 27 years. In 1992 there was a drastic increase in the inflation rate with 19.1 percent being due to drought and a decrease in crop production in Namibia and South Africa. This has caused the price of foods and oil products to rise which has worsened the situation according to the Bank of Namibia`s annual report for 1993. In 1994, the inflation rate was 10.8 percent and this has resulted in overall prices increases of the basket of goods and services, mainly food, housing, fuel and power (Likukela, 2007).

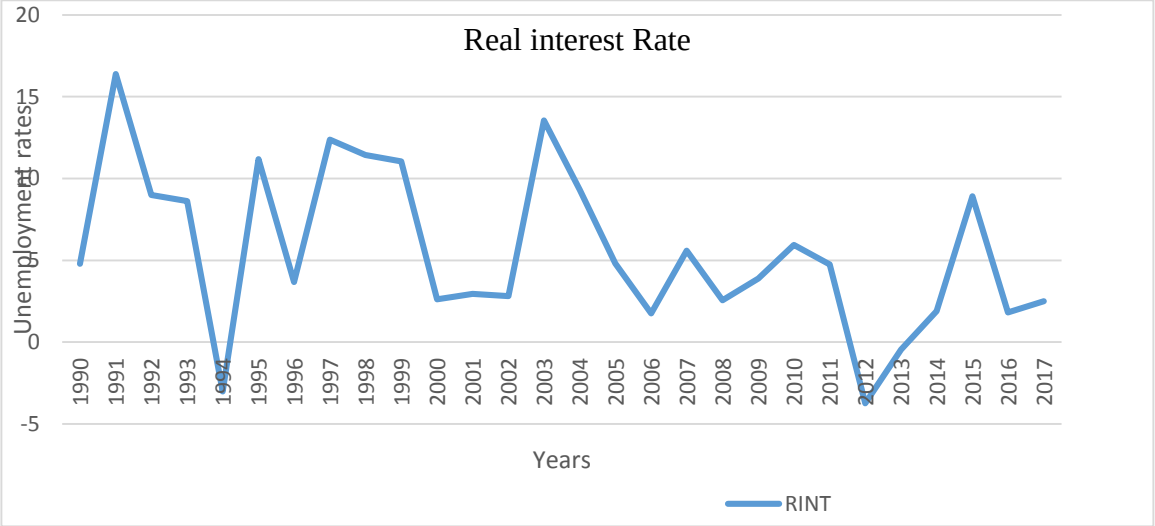
In 1998, the inflation rate dropped by 2.6 percent due to the reduction in the price of energy and transport (Shifotoka, 2015). In the year 2000, inflation was 9.3 percent due to Namibia adopting the Inflation Target Framework in 1993, and that applies to other members of the Common Monetary Area (CMA) trying to maintain 3 to 6 percent (African

Development Bank, 2008). In 2002, the inflation rate was 12.7 percent and this was attributed to high prices in foodstuffs (Shifotoka, 2015). Inflation fell below 5 percent in 2004-2005, thus remaining below 6 percent in 2006 as based on the Inflation Target Framework. In 2007-2009, the inflation rate increased from 6.5 percent to 9.5 percent before starting to decrease until 2016, even though the cost of living and low-income earners experienced.

2.3 Real Interest Rate

The interest rate can be defined as the cost incurred by the borrowers (investors) from the lender (Collins and Wanjau, 2011). Collins and Wanjau (2011) further explain that the interest rate is also regarded as one of the determinants of public investment as it affects the cost of investment projects and there is a negative relationship between the two variables (public investment and interest rate) but not under all circumstances. The chart below shows the interest rate trend from 1990-2017 for Namibia.

Figure 3: Real interest rate trends for Namibia 1991 - 2017



Data source: Bank of Namibia (2017) and Word Bank (2015)

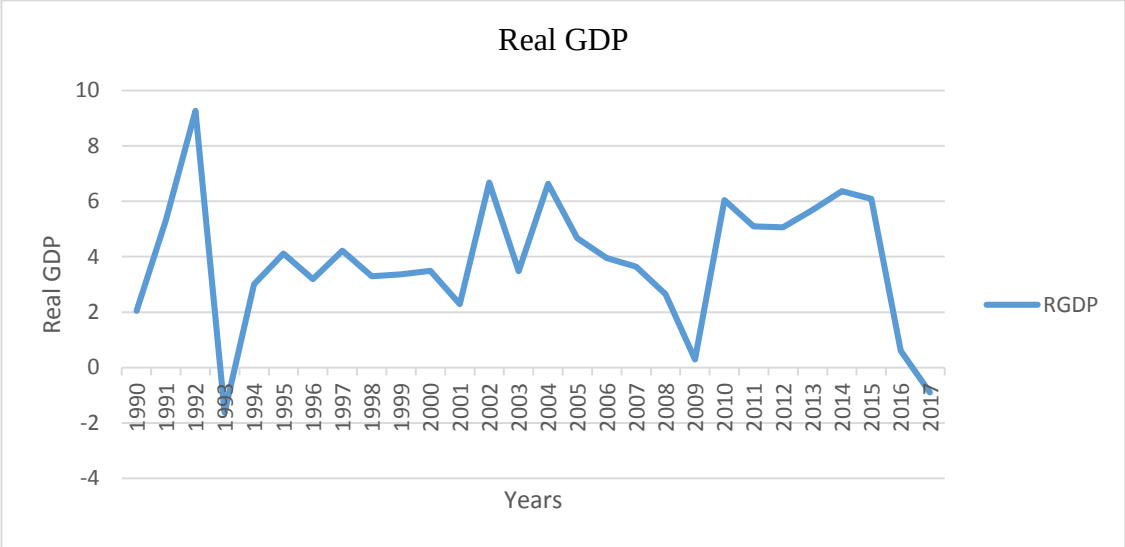
Figure 2 shows the real interest rate trend in Namibia from 1990 to 2017. As the graph depicts, the interest rate has been fluctuating over the past 27 years. In 1992 there was a drastic increase in the interest rate by 16.38 percent, this being the highest figure. From 2006 the interest rate trend started to decrease at an increasing rate until 2011. In 2012 and 2013, the interest rate stood at -3.7 percent and -0.45, respectively. From 2014, the interest rate increased to 8.91 percent in 2015 and started falling again in 2016, and 2.5 percent was recorded in 2017.

2.4 Real Gross Domestic Product (RGDP)

The trends of real GDP in Namibia for the period 1990-2017 are presented in Figure 4, which shows that Namibia experienced high real GDP growth of 9.27 percent during

1992, early after independence. After independence, from 1990 to 1998, the average for the GDP was 3.6% due to good performance in the fishing sector and agriculture (National Planning Commission, 2000). However, in 1993 real GDP growth was -1.6% due to cyclical drought in 1992. In 2008, this was a worldwide financial crisis year and real GDP growth rate decreased by 2.3% in 2009 as a result of weakening exports in the mining and quarrying sector (diamonds) and other non-renewable resources (Shifotoka, 2014). In 2009, high commodity prices as a result of increased global demand for natural resources (Shifotoka, 2014). Moreover, in 2010 real GDP growth was 6%, and 5.6% in 2011; this was due to the government decreasing taxes and increasing the government's spending in order to increase production, employment and income, thus to move the economy out of recession ever since 2009. In 2014-2015, real GDP decreased by 1.2% due to an increase in oil prices in Angola which leads to Namibia's economy to be depressed. In 2016, real GDP growth was 0.6% due to domestic demand which improved and enhanced production from new mines and exports (Shifotoka, 2014). From figure 4, the annual real GDP growth rate was negative in 1993 with a growth rate of -1.6% (Shifotoka, 2014).

Figure 4: Real GDP trends for Namibia 1991 - 2017

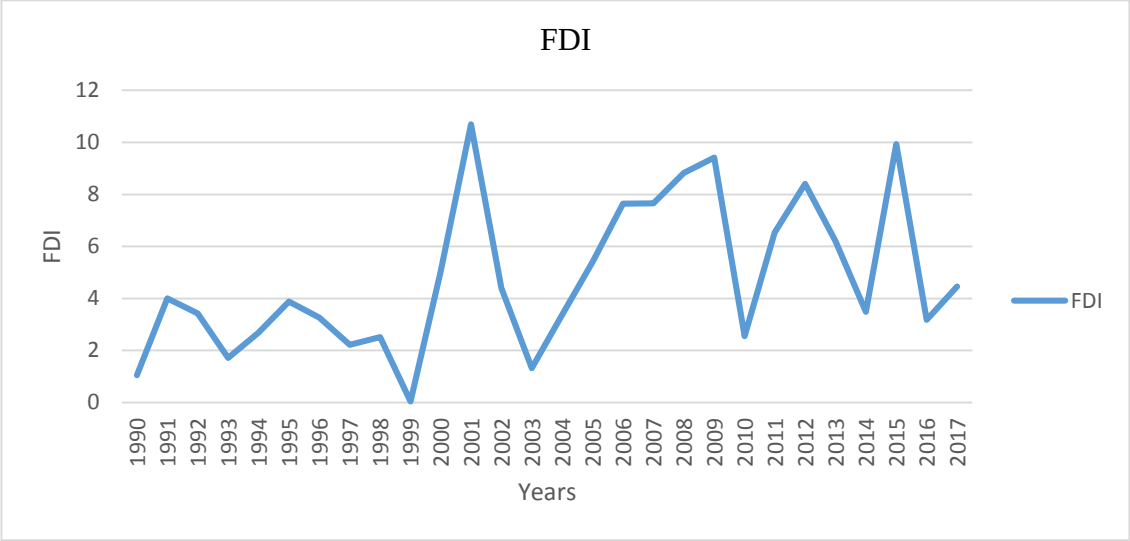


Data source: Bank of Namibia (2017) and Word Bank (2015)

2.5 Foreign Direct Investment (FDI)

Foreign direct investment in Namibia is defined as any proposed investment by a foreign national of assets with not less than 10% of the total share capital of a venture or the foreign national holds a management interest in the day to day running of the business concern (Foreign Investment Act, 1990). This was reviewed for some developments in FDI growth in Namibia.

Figure 5: Foreign Direct Investment trends for Namibia 1991 - 2017



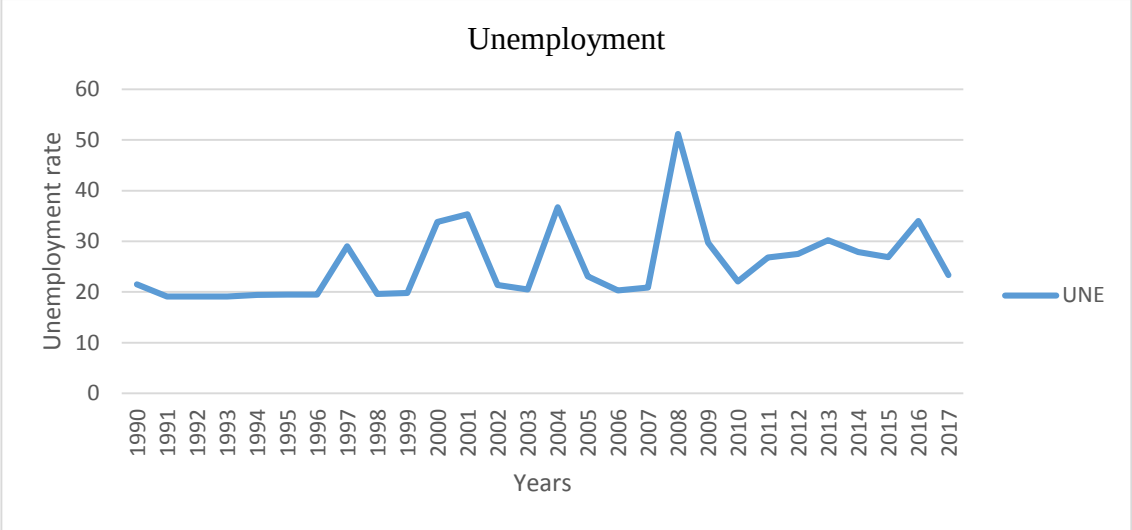
Data source: Bank of Namibia (2017) and Word Bank (2015)

After independence in 1990, Namibia opened borders for FDI. However, it did not receive enormous FDI inflows till the late 1990s. As Figure 5 shows, Namibia did not receive any substantial FDI inflows until 1997. FDI increased from 0.04% in 1999 to 5.02% in 2000 after reaching the highest rate of 10.7% in 2001 due to an increase in equity capital and reinvested earnings (Bank of Namibia, 2004). An increase in equity capital and reinvested earnings in 2001 made the government to attract more foreign investors after the loss of such during the apartheid period. The trend for FDI has been unstable throughout from 2003 to 2017 due to some economic factors and conditions.

2.6 Unemployment rate

The chart below shows the unemployment trend from 1990-2017 for Namibia.

Figure 6: Unemployment trends for Namibia 1991 - 2017



Data source: Bank of Namibia (2017) and Word Bank (2015)

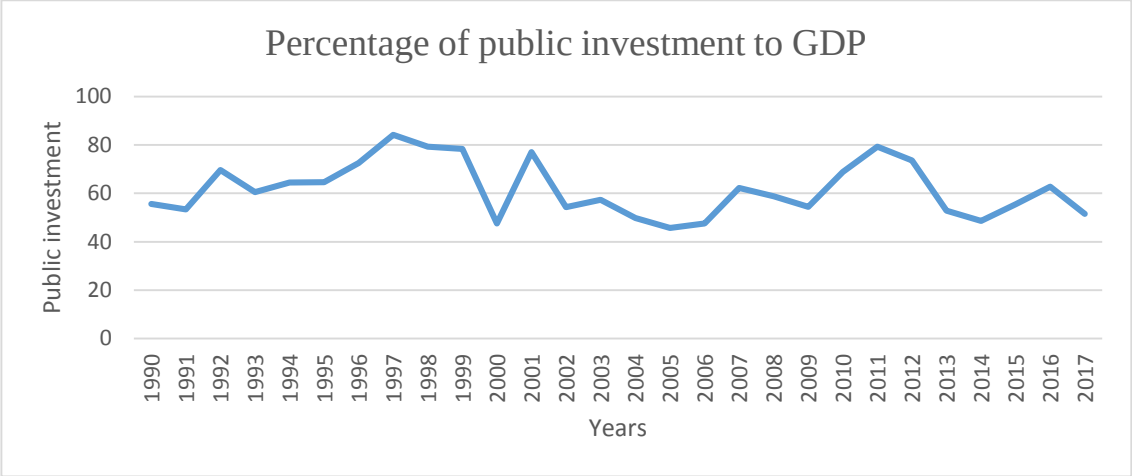
Figure 6 above shows the trends in the unemployment rate by broad definition in Namibia. According to Sunde and Akanbi (2016), Namibia swallowed high unemployment rates from the 1980s at 19%. In 1990 to 2010, the unemployment rate grew from 19% to 22.1% because the country was threatened by challenges and crises such as floods, diseases, poverty, and income inequality. In 2003, the unemployment rate was 20.5 percent because the country experienced drought and in Namibia most people are employed in the agriculture industry and as a result of the drought, there were reductions in the harvesting of crops and the quantity of livestock (Kanyenze and Lapeyre, 2012).

From 2004 to 2008, the unemployment rate was high as employment in agriculture and the fishing sector declined and especially considering that many people are employed by these two sectors (Shifotoka, 2015). As can be observed from figure 6 above, unemployment at 51.2% in 2008 was the highest since independence due to the global financial crisis which caused labourers to lose their jobs, high levels of retrenchment, closure of corporations and social instability due to the reduction in international demand for the commodities (Mwinga, 2012). From 2014 to 2015, unemployment declined from 27.9% to 26.9% since the government encouraged Small-Medium Enterprises and promoted vocational schools for school dropouts to gain skills.

2.7 Public investment

Public investment can play an essential role to improve the economic growth and level of economic development. Expenditure of government includes both the purchase of final goods and services and transfer payments. Expenditures help the government to undertake key functions such as national defense and education.

Figure 7: Percentage of public investment trends for Namibia 1991 - 2017



Data source: Bank of Namibia (2017) and Word Bank (2015)

Figure 7 above shows the percentage of public investment to GDP trends in Namibia from 1990 to 2017. As the graph depicts, the percentage of public investment to GDP has been rising since 1992, increasing from 69.6% in 1992 to 84.2% in 1997. It fell sharply to 47.6% in 2000, largely due to a decline in the saving of the general government (Shiimi and Kadhikwa, 1999). However, it recovered in the year 2001, reaching a peak of 77.1% and it started to decline again from the year 2002 to 2009 due to the financial crisis of 2008 and other challenges such as a possible bubble in the construction and real estate market, high household indebtedness and a disappearing Angolan consumer base (Bank of Namibia, 2015). It recovered thereafter but declined again from 2012 to 2014 as a result of higher current transfers necessitated by the drought (Shiimi and Kadhikwa, 1999). The trend increased over a two year period from 48.6% in 2014 to 62.8% of GDP in 2016 and started falling again in 2017 as a result of the economic slowdown in 2016 and due to that,

the GDP growth slowed significantly in 2016 with the weak growth rate continuing into 2017 (Spangenberg, 2017).

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

In this section, a review of different literature was done to get views of different studies conducted previously which are related to this study to avoid repeating findings of previous studies.

3.2 Theoretical literature

This section provides an overview of the existing knowledge in the area of determinants of public investment in Namibia. The main focus of this section is to summarise and synthesise the arguments and ideas of others, which form the basis for this study. The following selected theories of public spending were used in the study and they are discussed below:

3.2.1 Wagner's Law of increasing public expenditure

Wagner (1883) came up with a theory which states that there is a causal relationship between public expenditure and income growth. An expansion of public activities postulates that as real income increases, there is a long-run tendency for the share of public expenditure to increase relative to national income. The theory holds that for any country, public expenditure rises constantly as income growth expands. The responsiveness of public expenditure concerning Gross National Product is greater than one. However, the

relationship between public investment and the level of economic development depends on different variables.

3.2.2 Wiseman and Peacock hypothesis

This theory deals with the growth of public expenditure. It emphasises that the rise in public expenditure significantly depends on revenue collection. Public expenditure should not be expected to increase smoothly and continuously, but in jerks or a stop like fashion to accommodate natural causes such as natural disasters, war, epidemics, etc. Peacock and Wiseman (1961) proffer that during times of war, the government further increases the tax rates, and enlarges the tax structure to generate more funds to meet the increase in defence expenditure. After the war, the new tax rates and tax structures may remain the same, as people get used to them. Therefore, the increase in revenue results in a rise in government expenditure. Peacock and Wiseman (1961) emphasise that an increase in public expenditure can be also attributed to urbanisation, growth in population, civil right awareness and government duties awareness.

3.2.3 The Median Voter hypothesis

The median voter hypothesis states that under some circumstances government officials choose the level of government spending chosen by the median voter according to Turnbull and Chang (1998). However, the outcome of such a choice is a demand for public services by the median voter that depends upon such things as the median voter's income and the tax price where this price depends in turn on the voter's tax share and the relative unit cost of the public good as given by the technology of public provision (Turnbull and

Chang, 1998).

3.2.4 Musgrave and Rostow's theory of public expenditure

Edame and Eturoma (2014) argue that Musgrave and Rostow put forward a development model under the causes of growth in public expenditure. Edame and Eturoma (2014) further argue that public expenditure is a requirement of economic growth. The public sector initially provides economic infrastructure such as roads, hospitals and the supply of clean water. As economic growth takes place, the balance of public investment shifts towards human capital development through increased spending on education, health and welfare services. Edame and Eturoma (2014) assumed that the government grows like an organism, making decision on behalf of the citizens. Society's demand for infrastructure facilities such as education, health, electricity, transport and many more, grows faster than per capita income.

3.2.5 Ernest Engel's theory of public expenditure

Ernest Engel points out that the composition of the consumer budget changes as the family income increases. A smaller share of family income is spent on certain goods such as work clothing and a larger share on others, such as for coats and expensive jewellery. As average income increase, smaller changes in the consumption pattern for the economy may begin to take place. At the earlier stages of national development, there is a need for overhead capital such as roads, harbours, power installations, and pipe-borne water. But as the economy develops, one would expect the public share in capital formation to drop over time. The individual expenditure pattern is thus compared to nation expenditure and

Engel's finding is referred to as the declining portion of outlays on food (Edame and Eturoma, 2014).

3.2.6 Pure theory of public expenditure

Samuelson (1955) developed a pure theory of public expenditure which attempts to specify the conditions for the determination of that level and the composition of public expenditures which maximises the sum of individual utilities. The pure theory of public expenditure preserves the category of governmental services but highlights the specific forms of the consumption of these services. For this, a special theoretical construction is introduced, the concept of the public good.

According to Samuelson (1955), public expenditure will grow in sympathy to achieve growth in labor (L) and this will include an increase in education expenditures and growth in capital (K) through savings or borrowings and technological improvement (T); this is denoted by Q=F(K, L, T). To happen at the earlier stages of national development, there is a need for overhead capital such as roads, harbours, and power connection but as the economy develops, one would expect a public share in capital formation to decrease over time.

3.2.7 Maximum social advantage

Dalton (1970) explains that the maximum social advantage is attained where the marginal social benefit (MSB) of public expenditure and the marginal social sacrifice (MSS) of taxation are equated as denoted by MSB = MSS.

This demonstrates that to obtain a maximum social advantage, the public expenditure

should be carried up to the point where the marginal social benefit of the last currency or dollar spent becomes equal to the marginal social sacrifice of the last unit of currency or dollar taxed.

The government should collect revenue and spend the money to maximise the wellbeing of the people. When the government imposes taxes, some disutility is created. On the other hand, when the state expends some money, there is a gain in utility. The government should adjust revenue and expenditure so that surplus of utility is maximised and disutility is minimised.

3.2.8 Colin Clark Hypothesis

Another theory relating to the growth of public expenditure was developed by Colin Clark. The theory is concerned with the tolerance level of taxation. The theory says that in an economy, inflation emerges when the share of the government sector, as measured in terms of taxes and other receipts, exceeds 25 percent of the aggregated economic activity in the country. When public expenditure reaches 25 percent of the total economic activity or aggregate amount of expenditure in the country, the taxpayers' ability to pay more tax is exhausted. Public expenditure beyond this limit means a disincentive to producers and a fall in the production due to taxation beyond the tolerance level (Patinkin, 1976).

3.2.9 The Classical versus the Keynesian approach of public expenditure

Keynes (1936) categorised public expenditure as an exogenous variable that can generate economic growth instead of an endogenous phenomenon. Keynes (1936) believes the role

of the government to be crucial as it can avoid depression by increasing aggregate demand and thus, switching on the economy again by the multiplier effect. It is a tool that brings stability in the short run but this needs to be done cautiously as too much of public expenditure leads to inflationary situations while too little of it leads to unemployment. While Classical approach believes that too much government spending will increase the public sector and decrease the private sector where wealth is created. This theory is mainly focused on making long term solutions to economic problems.

3.2.10 Theory of public choice

Parikh (1997) explains the theory of public choice in the line of the argument that public expenditure needs to be financed by the tax revenue. If public expenditure is increased on social welfare programmes, it releases two opposite reactions in the electorate: the beneficiaries extol the government which has increased welfare; and the taxpayers who have to foot the bill have reservations about returning the party in charge of the government to power. The government has the perforce to weigh the intensity of the two reactions and accordingly keeping self-interest always in view without excessively sacrificing the interests of the state.

3.2.11 Positive theory of public expenditure

The positive theory of public expenditure theory explains the things as it is. The concern of this positive theory is thus very different from that of the extensive recent literature dealing with cost-benefit analysis and other techniques related to the efficiency with which

government expenditure programmes are executed. Like the theory of public goods, the cost-benefit and programme-budgeting discussions are concerned with how the government should do things rather than with why the government does and what it does (Parikh, 1997).

3.2.12 Normative theory of public expenditure

The normative theory of public expenditure is concerned with establishing the requirements for achieving the optimal provision of certain goods and services. Authors have therefore not been concerned with explaining what governments do but rather with what they should do under certain expectations if they want to allocate economic resources efficiently, to maximise social welfare. The normative theory of public expenditure is concerned with three difficulties. Firstly, the requirements for the optimal provision of a public good; secondly, the demonstration that the private market will fail to provide the optimal amount of such goods; and finally, the problem of whether a political mechanism which will achieve task properly, can be planned. Public goods theory, therefore, is essentially normative (Parikh, 1997).

3.2.13 The neoclassical model: Jorgenson's approach

The distinguishing feature of the neoclassical model is that it is based on an explicit model of optimisation behaviour, which relates to the desired capital stock to interest rates, output, capital prices and tax policies (Jorgenson, 1963).

Numerous models have been employed in the literature to explain the determinants of investment; among these models are the neo-classical investment model and the accelerator investment model (Keynesian approach). The distinguishing feature of the accelerator model is that it is based on the assumption of a fixed capital/output ratio. Keynes (1936) considered public spending as an exogenous factor to be used as a policy instrument to influence growth. On the other hand, public expenditure is seen as an endogenous factor or as an outcome, not a cause of growth in national income (Wagner, 1911).

Moreover, Peacock and Wiseman (1961) examined the displacement effect, to which during times of war tax rates are raised to generate more revenues, supporting the increase in defense spending. Peacock and Wiseman (1979) analysis the literature on public expenditure growth on provision of goods and services that provided by the government.

The relationship between public expenditure and gross domestic product (GDP) has been well discussed in economic literature (Peacock and Wiseman, 1961). Lastly, Wagner's law and Peacock-Wiseman's hypothesis emphasise on the fact that public expenditure tends to increase in the long run.

3.3 Empirical literature

The empirical literature review in this chapter revolves around existing literature on the evaluations of specific determinants of public investment. This involves summarising empirical studies that were done on the determinants of public investment by previous researchers. There has been relatively little research done on the determinants of public

investment in developing countries. Rabnawaz and Jafar (2015) found that there is a positive relationship between GDP and public investment in the short run. The increase in GDP causes a rapid increase in public investment. Similarly Fournier (2016) found that public investment has a positive effect on long-term growth and labour productivity. On contrary, Keynesian Counter-Cyclical theory implied the negative relationship between economic growth and public education expenditure in the long run.

Valila and Mehrotra (2005) analysed the evolution and determinants of public investment in Europe for the period 1972 to 2005. The results of Valila and Mehrotra's (2005) study found that public investment has been determined by national income, the stance of budgeting policies and fiscal sustainability considerations for the ten EU member states. Valila and Mehrotra (2005) further found that neither the cost of financing nor the fiscal rules embodied in the EMU have had a systematic impact on public investment. In addition, Turrim (2004) looked at public investment and the EU fiscal framework over the period 1979 to 1996. The results suggest that the impact of the EU rules for fiscal discipline is not a clear cut. This is consistent with the view that in the run-up to Maastricht, the budgetary adjustment implied a significant decline in public investment, especially in high debt countries. The results indicated that after Phase II of EMU, the negative relation between the previous period's budget balances and public investment started being insignificant.

Valila, Kozuluk and Mehrotra (1998) revealed that all public investment variables as well as public debt, current revenues and current disbursements are measured with GDP trend to reduce spurious correlations and multicollinearity. Abiad, Furceri and Topalova (2015) also found that public investment is more effective in enhancing output in countries with higher public investment efficiency when funded by issuing debt.

Furthermore, Edame and Eturoma (2014) discovered that public expenditure on education has a significant impact on economic growth and also expenditure on education is different between regimes but not significant. Similarly, Yung and Yusoff (2014) investigated the determinants of the public education expenditure in Malaysia during 35 year period from 1982 to 2016. The empirical findings identified that the real gross domestic product growth rate, unemployment rate, inflation rate and working age population are the long-run determinants of public education expenditure. The results further supported the Keynesian Counter-Cyclical theory as implied by the negative relationship between economic growth and public education expenditure in the long-run. The short-run analysis demonstrated that fluctuations in education expenditure were sensitive to the real gross domestic product growth rate, unemployment rate, population of age less than 15, and population of age greater than 64.

Belloc and Vertova (2006) provided empirical support for the crowding- in hypothesis and a positive relation between public investment and output. Moreover, Oukhallou (2016) revealed that public investment expenditures have a larger influence on GDP's evolution in developing countries. The results suggested that public investment spending

is relatively counterproductive in advanced economies, most likely because of high levels of crowding out; the latter are driven by public-private capital substitutability and the advanced position of the countries in terms of transitional dynamics. The study sheds light on efficiency as a concept that is significantly linked to the level of corruption.

Wong and Wai (1982) examined a modified version of the flexible accelerator theory of investment with particular reference to developing countries. The empirical results for five countries confirmed that government investment, the change in bank credit to the private sector and capital inflow to the private sector play important roles in determining private investment. The contributory effect and the crowding- out effect of government investment are assessed within the context of a recursive model. In addition, Ghali (2010) investigated public investment and private capital formation in a vector error-correction model of growth and results found that public investment have a negative short-run effect on private investment and a negative long-run effect on both private investment and economic growth.

Mourao (2014) searched long-term determinants of Portuguese public expenditures. The empirical analysis was conducted based on an equation using co-integration test. The study used a restrictive set of four variables: Number of Unemployed People, Number of Public Employees, Rate of Openness and Current Transfers. The variable associated with the dominant force is the Number of Unemployed, whose perceptual increase promotes the rise of almost 0, 30% of Portuguese real total expenditures. In the same vein, Foye (2014) did an analysis of the macroeconomic determinants of public investment in Nigeria. The ECM revealed a significant long term relationship among the variables, with

the coefficient being negative and large enough for feedback of approximately 0.64. The results also revealed that Real Gross Domestic Product, budget deficit, government debt, trade openness, public debt servicing, private investment, foreign direct investment and previous public capital spending were found to explain public capital spending while the degree of urbanisation did not have any effect on public capital spending.

It is observed that the crowding-out effect of public investment on private investment has dampened during the post-liberalisation period. The results also revealed that a "market-friendly" incumbent and an increase in foreign direct investment dampen the magnitude of the crowding out effect of public investment. Formal tests were conducted to examine whether the crowding-out effect was driven by political uncertainty and political business cycle channels but no evidence for the same was found. The results also revealed that public infrastructure (represented by KMs of roads per capita) has a positive effect on private investment in the short-run (Pradyumna, 2016). This is similar to the findings by Blejer and Khan (1984), who found that public infrastructure investment is complementary to private investment, other kinds of public investment lead to crowding-out of the private investment. This suggests that public investment should be more focused on goods and services which are enjoyed or consumed by many consumers simultaneously and non-excludable with significant positive externalities. In this model, a single endogenously determined structural break was included and the possibility of multiple breaks was excluded. There is a scope to increase multiple structural breaks and re-investigate the impact of public investment on private investment in India in future studies.

Chhibber and Kalloor (2017) analysed the determinants of public investment. The test empirical indicated that an increase in public investment by 5% of GDP, depreciate the real exchange rate by 10-15% and fix the bad loan problems in the banking sector, so that credit growth to the private sector is restored. The results further stated that an increase in GDP growth rate by at least 2% points on a long run results to 8% and GDP growth. Moreover, Hussein and Benhin (2015) study on public and private investment and economic development in Iraq from 1970 to 2010 revealed that in the long run, public investment affects real gross domestic product (GDP) positively and it statistically significantly; however, price and exchange rate volatility are found to harm real GDP.

In addition, Vu Le and Suruga (2005) proffer that Foreign Direct Investment (FDI), public capital, and private investment play important roles in promoting economic growth, whilst public non-capital expenditure harms economic growth, and excessive spending in public capital expenditure can hinder the beneficial effects of FDI. This is also supported by the study by Ndikumana (2007) found a positive relationship between FDI and percentage of public investment to GDP.

In another study, Odedokun (1997) discovered that infrastructural public investment facilitates private investment, especially in the long-run. It also promotes economic growth and efficiency, whereas non-infrastructural investment does the reverse. Also, long-term effects of public investment tend to be much more positive than short-term ones on growth, efficiency and private investments.

Erden and Holcombe (2006) discovered that public investment contributes less to overall productivity, and private investment does not necessarily undermine the role of public investment, because the public investment may increase productivity indirectly by enhancing the productivity of private capital. For example, public infrastructure expenditures may be complementary to private investment. Another approach to examining the effect of public investment on economic growth and productivity is therefore to test the hypotheses that public investment either promotes or displaces private investment by specifying a private investment model.

The results obtained revealed that the magnitude of the economic determinants of public investment is greater than those of structural and politico-institutional determinants, whether in the global case or in the individual case. Results also revealed that national income, government savings, private investment, control of corruption and the population significantly influence public investment (Ntavoua, 2018). Whereas, Tayeh and Mustafa (2011) revealed that population, unemployment and inflation rates are significantly related to public expenditures.

Shams (2016) examined the causal relationship between public investment and economic growth in Bangladesh from 1972/73 to 2013/14. From the study, cointegration analysis indicates a long-run relationship between the two variables. A unidirectional causality from public investment to growth was found based on of the Error Correction Model (ECM). The main result of the study is that public investment invariably leads to economic growth. As a policy suggestion, efficient management of public investment should be conducive to higher productive capacity which will lead to higher growth in Bangladesh.

Furthermore, the paper by Ashipala and Haimbodi (2003) highlighted that Botswana's economy behaves differently from the Namibian and South African economies. Based on this, the authors suggest that public investment should be used to stimulate economic growth in Namibia and South Africa, while in the case of Botswana, fiscal policies other than public investment might be more appropriate. However, Ashipala and Haimbodi (2003) caution that different kinds of public investment have different effects on economic growth.

Pattillo and Warner (2014) studied public investment as an engine of growth and the results show that only a weak positive association between investment spending and growth and only in the same year, as lagged impacts are not significant. Furthermore, there is little evidence of long term positive impacts. Some individual countries may be exceptions to the general result, for example Ethiopia in recent years as high public investment has coincided with high GDP growth, but it is probably too early to draw definitive conclusions. The fact that the positive association is largely instantaneous urges for the importance of either reverse causality as capital spending tends to be cut in slumps and increased in booms, or Keynesian demand effects, as spending boosts output in the short run. This idea argues against the importance of long term productivity effects, as these are triggered by the completed investments and not by the mere spending on the investments. A slump in growth rather than a boom has followed many public capital drives of the past. Case studies indicate that public investment drives tend eventually to be financed by borrowing and they have been plagued by poor analytics at the time investment projects were chosen, incentive problems and interest-group-infested

investment choices. On a different perspective, Milbourne, Otto and Voss (2003) used an extension of Mankiw, Romer and Weil's augmented Solow-Swan growth model to examine whether the public investment has a distinct role as a determinant of economic growth. It considers both the predictions of the model in steady state and in the transition to the steady state. For the steady state model, there is no significant effect from public investment on the level of output per worker. Using standard ordinary least squares (OLS) methods for the transition model, it observes a significant contribution to economic growth from public investment. When instrumental variables methods are used, however, the associated standard errors are much larger and the contribution of public investment is statistically insignificant.

Pereira and Andraz (2003) revealed that at the aggregate level public investment affects positively private inputs and private output. Empirical results at the industry level suggest that public investment tends to shift the sectoral composition of employment towards construction, transportation and the composition of private investment towards manufacturing, public utilities and communication. Furthermore, public investment tends to shift the composition of private output towards construction, durable manufacturing, transportation and wholesale trade. Results suggest that public investment seems to be a powerful instrument to enhance long-term private sector performance but it does so in a way that is rather unbalanced across industries. In a different view, Ramirez and Nazmi (2003) indicate that public expenditures on education and healthcare are found to have a positive and statistically significant effect on private capital formation and long-term economic growth. Public investment expenditures had a positive and significant effect on

output growth. Public investment's impact on economic growth was statistically identical to the impact of private capital spending. The contribution of public investment to output expansion came at the expense of private investment as indicating a significant crowding out effect.

Ulrich and Alan (1998) presented that an increase in public investment would not automatically translate into faster output and productivity growth. One reason not to take for granted a positive relationship between more public investment and faster growth is public investment's crowding out effect on private investment. Although the time-series regression results for Mexico all point towards a crowding out the coefficient of less than unity, the existence limits the growth impact of public investment by reducing its net effect on capital accumulation. The time-series results also suggest that the economy's total factor productivity growth responds positively to increases in the ratio of public to private investment.

In addition, Makuyana and Odhiambo (2017) indicated that public investment has a higher short-run growth impact, but in the long run the private investment-led growth is more important. Besides, while gross public investment crowds out private investment, infrastructural public investment has a long-run crowding effect. A non-infrastructural public investment was also reported to have a short-run crowding out effect on private investment. The results suggest that the productivity of public and private investment in

Zimbabwe can be improved by cutting back on non-infrastructural public investment to a basic minimum level while stimulating the growth in infrastructural public investment.

Pereira and Andraz (2012) examined whether public investment crowds in private investment and employment have a strong positive effect on output. The results indicated that one euro in public investment increases output in the long- term by 9.5 euros, which corresponds to a rate of return of 15.9%. The figures imply that there are strong long-term budgetary benefits from public investment in the form of increased future tax revenues. A closer look at the effects of different types of public investment uncovers the same general patterns. Dreger and Reimers (2014) indicated that private investment reacts to shocks in public investment both in terms of stock and flow variables. In contrast, public investment is rather exogenous. Therefore, the lack of public investment might have restricted private investment and GDP growth in the euro area.

Whereas, Ntembe, Amin and Tawah (2018) indicated that real gross domestic product, labour force, public investment and private investment are cointegrated. Also based on the estimates, public and private investments have positive and significant effects on the real gross domestic product in both the short-run and the long-run. The estimates further show that labour force has a significant long-run relationship with real gross domestic product but the study found no evidence of a significant short-run relationship. The error correction term is negative and significant, suggesting that any deviations of real GDP growth from the long-term value would be corrected subsequently.

Ashipala and Haimbodi (2003) examined whether an increase in public investment, private investment and public consumption in South Africa and Namibia will have a positive effect on economic growth and if there is a positive relationship between private investment and public investment in Namibia and South Africa. The paper further conducted an empirical analysis of the long-term relationship between public investment and economic growth and between public and private investment in Botswana, Namibia and South Africa. Public and private investment were found to be complementary and there was no evidence of a strong crowding-out effect in all three countries. In a different vein, Nguyen and Trinh (2018) indicated that public investment in Vietnam in the past period does affect economic growth in the pattern of an inverted-U shape with positive effects mostly occurring from the second year and negative effects constraining long-term growth. Meanwhile, investment from the private sector, state-owned enterprises, and FDI have positive effects on short-term economic growth, and state-owned capital stock has positive impacts on economic growth in both the short and long run. The estimated influence of public investment on private investment also showed a similar inverted-U shape in which public investments have crowding-in private investment short-term but crowding-out in the long run.

James and Embaye (2011) researched on what determines public investment in South Africa and their study estimated the determinants of real per capita government spending in the Republic of South Africa, using annual data for the period 1960 to 2007. This was a tumultuous period during which South Africa experienced a variety of internally imposed changes (e.g., the abolition of apartheid, changes in political institutions) and

externally generated shocks (e.g., war, oil shocks). Using multivariate cointegration techniques, the empirical results found that per capita government spending, per capita income, the tax share, and the wage rate are cointegrated, a result that supports the notion that government spending is associated not only with per capita income and the true cost of government service provision as given by the wage rate but also to the fiscal illusion caused by budget deficits. The study further found evidence that per capita government spending was positively affected by external shocks. These external shocks seem to play a significant role in explaining the dynamics of government spending growth.

Bin - Hafiz and Hasan (2016) explored the causal relationship between public investments and economic growth in the case of Bangladesh in the period 1976 - 2014, using a Vector Autoregression Model (VAR). The model included private investment, inflation, real interest rate, money supply, and foreign direct investment besides public investment. The GDP growth rate is used as a measure of economic growth, but public investment along with private investment, money supply, and foreign direct investment are expressed as ratios of GDP. The ECM model estimates indicate the existence of a long-run relationship between public investment and economic growth. According to the granger causality test, the study showed that there exists no short run causal relationship between public investment and economic growth.

Haque and Kneller (2007) examined the growth effects of public investment in the presence of corruption. The research looked at the role of simultaneity between public investment, corruption and growth, and the possible biases arising from the omission of

correlated variables from the single reduced form equation based analysis. The paper used the three-stage least squares method in a panel set up for a system of four equations on growth, public investment, corruption and private investment. The results from the study are twofold: firstly, corruption increases public investment, and secondly, corruption reduces the returns to public investment and makes it ineffective in raising economic growth.

Banaszewska (2018) studied the determinants of local public investments in Poland. The empirical results found that public investment increases both revenues and grants. The coefficients on population size and the share of old inhabitants cease to be negative and statistically significant for municipalities with fewer than ten thousand inhabitants. The results also revealed that apart from fiscal capacity, the investment policies of Polish municipalities are affected by economies of scale, local communities' preferences and infrastructural endowment.

Ukwueze (2015) researched on the determinants of the size of public expenditure in Nigeria. The results showed that the size of revenue and growth rate of national income/output and private investment significantly influence the size of public expenditure both in the short run and long run. The results further showed that external and domestic debts significantly influence the size of government expenditure only in the short run.

Ntavoua (2018) looked at the determinants of public investment in the cemac Sub-Region. The results indicated that the magnitude of the economic determinants of public investment is greater than those of structural and politico institutional determinants, whether in the global case or in the individual case. The results also revealed that national income, government savings, private investment, control of corruption and the population significantly influence public investment.

Other numerous studies looked at the impact of public investment. For example, Aziri (2017) considered the issue of whether public investments have a high impact on the average real growth of the economy of the Republic of Macedonia. The results found that public investments have a significant effect on economic development. Also, Pradyumna (2016) estimated the impact of public investment on private investment in India during 1970-2013 using ARDL procedure developed by Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001) by incorporating endogenously determined structural break in the model. The base line result implies that a 1% increase in public investment as a ratio to GDP leads to 0.81% and 0.53% decrease in private investment as a ratio to GDP in the long run (about 4 to 5 years) and short run (about 2 to 3 years), respectively, after controlling of economic conditions. To address the concern that the results may be driven by government consumption expenditure, fiscal deficit, or inadequate infrastructure, the analysis was repeated by estimating the investment function after including these variables and similar results were obtained. The investment regression was also estimated for a shorter sample period (1978–2013) to get the same result.

In addition, Phetsavong and Ichihashi (2012) investigated the impact of public investment on FDI and private domestic investment and the results show that public investment in developing Asian countries reduces the positive effect of FDI and private domestic investment on economic growth (crowding-out effect) when exceeding some extent levels. Regarding the second and the third model approaches, the interactive variables of FDI and private domestic investment appear to become negative when public investment exceeds 6.6 - 7.5% and 4.9 - 8% respectively, indicating that the positive effect of FDI and private domestic investment on growth becomes weaker because of an increase in public investment. Overall, public investment for developing countries in Asia has a substitutable effect on FDI and private domestic investment.

In light of that result, the increases in public investment should have a positive net impact on economic growth, despite significant crowding out effects. Chow breakpoint tests indicate, however, that the positive productivity effect appears to have weakened significantly in the past decade. A third reason for questioning a stable relationship is that the impact of increased public investment is likely to depend on how it is financed (Ulrich and Alan, 1998).

3.4 Conclusion

This chapter discussed the literature on the study. Literature reviews on the determinants of public investment in Namibia was presented both theoretically and empirically. The chapter summarized that, there are several theories about determinants of public investment. Many researches have been conducted but none identified the determinants

of public investment in Namibia using 1990 to 2017 time series data. Thus the researcher carried out this study in order to fill this gap. The next chapter presents the methodology on the topic under study.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Research design

The study employed a quantitative approach to analyses data using autoregressive distributed lag (ARDL) Bound Testing approach and Error Correction Model (ECM) method. The data was processed using E-Views for windows econometrics package.

4.2 Justification of Variables

Market efficient theory states that there is an inverse relationship between the rate of interest and public investment (Rosenberg, Reid, and Lanstein, 1985).

Public investment, Foreign Direct Investment and real GDP have a positive relationship. When Foreign Direct Investment and real GDP of a country rises, public investment also increase, this is because it shows that a country has a stable economy (Ndiaye and Xu, 2016).

Also, public investment and total inflation are inversely related. When prices rise consumers cannot buy a lot of goods or services, this discourages saving and make it hard for businesses to plan for the future. Abbas (2004) confirms that a one per cent increase in total inflation will be a result of immediate a decline in public investment.

Public investment and unemployment rate are negatively related. When unemployment rate is high, public investment is discouraged. Authors like Mourao (2014) confirmed that unemployment rate can affect the development of public investment.

4.3 Procedures

The study employed time-series quarterly data-set for the period ranging from 1990: Q1 to 2017: Q4. Secondary data was used to model the determinants of public investment in Namibia. The data covers many macroeconomic variables that include total inflation, real interest rate, Foreign Direct Investment, unemployment rate and real GDP. The data-sets were collated from the Bank of Namibia (BON), government reports, World Bank (WB) statistics, the Namibia Statistic Agency (NSA), and past research papers that were done on a similar topic and also written journals.

Unemployment data was obtained from the Labour Force Survey which is conducted once every four years (Shifotoka, 2015) leading to data missing in years that the Labour Force Survey was not conducted. Additionally, missing data may also be due to the transition of administration from the South African Government at independence in 1990. Nevertheless, to fill in the data gaps for unemployment for the years that the Labour Force Surveys were not conducted, the data was retrieved from the database of Eita and Ashipala (2010), whereby accepted scientific methods of interpolation and extrapolation were used to generate unknown data.

E-views software was used for data analysis which includes the following: the Augmented-Dickey-Fuller (ADF) and Phillip-Perron (PP) techniques to test for the presence of unit roots, autoregressive distributed lag (ARDL), and Bound Testing approach to determine long term or equilibrium relationship between variables and Error Correction Model (ECM) method. The adoption of this approach was informed and dictated by the nature of the macroeconomic data and order of integration.

4.4 Data analysis

This study used the model adopted by Yung and Yusoff (2014) to investigate the determinants of public investment. The model was modified slightly, that is, a variable was added to try to suit it to the Namibian context. The estimation of an ARDL model is built on three reasons. Firstly, Pesaran et al. (2001) advocate for the use of the ARDL model for the estimation of level relationships because the model suggests that once the order of the ARDL has been recognised, the relationship can be estimated by the Ordinary Least Squares (OLS) method. Secondly, the Bound test allows for testing for the existence of a relationship between variables in levels using a combination of I(1) and I(0) variables as regressors. That is, the order of integration of appropriate variables may not necessarily be the same. Therefore, the ARDL technique has the advantage of not requiring specific identification of the order of the underlying data. Thirdly, this technique is unbiased and it is efficient because it performs well with a small or finite sample size. Furthermore, it allows for the estimation of long-run and short-run components of the model simultaneously, thereby removing problems associated with omitted variables and serial correlations. Also, this method can distinguish between regressand and regressors. If there

is a cointegration relationship among the variables, it can be re-parameterised as an Error-Correction Model (ECM) which will contain both a short and long-run equation. The long run equation to be estimated is therefore specified below:

$$lnP_t = \alpha_0 + \alpha_1 lnINF_t + \alpha_2 lnRGDP_t + \alpha_3 lnUN_t + \alpha_4 RINT_t + \alpha_5 lnFDI_t + \mu_t \quad \text{.....Equation 1}$$

Where P_t is the explanatory variables, percentage of public investment to GDP, whereas INF, RGDP, UN, RINT and FDI are total inflation rate, real Gross Domestic Products, unemployment rate, real interest rate and Foreign Direct Investment, respectively. Subscript *t* is the time period and μ_t is the random error term.

In order to examine the long- and short-term effects, equation (2) is transformed into an ADL specification as an ECM (John and Pokhariyal, 2013). The ADL model is specified as:

$$\begin{aligned}\Delta lnPI_t = \beta_0 &+ \sum_{i=1}^{n} \alpha_{1i} \Delta lnPI_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta lnINF_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta lnRGDP_{t-i} \\ &+ \sum_{i=0}^{n} \alpha_{4i} \Delta lnUN_{t-i} + \sum_{i=0}^{n} \alpha_{5i} \Delta lnRINT_{t-0} + \sum_{i=0}^{n} \alpha_{6i} \Delta lnFDI_{t-i} \\ &+ \delta_1 lnPI_{t-1} + \delta_2 lnINF_{t-1} + \delta_3 lnRGDP_{t-1} + \delta_4 lnUN_{t-1} \\ &+ \delta_5 lnRINT_{t-1} + \delta_6 lnUN_{t-1} + \delta_7 lnRINT_{t-1} + \mu_t\end{aligned}$$

….Equation 2

Where β_0 represents public investment intercept and Δ is the first-difference operator.

Since this model is of auto-regression, there is a need to test if it is dynamically stable or meets stability condition. This means checking that all of the inverse roots of characteristic equation associated with the model are strictly within the unit circle (Gujarati and Porter, 2010). Thereafter, a Bound test was applied by using F-test, and the null and alternative hypotheses were formulated as follows:

H_0: There is no long-run relationship among the variables

H_1: There is a long-run relationship among the variables

The calculated *F*-statistic value is assessed with the critical values for the asymptotic distribution of the F-statistic. Based on the numbers of variables, (k + 1), there are lower and upper bounds on the critical values. The lower bound is based on the assumption that all of the variables are I(0), while the upper bound is based on the assumption that all of the variables are I(1). If the calculated F-statistic is less than the lower bound of I(0), it means that there is no co-integration. If the F-statistic is greater than the upper bound I(1), it implies that there is a long-run relationship among the variables. However, if the F-statistic lies between the lower and the upper bounds, the test is indecisive (Gujarati, 2004).

Long run elasticities

If there is a long run relationship between percentage of public investment to GDP, total inflation rate, real Gross Domestic Products, unemployment rate, real interest rate and

Foreign Direct Investment, the long run elasticities can be estimated using the equation below:

$$lnP_{t-1} = \gamma_0 + \sum_{i=0}^{k} \gamma_{21}\, lnP_{t-1} + \sum_{i=0}^{k} \gamma_{2i}\, lnINF_{t-1} + \sum_{i=0}^{k} \gamma_{3i}\, lnRGDP_{t-1} + \sum_{i=0}^{k} \gamma_{4i}\, lnUN_{t-1} + \sum_{i=0}^{k} \gamma_{5i}\, lnRINT_{t-1} + \sum_{i=0}^{k} \gamma_{6i}\, lnFDI_{t-1} + \mu_t$$

……..Equation 3

Equation (3) above represents the long run relationship; however, for policy reasons, it is essential to estimate the short run equation to capture the speed of adjustment (Gujarati and Porter, 2010). This is shown below in equation (4).

Short run elasticities

$$\Delta\, ln\, P_t = \gamma_0 + \sum_{i=1}^{k} \gamma_{1i}\, \Delta\, lnP_{t-1} + \sum_{i=0}^{k} \gamma_{2i}\, \Delta\, lnINF_{t-1} + \sum_{i=0}^{k} \gamma_{3i}\, \Delta\, lnRGDP_{t-1} + \sum_{i=0}^{k} \gamma_{4i}\, \Delta\, lnUN_{t-1} + \sum_{i=0}^{k} \gamma_{5i}\, \Delta\, lnRINT_{t-1} + \sum_{i=0}^{k} \gamma_{6i}\, \Delta\, lnFDI_{t-1} + \Psi\, EC_{t-1} + \mu_t$$

……..…Equation 4

In equation (4), Ψ is the speed of adjustment parameter and EC is the residual obtained from the estimated cointegration model of equation (3). The error correction coefficient

Ψ sign is expected to be negative, less than zero and significant coefficient, suggesting co-integration relationships among the variables which imply cointegration relation.

Furthermore, the study conducted the following tests for model efficiency: stability, heteroscedasticity and serial autocorrelation. The study also employed the Cumulative Sum of Recursive Residuals (CUSUM) approach to test the stability of the model. The tests are explained below:

Autocorrelation test - this test is used to determine whether there is a presence of correlation between a residual variable and lagged term. This study used Breusch-Godfrey serial correlation LM test (BG test); however, when residuals are correlated, it is said to be a problem and may lead to a wrong economic conclusion. The null and alternative hypotheses are formulated as follows:

H_0: No serial correlation between residual variables, whereas the alternative,

H_1: There is a serial correlation between residual variables.

Reject the null hypothesis when the p-value of observation-R-square is less than 0.05 level of significance and conclude that there is the presence of serial correlation in the model (Gujarati and Porter, 2010).

Heteroscedasticity – one of the classical linear regression model (CLRM) assumptions state that the model should have a constant variance to be estimated as a good model. Heteroscedasticity is used to test whether the variance of residual is constant. Thus, this study employed Bruesch-Pegan-Godfrey test in order to investigate the presence of heteroscedasticity. The null and alternative hypotheses are formulated as follows:

H_0: There is no heteroscedasticity (Homoscedasticity) and

H_1: There is heteroscedasticity (heteroscedasticity).

Reject the null hypothesis when F-statistic value is greater than alpha $\alpha = 0.05$ and conclude that the model is not fitted well, elsewhere, do not reject (Gujarati and Porter, 2010).

CHAPTER FIVE

EMPIRICAL ANALYSIS AND RESULTS

5.1 Introduction

This chapter outlines the results of the tests that were presented in chapter 4. The chapter further focuses on the Unit Root test for stationarity, cointegration bound test and ARDL estimated regression results approach for the variables that were empirically estimated as appropriate for the respective procedures. The study used E-Views package as the software to do the outlined tests.

5.2 Model estimation results and discussion

5.2.1 Unit Root Test

There are many tests in economics that determine whether the series is stationary or non-stationary. The Augmented-Dickey-Fuller and Phillip-Perron techniques were employed to test for the presence of a unit roots in the model; and these are used to find the variables' order of integration. The ARDL technique does not require a pretest of unit root. It was however used in this study because the ARDL cannot be used if the variables are integrated of order two. The result of these tests is displayed in Table 1.

Table 1: Unit Root test (ADF and PP) results

Variable		**Augmented Dickey Fuller Test (ADF)**	**Phillips Peron Test (PP)**	**Decision/ Order of**

	Model Specification	Levels	First Difference	Levels	First Difference	Integration
LNPI	Constant	-2.076844	-10.39410***	-2.089485	-10.60685***	I(1)
	Trend	-2.067516	-10.34618***	-2.080957	-10.55132***	I(1)
	None	0.082081	-10.44031***	0.125205	-10.66490***	I(1)
LNINF	Constant	-2.545304	-10.40260***	-2.638458*	-10.49152	I(0)
	Trend	-3.059493	-10.36179***	-3.244432*	-10.45140	I(0)
	None	-0.856762	-10.44031***	-0.843355	-10.52691***	I(1)
LNRGDP	Constant	-3.006565**	-7.247750	-3.031550**	-10.55025	I(0)
	Trend	-3.118319	-7.295782**	-2.983520	-11.64334***	I(1)
	None	-1.411110	-7.291716**	-1.193092	-10.62286***	I(1)
LNFDI	Constant	-3.736593**	-7.740783	-3.511747***	-14.82092	I(0)
	Trend	-3.950493**	-7.696113	-3.624556**	-14.75389	I(0)
	None	-2.157392**	-7.780589	-1.855396*	-14.73044	I(0)
LNRINT	Constant	-3.388956**	-9.591665	-3.567134***	-9.591665	I(0)
	Trend	-4.048163**	-9.539409	-4.285528***	-9.539409	I(0)

	None	-1.237935	-9.643651***	-1.245576	-9.643651***	I(1)
LNUNE	Constant	-1.619332	-7.227569**	-3.645709***	-14.40091	I(0)
	Trend	-1.903518	-7.244784***	-4.020370***	-14.42628	I(0)
	None	0.889678	-7.166146***	-0.008565	-14.47236***	I(1)

*Source: Author's compilation using E-Views. Note: a) *** means the variable is stationary at all levels of significance (1%, 5% & 10%) respectively, b) ** Means the variable is only stationary after 5% level of significance and c) * means the variable is only stationary at 10%.*

Table 1 presents the results of the unit root tests for the series. The results show that the percentage of public investment to GDP is stationary after first difference I(1) by both the ADF and PP. Inflation, real interest rate, and unemployment rate are stationary in levels (only at constant and trend). Real GDP is stationary in levels (only at constant) except for real interest rate, inflation rate and unemployment rate that are stationary after integrated of first order I(1) processes as confirmed by both the ADF and PP tests (only at none). Foreign direct investment series is stationary in levels as confirmed by both ADF and PP tests. Real GDP (only at trend and none) is integrated of order one I(1) in both ADF and PP. Since some series are non-stationary in levels, the next step was to difference them once. Taking the first differencing resulted in the percentage of public investment to GDP, real GDP (only at trend and none), real interest rate, inflation rate and unemployment rate (RINT, INF and UNE only at none) variables becoming stationary suggesting that they

are of I(1) processes. However, the hypothesis of the presence of a unit root was rejected. The ARDL technique can only be applied to variables whose order of integration is either I(0) and/or I(1). Both ADF and PP results confirmed that there is no variable integrated of order two I(2). The mixture of both I(0) and I(1) variables would gave the licence to use ARDL

technique.

5.2.2 Cointegration test

The next step was to estimate and determine the long-run relationship among the variables used in the percentage of public investment to GDP model using the ARDL approach. The study employed the ARDL bounds test as well as Johansen Cointegration test to test whether the variables are cointegrated. The results are presented in Table 2a and Table 2b.

Table 2a: Bounds test results

Level of Significance	**Lower bound value**	**Upper bound values**	**F-statistic Value**	**Null Hypotheses**
10%	2.26	3.35	2.287193	Cointegration
5%	2.62	3.79		No cointegration
2.5%	2.96	4.18		No cointegration
1%	3.41	4.68		No cointegration

Source: Author's compilation using E-views, Note: K=5 d.f, the lag length is chosen automatic by the e-view using Akaike information criteria

Table 2b: The Johansen Cointegration test

Maximum Eigen Test				**Trace Test**			
H_0: **rank=r**	H_a: **rank =r**	**statistics**	**95% critical value**	H_0: **rank=r**	H_a: **rank =r**	**statistics**	**95% critical value**
r<=0	r=0	0.243720	21.50947	r<=0	r=0	75.64870	95.75366
r<=1	r=1	0.238899	21.02020	r<=1	r=1	54.13923	69.81889
r<=2	r=2	0.206139	17.77519	r<=2	r=2	33.11903	47.85613
r<=3	r=3	0.137157	11.35927	r<=3	r=3	15.34383	29.79707
r<=4	r=4	0.048168	3.801208	r<=4	r=4	3.984560	15.49471
r<=5	r=5	0.002378	0.183352	r<=5	r=5	0.183352	3.841466

Source: Owner's compilation using E-Views

A Bound test was applied by using F-test, and the null and alternative hypotheses were formulated as follows:

H_0: There is no long-run relationship among the variables

H_1: There is a long-run relationship among the variables

The calculated *F*-statistic is 2.287193 which is less than all the upper bound critical value at the 5%, 10%, 2.5% and 1% level of significance, using a fixed lag length of 5 d.f suggested by Akaike information criteria and at none repressor. This means that the null hypothesis (H_0) is accepted. This implies that there is no long-run relationship among the variables. Since the variables in the percentage of public investment to GDP model are

not cointegrated, the study did not go further to estimate the short-run (ARDL Error Correction) equation.

Table 2b above indicate the results for the Johansen cointegration test, to verify if cointegration does not exist as confirmed from Bound test results. Both Trace and Maximum Eigen value test indicated that there are no cointegrating equations. This is because the statistics are less than the critical values, therefore failing to reject the null hypothesis of no cointegrating variables. The absence of cointegration among the variables implies that no long run relationship exist between public investment, inflation, foreign direct investment, real gross domestic product, real interest rate and unemployment. Therefore we can proceed with the rest of the analysis of the long-run ARDL. The long-run ARDL results in difference are presented in Table 3.

Table 2: ARDL estimations

Dependent variable ΔPI						
The long-run estimated results						
Constant	R-square	D-W	F-statistic (P-value)			
0.001 (0.335)	0.699	2.055	0.001			
Lag Order	ΔPI	ΔINF	ΔFDI	ΔRGDP	ΔRINT	ΔUNE
0		0.041	0.0100	-0.026	0.048	-0.108

		(1.506)	(1.230)	(-1.942)	(2.723)	(-3.407)
1	-0.003 (-0.019)	-0.000 (-0.006)	-3.950 (-0.005)	-1.550 (-0.002)	-2.560 (-0.001)	-0.000 (-0.013)
2	-0.000 (-0.002)	5.460 (0.003)	-2.420 (-0.006)	3.500 (0.006)	2.730 (0.000)	-0.000 (-0.008)
3	-0.000 (-0.002)	5.460 (0.003)	-2.420 (-0.006)	2.310 (1.880)	2.730 (-0.000)	-0.000 (-0.008)
4	0.298 (1.367)	0.0378 (1.329)	0.003 (0.457)	-0.0275 (-2.761)	-0.005 (-0.427)	-0.073 (-2.303)
5		0.001 (0.026)	-5.870 (-0.011)	-5.150 (-0.001)	-0.000 -0.017)	-0.000 (-0.008)

Source: Author's compilation using E-Views. Note: value on top of the value in brackets is coefficients values while the one in brackets are t-statistic values. K=3 d.f, the lag length used is five as suggested by Akaike lag length criteria.

From Table 3, real interest rate, unemployment rate, foreign direct investment and real GDP are significant in explaining the percentage of public investment to GDP, while inflation is insignificant in explaining the percentage of public investment to GDP. The real gross domestic products lag 4 as well as unemployment rate lag 4 are all found to be significant in explaining the percentage of public investment to GDP in Namibia. This means that the percentage of public investment to GDP of the current period is not only explained by the current period value but also by the previous values of real gross domestic

products and unemployment rate. The sign for FDI is positive as expected hence, and this supports many scholars who found a positive relationship between FDI and percentage of public investment to GDP (Ndikumana, 2007). The sign for the inflation and real interest rate was expected to be negative, as it was found that there is a negative relationship between interest rate, inflation, and the percentage of public investment to GDP. The sign for real gross domestic product is negative but it was expected to be positive based on economic theory in explaining the percentage of public investment to GDP. This is because the resources were not available for the expansion of current and future production (United Nations Development Programme, 2010). This means that there is a negative relationship between percentage of public investment to GDP and economic growth in Namibia. The sign for unemployment is negative as expected in defining the percentage of public investment to GDP. This is proven that an increase in public investment spending would boost jobs in the short run and pay enormous dividends in more rapid productivity growth in coming decades. In contrast, the payoff to spending cuts would be depressed job growth in the next few years and foregone productivity gains in the longer run (Bivens, 2012).The results further show that there is a positive relationship between Foreign Direct Investment and the percentage of public investment to GDP in Namibia.

The model is found to be significant since the F-value probability 0.002 is less than 0.05 levels of significance. The R-square of 0.699 suggests that about 69.9% of the variation in percentage public investment to GDP is explained by the inflation, foreign direct investment, real gross domestic product, real interest rate and unemployment in Namibia.

The results also indicate the absence of autocorrelation, since the Durbin-Watson value of 2.018 is closer to 2.

The model is found to be significant since the F-value probability of 0.001 is less than 0.05 levels of significance. The

ARDL long run estimation equation:

$$\Delta lnPI = 0.001 + 0.041INF + 0.010FDI - 0.026RGDP + 0.048RINT - 0.108UNE$$

(0.335) (1.506) (1.230) (-1.942) (2.723) (-3.407)

The estimated long-run function presented in the previous section indicates that: A N$1 increase in the inflation rate, leads to a 0.041 increase in the percentage of public investment to GDP. This implies that, a one dollar appreciation in inflation rate, increases public investment with 4.1%. A N$1 increase in foreign direct investment leads to a 0.01 cents increase in the percentage of public investment to GDP. A N$1 growth in real gross domestic products leads to a 0.026% decrease in the percentage of public investment. This implies that, a one dollar depreciation on RGDP, decreases public investment with 2.6%.A N$1 increase in real interest rate leads to a 0.048 cents increase in the percentage of public investment to GDP. This means that a one percent increase in real interest rate, leads to public investment to grow with 4.8% and a N$1 increase in unemployment leads to 0.108 decrease in the percentage of public investment to GDP. The model was further tested for the efficiency test.

5.2.3 Model efficiency test

The study further tested for heteroscedasticity and serial correlation. The results confirm the absence of serial correlation since the probability of Chi-Square 0.886 is greater than 0.05. Therefore, the test failed to reject the null hypothesis suggesting no presence of serial correlation. Also, table 4 shows that there is no heteroscedasticity since p-value of Obs*R-squared is 0.664 greater than 5% level of significance and fails to reject the null hypothesis which is desirable. Therefore, the econometric model employed in the study is certainly strong from a practical viewpoint. The model has met the desired econometric properties. The results are reported in Table 4.

Table 3: Diagnostic Checks

Test	Null hypothesis	Obs*R-squared	Probability of Chi-Square
ARCH	Homoscedasticity	0.189270	0.6635
Breusch-Godfrey Serial Correlation LM Test	No serial correlation	0.243215	0.8855

Source: Owner's compilation using E-Views

5.2.4 Stability test

The stability test is used to test whether the model is stable. The study employed the Ramsey Reset test approach to test the stability of the model. The result of this test is revealed in table 5. Since the probability of F-statistic 0.64008 is greater than 0.05 level of significance, the null hypothesis which claims that the model is stable is accepted and concludes that percentage of public investment to GDP model is stable.

Table 4: Stability test

Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.800053	65	0.4266
F-statistic	0.640084	(1, 65)	0.4266

Source: Owner's compilation using E-Views

CHAPTER SIX

CONCLUSION AND POLICY RECOMMENDATIONS

6.1. Introduction

In previous chapters, the results were presented and analysed. In the present chapter, comments on the present study are outlined. The comments include the conclusion and recommendations to policymakers about the findings of the study. The chapter also provides direction for future research.

6.2 General conclusion

This study investigated the determinants of public investments, particularly using empirical evidence from Namibia for the period 1990-2017. The main objective was to analyse the factors (inflation, real interest rate, real GDP, Foreign Direct inflation, unemployment) that determine the level of public investment in Namibia. In this regard, the study employed the autoregression distributive lag model (ARDL). The study conducted an ARDL bound test to determine the long-run relationship among the variables used in the percentage of public investment to GDP model. However, the results revealed that the null hypothesis (H0) is accepted and this implies that there is no long-run relationship among the variables. From ARDL estimations results, foreign direct investment, real interest rate, unemployment rate, and real GDP are significant in explaining the percentage of public investment to GDP, no statistically significant relationship between inflation and FDI was found in explaining the percentage of public investment to GDP. The real gross domestic products lag 4 as well as unemployment rate

lag 4 are all found to be significant in explaining the percentage of public investment to GDP in Namibia. This means that the percentage of public investment to GDP of the current period is not only explained by the current period value but also by the previous values of real gross domestic products and unemployment rate. The sign for the inflation and real interest rate is supposed to be negative as it was found that there is a negative relationship between interest rate, inflation, and the percentage of public investment to GDP. The sign for real gross domestic product is negative but was expected to be positive based on economic theory in explaining the percentage of public investment to GDP. This means that there is a negative relationship between the percentage of public investment to GDP and economic growth in Namibia. The sign for unemployment is negative as expected in defining the percentage of public investment to GDP. The sign for FDI is positive as expected. This indicates that there is a positive relationship between Foreign Direct Investment and the percentage of public investment to GDP in Namibia.

6.3. Policy recommendations

Namibia is categorized amongst the upper-middle-income country with mineral riches and population of about 2.5 million (Word bank, 2016). Investment is crucial for economic development since it contributes to growth, employment and more generally economic dynamism. Foreign direct investment (FDI) has become a cornerstone of development finance and it can be a driver of economic transformation (Inambao, 2016). To boost the Namibian economy, it is advisable to increase the percentage of public investment to GDP as most researchers recommend Ashipala and Haimbodi (2003). Based on the findings of this research, the study recommends some ways to implement policies to encourage the

percentage of public investment to GDP in Namibia. Firstly, there is a positive relationship between FDI and the percentage of public investment to GDP, and the policy implications are that it is important to have positive FDI to boost foreign investments and to have a stable economy. Secondly, inflation and the percentage of public investment to GDP were found to have a positive relation, which is contrary to the findings of the study by Abbas (2004) which confirmed that a 1% increase in total inflation will be a result of immediate decline in public investment. The findings also found the inverse relationship between real GDP and the percentage of public investment to GDP, which contradicts with the economic policy. Higher interest rates discourage investors, and this suggests that the country has the potential to further increase and maintain higher public investment and envisage the level of public investment in the future.

It would be necessary for further studies to be undertaken to determine the percentage of public investment to GDP in Namibia by employing techniques that are different from those that have been used in this study. In this perspective, particular attention should be paid to the ARDL approach. Moreover, there is a need to discover the possibility of including more explanatory variables that would potentially assist in explaining the percentage of public investment to GDP in Namibia. Future studies should consider the addition of more countries in the SADC region. The study recommends that investment strategies/policies must encourage investment expansion to enhance economic growth in Namibia. In this regard, it would be a good idea to include investment policy incentives as part and parcel of the strategies that are used in the promotion of the country's investments.

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APPENDICES

Appendix A: Data Set

Years	RINT	RGDP	INF	PI	FDI	UNE
1990	4.783	2.05	12.1	23.35	1.05	21.5
1991	16.38134	5.343	11.904	25.22	4	19.1
1992	8.998077	9.27	19.1	26.54	3.43	19.1
1993	8.619945	-1.62	8.533	26.04	1.72	19.1
1994	-3.01658	3.005	10.759	23.6	2.69	19.4
1995	11.18821	4.115	10.01	25.06	3.88	19.5
1996	3.662156	3.196	8.007	25.04	3.26	19.5
1997	12.37925	4.216	8.825	24.98	2.22	29
1998	11.43498	3.291	6.206	24.51	2.51	19.6
1999	11.04477	3.366	8.577	25.08	0.04	19.8
2000	2.619612	3.497	9.268	23.5	5.02	33.8
2001	2.941139	2.293	10.212	22.83	10.7	35.3
2002	2.807955	6.68	12.716	21.49	4.39	21.4
2003	13.55763	3.477	7.215	22	1.32	20.5
2004	9.307952	6.632	4.137	20.37	3.38	36.7
2005	4.815108	4.67	2.282	19.28	5.41	23.1
2006	1.74602	3.948	4.961	19.48	7.64	20.3
2007	5.588998	3.646	6.548	23.86	7.66	20.9
2008	2.549995	2.65	9.095	21.8	8.83	51.2

2009	3.884938	0.296	9.452	23.86	9.42	29.7
2010	5.944006	6.039	4.875	25.55	2.55	22.1
2011	4.744408	5.091	5.006	23.19	6.54	26.8
2012	-3.74657	5.064	6.722	24.97	8.41	27.5
2013	-0.45021	5.681	5.601	25.99	6.2	30.2
2014	1.881445	6.372	5.348	26.24	3.49	27.9
2015	8.91	6.09	3.4	25.61	9.93	26.9
2016	1.82	0.6	6.78	24.23	3.18	34
2017	2.507	-0.9	6.1	24.51	4.46	23.33

Appendix B: Unit Root Test

Augmented Dickey-Fuller

Level

Null Hypothesis: LNPI has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.076844	0.2544
Test critical values:	1% level	-3.490210	
	5% level	-2.887665	
	10% level	-2.580778	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNPI has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.067516	0.5577

Test critical values:	1% level	-4.042819
	5% level	-3.450807
	10% level	-3.150766

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNPI has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.082081	0.7068
Test critical values:	1% level	-2.585962	
	5% level	-1.943741	
	10% level	-1.614818	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNINF has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.545304	0.1077
Test critical values:	1% level	-3.490210	
	5% level	-2.887665	
	10% level	-2.580778	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNINF has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.059493	0.1213
Test critical values:	1% level	-4.042819	
	5% level	-3.450807	
	10% level	-3.150766	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNINF has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.856762	0.3427
Test critical values:	1% level	-2.585962	
	5% level	-1.943741	
	10% level	-1.614818	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNFDI has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.736593	0.0047
Test critical values:	1% level	-3.490210	
	5% level	-2.887665	
	10% level	-2.580778	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNFDI has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.950493	0.0131
Test critical values:	1% level	-4.042819	
	5% level	-3.450807	
	10% level	-3.150766	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNFDI has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.157392	0.0304
Test critical values:	1% level	-2.585962	

	5% level	-1.943741
	10% level	-1.614818

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNRGDP has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.006565	0.0376
Test critical values:	1% level	-3.495677	
	5% level	-2.890037	
	10% level	-2.582041	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNRGDP has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.118319	0.1077
Test critical values:	1% level	-4.050509	
	5% level	-3.454471	
	10% level	-3.152909	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNRGDP has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.411110	0.1465
Test critical values:	1% level	-2.587831	
	5% level	-1.944006	
	10% level	-1.614656	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNRINT has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.388956	0.0137
Test critical values:	1% level	-3.499167	
	5% level	-2.891550	
	10% level	-2.582846	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNRINT has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.048163	0.0102
Test critical values:	1% level	-4.055416	
	5% level	-3.456805	
	10% level	-3.154273	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNRINT has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.237935	0.1970
Test critical values:	1% level	-2.589020	
	5% level	-1.944175	
	10% level	-1.614554	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNUNE has a unit root

Exogenous: Constant

Lag Length: 12 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.619332	0.4690
Test critical values:	1% level	-3.497727	

	5% level	-2.890926
	10% level	-2.582514

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNUNE has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 12 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.903518	0.6453
Test critical values:	1% level	-4.053392	
	5% level	-3.455842	
	10% level	-3.153710	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNUNE has a unit root

Exogenous: None

Lag Length: 12 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.889678	0.8989
Test critical values:	1% level	-2.588530	
	5% level	-1.944105	
	10% level	-1.614596	

*MacKinnon (1996) one-sided p-values.

First difference

Null Hypothesis: D(LNPI) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.39410	0.0000
Test critical values:	1% level	-3.490772	
	5% level	-2.887909	
	10% level	-2.580908	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNPI) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.34618	0.0000
Test critical values:	1% level	-4.043609	
	5% level	-3.451184	
	10% level	-3.150986	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNPI) has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-10.44031	0.0000

Test critical values:	1% level	-2.586154
	5% level	-1.943768
	10% level	-1.614801

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNINF) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.40260	0.0000
Test critical values:	1% level	-3.490772	
	5% level	-2.887909	
	10% level	-2.580908	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNINF) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.36179	0.0000
Test critical values:	1% level	-4.043609	
	5% level	-3.451184	
	10% level	-3.150986	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNINF) has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.44031	0.0000
Test critical values:	1% level	-2.586154	
	5% level	-1.943768	
	10% level	-1.614801	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNFDI) has a unit root

Exogenous: Constant

Lag Length: 3 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.740783	0.0000
Test critical values:	1% level	-3.492523	
	5% level	-2.888669	
	10% level	-2.581313	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNFDI) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 3 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.696113	0.0000
Test critical values:	1% level	-4.046072	

	5% level	-3.452358
	10% level	-3.151673

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNFDI) has a unit root

Exogenous: None

Lag Length: 3 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.780589	0.0000
Test critical values:	1% level	-2.586753	
	5% level	-1.943853	
	10% level	-1.614749	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNRGDP) has a unit root

Exogenous: Constant

Lag Length: 3 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.247750	0.0000
Test critical values:	1% level	-3.501445	
	5% level	-2.892536	
	10% level	-2.583371	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNRGDP) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 3 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.295782	0.0000
Test critical values:	1% level	-4.058619	
	5% level	-3.458326	
	10% level	-3.155161	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNRGDP) has a unit root

Exogenous: None

Lag Length: 3 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.291716	0.0000
Test critical values:	1% level	-2.589795	
	5% level	-1.944286	
	10% level	-1.614487	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNRINT) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.591665	0.0000
Test critical values:	1% level	-3.501445	
	5% level	-2.892536	
	10% level	-2.583371	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNRINT) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.539409	0.0000
Test critical values:	1% level	-4.058619	
	5% level	-3.458326	
	10% level	-3.155161	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNRINT) has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-9.643651	0.0000

Test critical values:	1% level	-2.589795
	5% level	-1.944286
	10% level	-1.614487

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNUNE) has a unit root

Exogenous: Constant

Lag Length: 11 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.227569	0.0000
Test critical values:	1% level	-3.497727	
	5% level	-2.890926	
	10% level	-2.582514	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNUNE) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 11 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.244784	0.0000
Test critical values:	1% level	-4.053392	
	5% level	-3.455842	
	10% level	-3.153710	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNUNE) has a unit root

Exogenous: None

Lag Length: 11 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.166146	0.0000
Test critical values:	1% level	-2.588530	
	5% level	-1.944105	
	10% level	-1.614596	

*MacKinnon (1996) one-sided p-values.

Phillips-Perron results

Levels

Null Hypothesis: LNPI has a unit root

Exogenous: Constant

Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.089485	0.2494
Test critical values:	1% level	-3.490210	
	5% level	-2.887665	
	10% level	-2.580778	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNPI has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-2.080957	0.5503

Test critical values:	1% level	-4.042819
	5% level	-3.450807
	10% level	-3.150766

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNPI has a unit root

Exogenous: None

Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.125205	0.7201
Test critical values:	1% level	-2.585962	
	5% level	-1.943741	
	10% level	-1.614818	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNINF has a unit root

Exogenous: Constant

Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.638458	0.0884
Test critical values:	1% level	-3.490210	
	5% level	-2.887665	
	10% level	-2.580778	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNINF has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.244432	0.0813
Test critical values:	1% level	-4.042819	
	5% level	-3.450807	
	10% level	-3.150766	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNINF has a unit root

Exogenous: None

Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.843355	0.3485
Test critical values:	1% level	-2.585962	
	5% level	-1.943741	
	10% level	-1.614818	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNFDI has a unit root

Exogenous: Constant

Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.511747	0.0094
Test critical values:	1% level	-3.490210	
	5% level	-2.887665	
	10% level	-2.580778	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNFDI has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.624556	0.0322
Test critical values:	1% level	-4.042819	
	5% level	-3.450807	
	10% level	-3.150766	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNFDI has a unit root

Exogenous: None

Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.855396	0.0608
Test critical values:	1% level	-2.585962	
	5% level	-1.943741	
	10% level	-1.614818	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNRGDP has a unit root

Exogenous: Constant

Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.031550	0.0353
Test critical values:	1% level	-3.495677	
	5% level	-2.890037	
	10% level	-2.582041	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNRGDP has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.983520	0.1420
Test critical values:	1% level	-4.050509	
	5% level	-3.454471	

	10% level	-3.152909

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNRGDP has a unit root

Exogenous: None

Bandwidth: 13 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.193092	0.2118
Test critical values:	1% level	-2.587831	
	5% level	-1.944006	
	10% level	-1.614656	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNRINT has a unit root

Exogenous: Constant

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-3.567134	0.0082

Test critical values:	1% level	-3.499167
	5% level	-2.891550
	10% level	-2.582846

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNRINT has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.285528	0.0050
Test critical values:	1% level	-4.055416	
	5% level	-3.456805	
	10% level	-3.154273	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNRINT has a unit root

Exogenous: None

Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*

Phillips-Perron test statistic		-1.245576	0.1945
Test critical values:	1% level	-2.589020	
	5% level	-1.944175	
	10% level	-1.614554	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNUNE has a unit root

Exogenous: Constant

Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.645709	0.0063
Test critical values:	1% level	-3.490210	
	5% level	-2.887665	
	10% level	-2.580778	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNUNE has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.020370	0.0107
Test critical values:	1% level	-4.042819	
	5% level	-3.450807	
	10% level	-3.150766	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNUNE has a unit root

Exogenous: None

Bandwidth: 16 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.008565	0.6777
Test critical values:	1% level	-2.585962	
	5% level	-1.943741	
	10% level	-1.614818	

*MacKinnon (1996) one-sided p-values.

First Difference

Null Hypothesis: D(LNPI) has a unit root

Exogenous: Constant

Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.60685	0.0000
Test critical values:	1% level	-3.490772	
	5% level	-2.887909	
	10% level	-2.580908	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNPI) has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.55132	0.0000
Test critical values:	1% level	-4.043609	

	5% level	-3.451184
	10% level	-3.150986

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNPI) has a unit root

Exogenous: None

Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.66490	0.0000
Test critical values:	1% level	-2.586154	
	5% level	-1.943768	
	10% level	-1.614801	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNINF) has a unit root

Exogenous: Constant

Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.49152	0.0000
Test critical values:	1% level	-3.490772	
	5% level	-2.887909	
	10% level	-2.580908	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNINF) has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.45140	0.0000
Test critical values:	1% level	-4.043609	
	5% level	-3.451184	
	10% level	-3.150986	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNINF) has a unit root

Exogenous: None

Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.52691	0.0000
Test critical values:	1% level	-2.586154	
	5% level	-1.943768	
	10% level	-1.614801	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNFDI) has a unit root

Exogenous: Constant

Bandwidth: 31 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.82092	0.0000
Test critical values:	1% level	-3.490772	
	5% level	-2.887909	
	10% level	-2.580908	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNFDI) has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 31 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.75389	0.0000
Test critical values:	1% level	-4.043609	
	5% level	-3.451184	
	10% level	-3.150986	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNFDI) has a unit root

Exogenous: None

Bandwidth: 31 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.73044	0.0000
Test critical values:	1% level	-2.586154	
	5% level	-1.943768	
	10% level	-1.614801	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNRGDP) has a unit root

Exogenous: Constant

Bandwidth: 21 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.55025	0.0000
Test critical values:	1% level	-3.497029	
	5% level	-2.890623	
	10% level	-2.582353	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNRGDP) has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 26 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-11.64334	0.0000
Test critical values:	1% level	-4.052411	
	5% level	-3.455376	
	10% level	-3.153438	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNRGDP) has a unit root

Exogenous: None

Bandwidth: 21 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.62286	0.0000
Test critical values:	1% level	-2.588292	
	5% level	-1.944072	
	10% level	-1.614616	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNRINT) has a unit root

Exogenous: Constant

Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.591665	0.0000
Test critical values:	1% level	-3.501445	
	5% level	-2.892536	
	10% level	-2.583371	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNRINT) has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.539409	0.0000
Test critical values:	1% level	-4.058619	
	5% level	-3.458326	
	10% level	-3.155161	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNRINT) has a unit root

Exogenous: None

Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.643651	0.0000
Test critical values:	1% level	-2.589795	

	5% level	-1.944286
	10% level	-1.614487

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNUNE) has a unit root

Exogenous: Constant

Bandwidth: 16 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.40091	0.0000
Test critical values:	1% level	-3.490772	
	5% level	-2.887909	
	10% level	-2.580908	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNUNE) has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 16 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-14.42628	0.0000

Test critical values:	1% level	-4.043609
	5% level	-3.451184
	10% level	-3.150986

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNUNE) has a unit root

Exogenous: None

Bandwidth: 16 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-14.47236	0.0000
Test critical values:	1% level	-2.586154	
	5% level	-1.943768	
	10% level	-1.614801	

*MacKinnon (1996) one-sided p-values.

Appendix C: Lag length criteria

VAR Lag Order Selection Criteria

Endogenous variables: LNPI LNINF LNFDI

LNRGDP LNRINT LNUNE

Exogenous variables: C

Date: 06/28/19 Time: 19:45

Sample: 1990Q1 2017Q4

Included observations: 104

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1615.167	NA	1395861.	31.17628	31.32884	31.23809
1	-1223.217	731.1370	1487.801	24.33109	25.39902*	24.76374*
2	-1215.507	13.49282	2580.537	24.87513	26.85842	25.67862
3	-1202.476	21.30049	4082.525	25.31684	28.21550	26.49117
4	-1172.032	46.25177	4693.783	25.42368	29.23771	26.96886
5	-1070.457	142.5945*	1404.378*	24.16264*	28.89203	26.07866
6	-1063.220	9.325520	2653.605	24.71576	30.36052	27.00262
7	-1050.591	14.81491	4692.664	25.16520	31.72533	27.82290
8	-1018.468	33.97544	5986.706	25.23978	32.71527	28.26832

* 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

Appendix D: Cointegration Test

A)

ARDL Bounds Test

Date: 06/24/19 Time: 23:26

Sample: 1991Q1 2016Q4

Included observations: 86

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	2.287193	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

B)

Johansen test

Date: 02/28/20 Time: 18:39

Sample (adjusted): 1991Q2 2016Q4

Included observations: 77 after adjustments

Trend assumption: Linear deterministic trend

Series: LNPI LNINF LNFDI LNRGDP LNRINT LNUNE

Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.243720	75.64870	95.75366	0.5195
At most 1	0.238899	54.13923	69.81889	0.4556
At most 2	0.206139	33.11903	47.85613	0.5503
At most 3	0.137157	15.34383	29.79707	0.7574
At most 4	0.048168	3.984560	15.49471	0.9048
At most 5	0.002378	0.183352	3.841466	0.6685

Trace test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.243720	21.50947	40.07757	0.9333
At most 1	0.238899	21.02020	33.87687	0.6826
At most 2	0.206139	17.77519	27.58434	0.5139
At most 3	0.137157	11.35927	21.13162	0.6115
At most 4	0.048168	3.801208	14.26460	0.8797

At most 5	0.002378	0.183352	3.841466	0.6685

Max-eigenvalue test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Appendix E: Long run model estimation

Dependent Variable: DLNPI

Method: ARDL

Date: 06/28/19 Time: 22:12

Sample (adjusted): 1991Q3 2016Q4

Included observations: 74 after adjustments

Dependent lags: 4 (Fixed)

Dynamic regressors (5 lags, fixed): DLNINF DLNFDI DLNRGDP DLNRINT DLNUNE

Fixed regressors: C

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
DLNPI(-1)	-0.002963	0.156424	-0.018939	0.9850
DLNPI(-2)	-0.000224	0.114586	-0.001954	0.9985
DLNPI(-3)	-0.000224	0.114586	-0.001954	0.9985
DLNPI(-4)	0.297564	0.217692	1.366900	0.1795

DLNINF	0.040916	0.027173	1.505758	0.1402
DLNINF(-1)	-0.000154	0.027615	-0.005564	0.9956
DLNINF(-2)	5.46E-05	0.018927	0.002887	0.9977
DLNINF(-3)	5.46E-05	0.018927	0.002887	0.9977
DLNINF(-4)	0.037795	0.028449	1.328506	0.1917
DLNINF(-5)	0.000673	0.026081	0.025804	0.9795
DLNFDI	0.010015	0.008142	1.230026	0.2261
DLNFDI(-1)	-3.95E-05	0.007736	-0.005108	0.9960
DLNFDI(-2)	-2.42E-05	0.004111	-0.005881	0.9953
DLNFDI(-3)	-2.42E-05	0.004111	-0.005881	0.9953
DLNFDI(-4)	0.002560	0.005603	0.456836	0.6503
DLNFDI(-5)	-5.87E-05	0.005576	-0.010519	0.9917
DLNRGDP	-0.026311	0.013548	-1.942023	0.0594
DLNRGDP(-1)	-1.55E-05	0.009521	-0.001626	0.9987
DLNRGDP(-2)	3.50E-05	0.006132	0.005701	0.9955
DLNRGDP(-3)	3.50E-05	0.006132	0.005701	0.9955
DLNRGDP(-4)	-0.027496	0.009958	-2.761311	0.0087
DLNRGDP(-5)	-5.15E-05	0.009338	-0.005513	0.9956
DLNRINT	0.047982	0.017622	2.722894	0.0096
DLNRINT(-1)	-2.56E-05	0.018685	-0.001370	0.9989
DLNRINT(-2)	2.73E-06	0.008720	0.000313	0.9998
DLNRINT(-3)	2.73E-06	0.008720	0.000313	0.9998
DLNRINT(-4)	-0.005484	0.012842	-0.427039	0.6717

DLNRINT(-5)	-0.000200	0.011553	-0.017352	0.9862
DLNUNE	-0.108211	0.031761	-3.407013	0.0015
DLNUNE(-1)	-0.000322	0.024817	-0.012963	0.9897
DLNUNE(-2)	-0.000151	0.019411	-0.007781	0.9938
DLNUNE(-3)	-0.000151	0.019411	-0.007781	0.9938
DLNUNE(-4)	-0.072932	0.031674	-2.302615	0.0267
DLNUNE(-5)	-0.000264	0.031445	-0.008399	0.9933
C	0.001079	0.003224	0.334695	0.7396

R-squared	0.699144	Mean dependent var	-0.001096
Adjusted R-squared	0.436860	S.D. dependent var	0.036326
S.E. of regression	0.027260	Akaike info criterion	-4.061352
Sum squared resid	0.028981	Schwarz criterion	-2.971591
Log likelihood	185.2700	Hannan-Quinn criter.	-3.626633
F-statistic	2.665596	Durbin-Watson stat	2.055456
Prob(F-statistic)	0.001763		

*Note: p-values and any subsequent tests do not account for model selection.

Appendix F: Model efficiency test

Heteroskedasticity Test: ARCH

F-statistic	0.185132	Prob. F(1,81)	0.6681
Obs*R-squared	0.189270	Prob. Chi-Square(1)	0.6635

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.090755	Prob. F(2,64)	0.9134
Obs*R-squared	0.243215	Prob. Chi-Square(2)	0.8855

Appendix G: Stability test

Ramsey RESET Test

Equation: UNTITLED

Specification: LNPI LNPI(-1) LNPI(-2) LNPI(-3) LNPI(-4) LNINF LNINF(-1)

LNFDI LNRGDP LNRGDP(-1) LNRGDP(-2) LNRGDP(-3) LNRGDP(-4)

LNRINT LNRINT(-1) LNUNE LNUNE(-1) LNUNE(-2) LNUNE(-3)

LNUNE(-4) C

Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.800053	65	0.4266
F-statistic	0.640084	(1, 65)	0.4266

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.000452	1	0.000452
Restricted SSR	0.046338	66	0.000702
Unrestricted SSR	0.045887	65	0.000706

Unrestricted Test Equation:

Dependent Variable: LNPI

Method: ARDL

Date: 06/28/19 Time: 22:50

Sample: 1991Q1 2016Q4

Included observations: 86

Maximum dependent lags: 4 (Automatic selection)

Model selection method: Akaike info criterion (AIC)

Dynamic regressors (4 lags, automatic):

Fixed regressors: C

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNPI(-1)	2.933102	2.614559	1.121834	0.2661
LNPI(-2)	-1.78E-11	0.125231	-1.42E-10	1.0000
LNPI(-3)	2.99E-11	0.125231	2.39E-10	1.0000
LNPI(-4)	0.325802	0.305261	1.067289	0.2898
LNINF	0.198389	0.176909	1.121420	0.2662
LNINF(-1)	-0.200136	0.179339	-1.115964	0.2685
LNFDI	0.013502	0.012437	1.085577	0.2817
LNRGDP	-0.030131	0.027536	-1.094250	0.2779
LNRGDP(-1)	-0.017473	0.017443	-1.001708	0.3202

LNRGDP(-2)	1.14E-13	0.007849	1.45E-11	1.0000
LNRGDP(-3)	-1.70E-13	0.007849	-2.16E-11	1.0000
LNRGDP(-4)	-0.038806	0.035195	-1.102599	0.2743
LNRINT	0.144216	0.128741	1.120204	0.2667
LNRINT(-1)	-0.135865	0.121339	-1.119719	0.2670
LNUNE	-0.306138	0.274044	-1.117114	0.2681
LNUNE(-1)	0.176048	0.158261	1.112386	0.2701
LNUNE(-2)	-1.53E-12	0.024634	-6.19E-11	1.0000
LNUNE(-3)	3.11E-12	0.024634	1.26E-10	1.0000
LNUNE(-4)	-0.117572	0.106303	-1.106006	0.2728
C	-2.297669	3.434964	-0.668906	0.5059
FITTED^2	-0.396386	0.495450	-0.800053	0.4266

R-squared	0.934579	Mean dependent var	3.156274
Adjusted R-squared	0.914450	S.D. dependent var	0.090840
S.E. of regression	0.026570	Akaike info criterion	-4.209682
Sum squared resid	0.045887	Schwarz criterion	-3.610364
Log likelihood	202.0163	Hannan-Quinn criter.	-3.968484
F-statistic	46.42830	Durbin-Watson stat	1.928976
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.