AN ANALYSIS OF THE NEXUS BETWEEN PUBLIC DEBT AND PRIVATE INVESTMENT:EVIDENCE FROM NAMIBIA

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ABSTRACT

Public debt in Namibia has been rising over the years and the question is whether the persistently high debt level can negatively affect private gross fixed capital formation or not. Applying the Autoregressive Distributed Lag (ARDL) model for cointegration on data for the period 2010Q1 to 2019Q4, this study empirically examined the nexus between public debt and private gross fixed capital formation in Namibia. The ARDL test results revealed the existence of a long-run relationship between the variables. Domestic debt and interest rate were found to have a statistically significant negative effect on private gross fixed capital formation in the long-run. These findings are consistent with the Classical and Neoclassical Views, which state that domestic debt crowds-out private investment. Moreover, the Granger Causality test was employed as a confirmatory test to determine the direction of causality between public debt and private gross fixed capital formation. The Granger Causality test results show the presence of no causality between public debt and private investment in Namibia. A bi-directional relationship was, however, found to exist between interest rate and private gross fixed capital formation. Moreover, a statistically significant bi-directional causal relation was also discovered between gross domestic product and gross fixed capital formation. Policy implications from these findings are that proper debt management to support private gross fixed capital formation in Namibia is fundamental. Furthermore, the newly established revenue agency could create new avenues to raise funds to widen the revenue base. Finally, the government could moderately increase external borrowing, albeit with caution, as external debt can be susceptible to external shocks, which affect debt service cost.

DECLARATION

I, Ester Ndapandula Ndeutala Ngwena, hereby declares this study is my own work and 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.

Ester N.N.Ngwena	April 2022
Name of Student	Date

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DEDICATION

I dedicate my Thesis to my mother Meme Petelina Ngwena and late father Tate Thomas Tuhafeni Ngwena. Thank you for being the best parents and motivating me to be the best version of myself. I love you and may the Lord bless you.

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CHAPTER ONE: INTRODUCTION

1.1 Background of the study

The global financial crisis of 2009 impacted several economies and contributed to the increase in level of public debt worldwide. Government borrowing is caused by increased government expenditure, inadequate domestic savings and reduced tax base sources. Generally, the government undertakes 3 financing activities namely printing money, borrowing or collecting taxes. Developing economies such as Namibia, have large informal markets and a narrow tax base, which limits the success of tax regimes and reduces the government's ability to raise revenue from the domestic market. Government revenues in Namibia are mainly generated from direct taxes, indirect taxes and taxes on international trade (Southern African Customs Union). The decrease in government revenue, and considering the high spending needs of government, leads to large budget deficits, and equally increases the public debt appetite. Traditionally the public borrowing approach has been used over the years by developed and developing countries to finance the gap between government tax revenues and expenditure. Public debt also known as government debt is used interchangeably in this study. The financing of budget deficit through public borrowing involves the use of both domestic and external debt instruments by the government.

According to Silva *et al*., (2010) domestic debt is an instrument used by the central bank to implement monetary policy. The central bank usually conducts open market operations, buying and selling government securities to control market liquidity. From an external borrowing perspective, this includes multilateral loans from institutions such as the International Monetary Fund (IMF), African Development Bank (AfDB) and the World Bank, as well as bilateral loans from other governments. The IMF's 2018 study (cited in Mupunga *et al*., 2019)

emphasized that total average public debt in Southern African Development Community (SADC) increased from 34.9% of GDP in 2010 to 54.9% of GDP in 2018. The increase in public debt was attributed to the general increase in external and domestic debt.

Investment is vital for a country's economic growth, since it increases the productive capacity of an economy, which in turn increases the level of employment and promotes technical progress through embodiment of new techniques (Majeed & Khan, 2008). There are two types of investment i.e., public and private investment. Public investment plays an important role in promoting private investment, either positively through good public investment or negatively through poor public investment. According to Aswata (2018) private investment entails the purchase of capital assets with the expectation to generate income or appreciate in value or both. Furthermore, private investment is a significant tool for fostering innovation, boosting economic growth, and alleviating poverty. Developing countries with very low investment rates lack incentives for innovation and returns on investment which are not so predictable and the major cause of slow growth in developing countries. Mose *et al*., (2020) highlighted that the levels of private investment in the Sub-Saharan Africa are very low in comparison to developed economies, due to the relatively small size of the formal private sector and hence the struggle to gain access to funds for local investment. Gross fixed capital formation refers to private investment in this study.

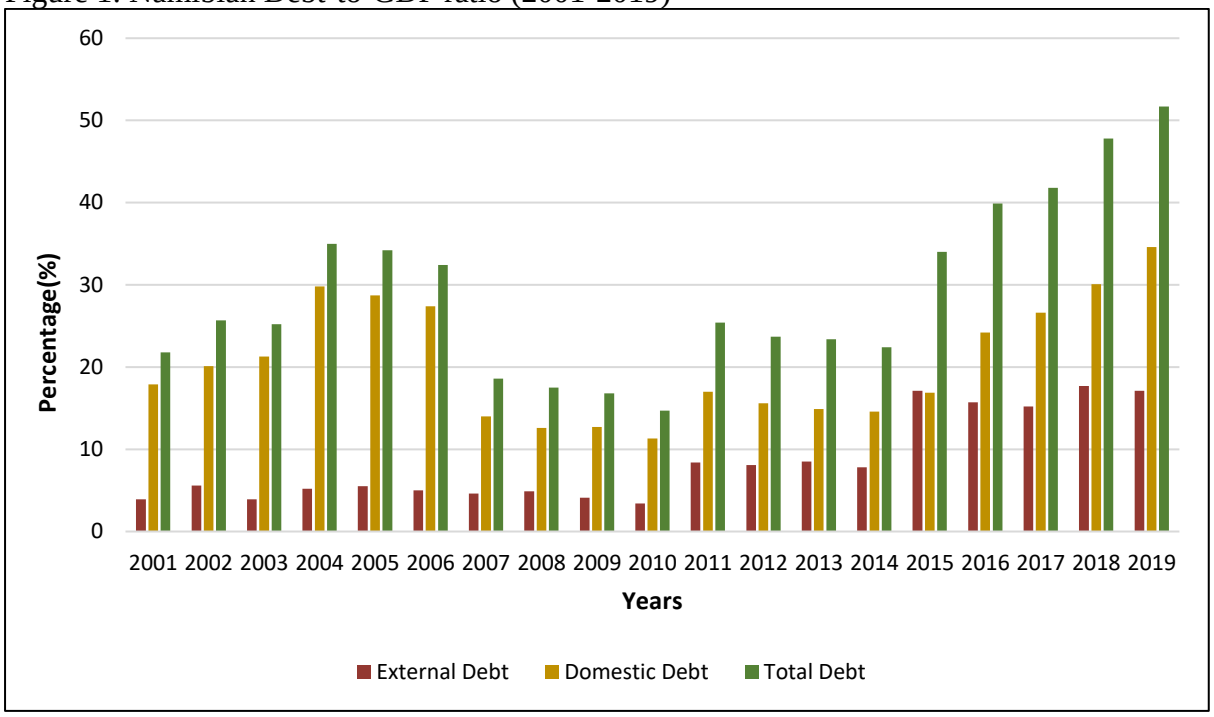
Economic researchers from all over the globe engaged in extensive debates around the goodness or evilness of public debt. A study by Mabula and Mutasa (2019) implied that public debt is a two-edged sword, because it has two-fold effects on the economy through private investment. Firstly, increasing government debt crowds-out private investment through rising interest rates. Also, via possible future high taxes in order for the government to finance budget deficits and service the debt. This illustrates the negative effect that public debt has on private

investment in an economy. Secondly, public debt crowds-in private investment a positive effect, through investing in capital projects such as road infrastructure, education, health care facilities which eventually reduces the marginal cost of one unit of output for the private sector (Piana, cited in Senibi *et al.*, 2017).

1.1.1 Public debt in Namibia

Over the years the Namibian government relied on continuous borrowing from internal and external sources to cover the budget deficit, due to the narrow tax base. According to Sherbourne *et al*., (2002) public debt prior to 1997/98 included the debt inherited pre-independence, and not only debt accumulated after the independence of Namibia. The main contributors of domestic debt in Namibia are the Internal Registered Stock (IRS) and Treasury Bills (TBs). In terms of foreign debt stocks, this consists of multilateral (foreign development banks) loans, bilateral loans, and foreign bonds (Euro and JSE). During September 2016, the credit rating agencies changed Namibia's sovereign credit rating outlook from stable to negative due to the rapid growth in governmental debt (Bank of Namibia, 2017). Overtime the Namibian debt stock have been sleepwalking its way into troublesome debt-to-GDP ratios that increased from 7% of GDP in 1990/91 to 45% to GDP in 2018/19 (First Capital Namibia, 2019). The initial debt-to-GDP threshold was 25% and further revised to 35%.

Figure 1: Namibian Debt-to-GDP ratio (2001-2019)



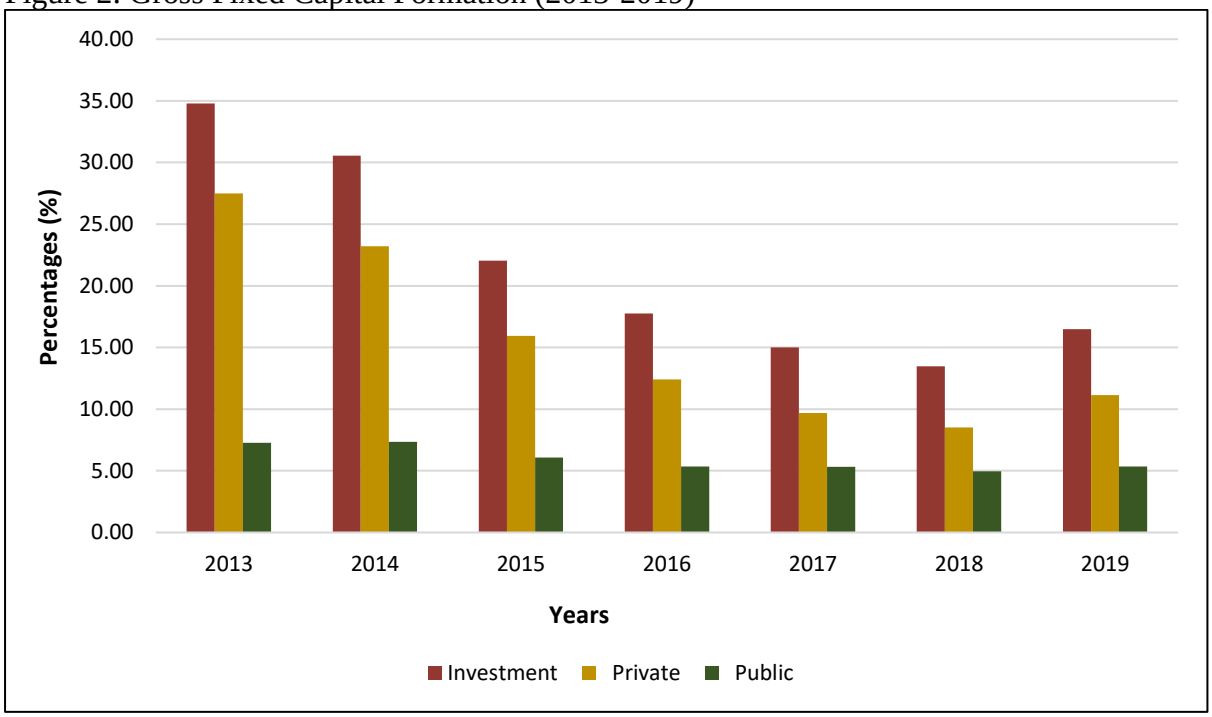
Source: Own compilation using Bank of Namibia annual reports

The continuous growth in domestic debt post-independence has been a concern. As illustrated in Figure 1, during 2001 the total debt-to-GDP ratio was within the 25% benchmark and stood at 21.8% and surpassed the benchmark slightly by 0.7% by the end of 2002. According to the Bank of Namibia (2004) total debt-to-GDP ratio rose to 35%, as domestic debt increased significantly from 21.35% to 29.8% in order to finance the gap in budgetary operations due to revenue shortfalls. In the same vein, external debt-to-GDP ratio increased to 5.2% from 3.9% because of the disbursements of funds on existing loans, especially those used to fund the upgrading of roads and the extension of the railway line. The total debt-to-GDP ratio, however, continued to decline from 2005 and increased in 2015 to 34.0%, which remained within the government debt ceiling of 35% (Bank of Namibia, 2015). In comparison to the external debt-to-GDP ratio, the domestic debt-to-GDP ratio continued to be the significant source of government budget financing over the years. After 2015, the ratio kept rising and the total debt-to-GDP ratio stood at 51.7% at the end of 2019 (Bank of Namibia, 2020).

1.1.2 Private investment in Namibia

The private sector is the primary source of investment in Namibia as portrayed in Figure 2. In order to encourage economic growth, eliminate unemployment, and diversify the economy, the government places high priority on attracting more domestic and foreign investment, which in turn will also enhance investment activities in the private sector. Investment another term for Gross Fixed Capital Formation (GFCF) is defined as the total value of a producer's acquisitions, less disposals, of fixed assets during the accounting period plus certain additions to the value of non-produced assets realized by the productive activity of institutional units (Namibia Statistics Agency, 2019).

Figure 2: Gross Fixed Capital Formation (2013-2019)



Source: Bank of Namibia

As depicted in Figure 2, public investment over the years varied between 7.36% and 4.96% for the period 2013-2019. The private sector on the other hand, continues to be the main driver of investment in Namibia with private investment ranging from 27.50% and 8.52%, which translate into 15.49% on average. The reduction in GFCF during 2016 was because of mining

and quarrying that resulted from the completion of these investments as well as new mines which were under construction (National Planning Commission, 2018). The aggregate GFCF declined between 2013 and 2018 and rose slightly to 16.49% in 2019. During 2019, Gross Fixed Capital Formation as a ratio to Gross Domestic Product (GDP) was 16.49% (private constituted of 11.14% and public 5.35%), which was a result of capital inflows from abroad into the economy (Namibia Statistics Agency, 2019).

1.2 Statement of the problem

Namibia has been experiencing persistent increases in the sovereign debt, because of high state expenditure that increased significantly from N$2.2 billion in 1990/91 to N$65 billion in 2018/19. Also, the debt ratio increased from 7% (N$501 million) in 1990/91 to 45% (N$83.7billion) for 2018/19 and expected to increase to 46% (N$92.7 billion) comprising of 65% and 35% of domestic and foreign debt, respectively (First Capital Namibia, 2019). This is above the 25% debt-to-GDP ratio benchmark that was adopted by cabinet and also specified in the Medium Term Expenditure Framework (Zaaruka *et al*., 2004). The debt further exceeds the current government debt ceiling of 35%. First Capital Namibia (2019) explained that the failure to keep debt under control over the years, resulted in the government reducing its expenditures drastically and this led to significant macroeconomic consequences such as economic recessions that the country experienced for most parts of 2017 and 2018.

In the same vein, Motlaleng *et al*., (2011) highlighted that the GFCF by the private sector in Namibia averaged 6.6% of real gross domestic product during the period 1990-2008 and included private investment abroad. Likewise, the authors elaborated that Namibia was unable to meet the secondary target of increasing domestic investments by at least 30% of GDP as per the SADC Regional Indicative Strategic Development Plan. Private investment was identified as one of the major contributors to economic growth in both industrialized and developing

nations like Namibia. There are various arguments since the time of Adam Smith regarding the crowding-out and crowding-in effect of private investments due to government debt. The former suggests public debt reduce private investment, whereas the latter asserts that public debt stimulates private investment. It is against this background, that this study intends to determine whether a long-run relationship exists between public debt and private investment in Namibia. Additionally, the study also examines the direction of causality between public debt and private investment.

1.3 Objectives of the study

The principal objective of the study is to examine the relationship between government debt and private investment in Namibia.

The specific objectives of the study:

a) to estimate the long-run relationship between public debt and private investment; and
b) to establish whether, or not there exists a causal relationship between public debt and private investment in Namibia.

1.4 Hypotheses of the study

a) H_0: There is no long-run relationship between public debt and private investment.

   H_1: There is a relationship between public debt and private investment.

b) H_0: There is no causal relationship between public debt and private investment.

   H_1: There is a causal relationship between public debt and private investment.

1.5 Significance of the study

The study will enable the government, policy makers and other stakeholders in the Namibia to better understand the relationship between public debt and private investment. This study will enable policy makers to know whether government borrowing is followed by any crowding-out or crowding-in effects of private investment, to ensure that appropriate policies are formulated, effectively implemented, and to strengthen those that are already in place. Moreover, given the significance of private investment in economic growth and development, it is critical to determine if buildup of governmental debt has an impact on private investment.

1.6 Limitation of the study

This study is limited in the sense that the period 2010-2019 is less than 30 observations hence, this will be mitigated by making use of quarterly time series data.

1.7 Delimitation of the study

Several macroeconomic variables affect private investment; however, the scope of this study solely focuses on domestic debt, external debt, gross domestic product and interest rate.

1.8 Organization of the study

Chapter one introduces the study's context. It gives a historical review of public debt and private investment. It also looks at the objectives the study and emphasizes the importance of this research.

Chapter two deals with the literature review, both theoretical and empirical and presents an overview of the literature reviewed. Chapter three presents the research design used in the study, the sources of data and methods of data collection. The description of variables and the methods of data analysis are also presented in this section.

Chapter four presents the empirical findings, results of diagnostic tests and discussion of the results. Chapter five provides the conclusions, policy implications emanating from the study, recommendations, and areas of further research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Theoretically, different economists belonging to various schools of thought greatly discussed the relationship between public debt and private investment. This chapter deals with the review of literature and empirical literature on the relationship between public debt and private investment. The theories guiding this study concerning public debt effects on private investment are the Classical, Neoclassical, Keynesian, Ricardian, and other major contributions to the theoretical debate.

2.2 Theoretical Review

2.2.1 Classical View

The Classical View claims that government debt crowds-out private investment through the transfer of resources from the private sector to the relatively less productive public sector. According to Say (1880) moderate debt levels could be beneficial provided that it is placed in productive investment because capital would be put to good use instead of left in the hands of individuals that would opt to consume it or leave it idle. On the other hand, public debt could be disadvantageous when resources are diverted away from productive use towards unproductive consumption. Government debt has a more detrimental effect on countries with low credit levels by rising interest rates since the government would be willing to pay higher interest rates than what individuals would be willing to pay. As a result, unless debt is used for productive investment, it is preferable if the government refrains from borrowing or if the capital remains idle in the hands of individuals, as the government will not have to pay any interest payments.

2.2.2 Keynesian View

The Keynesian economists are of the view that a positive relationship exists between budget deficit (high public debt) and private investment. Also, the Keynesian school of thought assumes that there are unemployed resources, and increased deficit spending by the government would result in increases aggregate demand, private investment and savings at a particular level of interest (Bernheim, 1989). Equally, Eisner's 1986 study (cited in Bernheim, 1989) suggests that increased aggregate demand enhances the profitability of private investments and leads to a higher level of investment at any given rate of interest. Therefore, government can use debt creation for productive investment that could increase national income and stimulate economic growth. For instance, a rise in government expenditure could fuel the domestic economic activity and crowds-in private investment (Ncanywa & Masoga, 2018).

2.2.3 Ricardian Equivalence View

The Ricardian Equivalence Theorem suggests that there would be no crowding out of private investment because as the government borrows money, individuals will reduce consumption and increase savings in order to offset the increase in future tax burdens which they foresee as a result of government spending deficits (Carrasco cited in Thilanka & Ranjith, 2018). This theorem assumes that individuals are rational and anticipate the future. This means that in a case were individuals are aware of an increase in their tax burden in the future, the individuals might reduce consumption and save more or invest an amount of funds that matches the reduced taxes. If the present government expenditure is financed by borrowing, the taxes paid by the current generation would be less and the taxation of the future generations, however, will be higher to repay the debt entailing that disposable income in the next period would be decreased.

2.2.4 Neoclassical View

The Neoclassical economists argue that government borrowing from banks increases its purchasing power and allows it to bid away resources from other sectors. Under full employment condition, the government spending displaces private investment through driving up the price level and the interest rate for credits (Lau *et al*., 2019). According to Bernheim (1989), an increase in debt financed deficits leads to an increase in interest rates, which reduces private investment and lowers output. While, tax financed government spending, results in fiscal deficit, which will increase present consumption by moving taxes to future generations. This would mean that for the capital market to be in equilibrium, savings will need to decrease, and the interest rates will need to increase. The higher interest rates, on the other hand, will discourage private investment, and subsequently result in slow economic growth.

2.2.5 Other Major Views to the Theoretical Debate

Other authors also contributed to the debate on public debt and private investment. According to Modigliani (1961) an increase in debt benefits the generation that exist at the time of the increase, however the next generation would bear the burden of the current national debt through a reduction in private capital stock and the opposite holds. The burden or gain to future generations is measured by the interest rate at which the government borrows which could be taken as a proxy to represent the marginal productivity of private capital. Whereas, Lerner (1943) argued that government debt should only be taken on up to the point where the interest rate is more attractive for private investments. Only if the public wants to hold more bonds and have less money at their disposal should government debt be issued. This is to avoid a situation where the public has so much money and is eager to lend it out, causing interest rates to drop lower and the private sector to spend a lot of money, resulting in inflation. The excess liquidity in the private sector is thus reduced by the government through the issuance of public debt. As

a result, debt is seen as a tool used to attain the optimal interest for private investment rather than as a means of balancing the budget. Moreover, deficits in government revenue could be covered by either printing money or borrowing.

2.3 Empirical Literature Review

In general, economists hold opposing viewpoints on the impact of government debt on private investment. A number of studies have been undertaken employing various estimation approaches, data sets, and yield varying conclusions for different countries. This section divides the findings into 2 categories: crowding out effect and crowding in effect.

Muhdi and Sasaki (2009) investigated the role of external and internal debt for the case of Indonesia using the Ordinary Least Squares regression. The study employed annual data for the period 1991 - 2006 and found that external debt has a positive effect on both investment and growth levels. In addition, domestic debt was found to discourage private investment through the crowding-out effect and reduces economic growth levels in Indonesia.

Similarly, Akram (2011) assessed the impact of public debt on the economic growth in Pakistan using the Autoregressive Distributed Lag model. The study used time series data for the period of 1972 -2009. The study found the existence of the “Debt Overhang effects” for Pakistan and that per capita GDP and investments had a significant relationship with public external debt. However, the relationships between investment and per capita GDP to debt servicing was found to be insignificant thus, the crowding-out effect of external debt could not be confirmed. Whereas domestic public debt was found to have a crowding-out effect on private investments and had a negative relationship with per capita GDP.

In addition, Ezeabasili and Nwakoby (2013) adopted a cointegration and structural analysis technique to examined the controversial relationship between government expenditure and

private investment within the Nigerian context using time series data from 1970-2006. A positive long run relationship was discovered between private investment and real growth of the national economy, which confirmed the relevance of the accelerator principle to Nigeria. Also, the results revealed that fiscal deficits had a bad effect on private investment. Moreover, the debt profile of the country also has negative impact on private investment in Nigeria.

In the same vein, Asogwa and Chetachukwu (2013) examined the crowding-out effect of budget deficits on private investment in Nigeria. The study adopted an analytical framework that employed the Ordinary Least Squares and Granger Causality test. The analysis confirmed that budget deficits crowds-out private investments and that private investments further granger cause budget deficit with feedback.

Also, Shetta and Kamaly (2014) using the Vector Autoregression (VAR) analysis on Egypt revealed that government borrowing crowds-out private investment. The study used quarterly data spanning from 1970Q1-2009Q2 and estimated a Vector Autoregressive model. The study found a significant crowding-out effect of government borrowing from the domestic banks on private credit. Moreover, this crowding-out effect came from the endogenous response of the banking sector to increased government borrowing.

King'wara (2014) explored the impact of public domestic debt on private investments levels in Kenya for the period 1967-2007. The study employed an investment function with 4 independent variables, namely, gross domestic product, interest rate, public domestic debt and public investment. The study tested for unit root and performed the cointegration test. The results showed the existence of a negative relationship between domestic public debt and private investment. Also, the findings showed that the impact of public investment on private investment was not as significant as public domestic debt, gross domestic product and interest rate variables. Equally, the interest rate has a negative impact on private investments.

Moreover, Kamundia *et al*., (2015) used time series data from the period 1980-2013 and examined the effect of public debt on the levels of private investment and economic growth in Kenya. The Ordinary least squares estimation was used to estimate the model. In addition, the Granger Causality test was used to determine the direction of causality between public debt and private investments and also between public debt and economic growth. The causality tests showed presence of unidirectional causality from debt to private investment and GDP growth. Moreover, debt was found to have a negative effect on private investment and a positive effect on economic growth. This implied that debt plays a huge role in the determination of the level of private investment and economic growth in Kenya.

Using the Johansen Cointegration technique and Vector Error Correction model, (Akomolafe *et al*., 2015) investigated the effect of public borrowing on private investment in Nigeria using time series data from 1980-2010. The study separated public debt into domestic and external debt. The empirical results revealed that domestic debt crowds-out domestic investment both in the short-run and long-run while external debt crowds-in domestic investment in the long-run.

Additionally, Aswata (2018) employed the Autoregressive Distributed Lag panel model using a panel of 4 countries for the period between 1992-2015. The study established that public debt crowds-out private domestic investment and foreign direct investment in the long run. When compared to foreign direct investment, the size of the impact was greater for private domestic investment.

Ozdemir and Gomez (2020) similarly, assessed the impact of domestic debt on private investment in the Gambia using an Autoregressive Distributed Lag approach. The study used annual time series data for the period 1980-2013. The test found a long-run relationship between the variables. Moreover, domestic debt was found to have a negative effect on private

investment in the short-run but not in the long-run. Equally, the study revealed that real interest rate had a crowding-out effect on private investment in the long-run, however in the short-run the relationship was positive.

In contrast, other studies supported the crowding-in effect of public debt on private investment. Khan and Gill (2009) investigated the crowding-out effect of public borrowing on private investment in Pakistan. The study used an investment function with 3 independent variables, that is public borrowing, gross domestic product and lending rate. The study employed the unit root test, cointegration test and Vector Error Correction model using time series data of 34 years, i.e., fiscal year of 1971-72 to 2005-06. The results provided evidence of crowding-in effect, which explained the direction of public expenditures towards private sector through contractors, politicians and bureaucrats, instead of public projects.

Afonso and Jalles (2011) further examined the linkages between investment and fiscal policies. The study used time series data for a panel of 95 developed and developing countries for the period 1970-2008. The empirical results indicated that total government expenditure and public investment crowds-in private investment. Also, government consumption spending was however, found to have a negative effect on private investment. Similarly, interest payments also had a negative impact on both public and private investment. Whereas government health spending was found to play a complementary role in enhancing private investment in emerging countries.

Also, Snyder (2011) using the Vector Error Correction model analysed if the Federal budget deficits crowds-out private investment in the United States of America. Time series data for the period 1947-2010 was used for the study. The study revealed that government spending has crowding-in effects on private investment. The results showed that national borrowing had a

negative impact on investment, however, government spending crowds-in investment as stated by the Keynesian multiplier effect.

Putunoi and Mutuku (2013) further investigated the relationship between domestic debt and economic growth in Kenya using VAR. A positive and statistically significant relationship was found to exist between domestic debt and economic growth. The study indicated that if domestic debt is used for productive purposes, then it will have a positive effect. A negative interest rate and GDP growth were found to be statistically insignificant. This implied that debt has no effect on interest rates and therefore no crowding-out effect on private investments.

Another study by Şen and Kaya (2014) examined the effect of government spending on private investment in Turkey from 1975 to 2011 to test if there exists any crowding-out or crowding-in effects. The study found that government current transfer spending, government current spending and government interest spending crowds-out private investment. Though, government capital spending crowds-in private investment during the study period.

Likewise, Apere (2014) analysed the impact of public debt on private investment in Nigeria: evidence from a non-linear model for the period 1981-2012. An instrumental variable technique of estimation and bootstrapping technique was adopted for the computation of normal based standard errors for the turning points to regress private investment as a ratio of GDP on domestic debt, domestic debt squared, external debt, external debt squared, and private consumption expenditure as a percentage of GDP. The results revealed a linear and positive relationship between domestic debt and private investment; a U- shaped impact of external debt on private investment; and an inverse relationship between private consumption expenditure and private investment.

Similarly, Ebi and Imoke (2017) empirically investigated the debt growth relationship in Nigeria for the period 1970-2014 and a Quadratic function was used in modeling the various relationship of interest. The results found a non-linear relationship between private investment and public debt: a moderate level of public debt spurs private investment while high level of public debt erodes the positive impact on investment.

In addition, Thilanka and Ranjith (2018) assessed the impact of public debt on private investment in Sri Lanka using the annual data for the period 1978-2015. The study followed some econometric steps respectively unit root test, Johansen cointegration test and lastly employed the Vector Error Correction model to find the long-run impact. The findings revealed presence of crowding-in effect of public debt on private investment in the long-run implying that government has diverted borrowing funds as spurring private sector. Also, real GDP positively affects private investment suggesting further expansion of the economy is inevitable.

In the case of Namibia, Ashipala and Haimbodi (2003) tested the impact of public investment on economic growth in Namibia, South Africa and Botswana in which Namibia was the focus. The study used the VECM methodology to empirically analyse the impact of public investment on economic growth. The empirical analysis indicated that private investment has a significant positive effect on GDP in both the South African and Namibian cases. The authors also found that although public investment had the expected positive sign, the effect of public investment on GDP was found to be statistically insignificant in all three cases. Therefore, no strong inferences were drawn from those findings. The study only concluded that given the available data, public investment and GDP were found to be positively correlated. Furthermore, the study also concluded that there was no evidence of a strong crowding-out effect in the three cases rather public investment and private investment complement each other.

Equally, a study by Motlaleng *et al*., (2011) looked at the effectiveness of fiscal spending in the context of crowding out/in hypothesis for Namibia. The study used two models for the investigation and employed time series quarterly data for the period 1990Q1 to 2005Q2. The Neoclassical school advocates that private investment was dampened by an increase in government spending. An increase in government spending, on the other hand, stimulates private investment in the Keynesian model. The first model employed government expenditures and the second model used government budget deficit together with gross domestic product and lending interest rate. The findings of the paper verified both the Keynesian and Neoclassical views for Namibia. While increases in government spending was found to crowd-in private investment, government budget deficits were found to crowd-out private investment.

In conclusion, existing studies on the relationship between government debt and private investment, however, is ambiguous. Moreover, previous studies in Namibia focused on the impact of public investment on economic growth and the effectiveness of fiscal spending in the context of crowding out/in hypothesis. The current study intends to add to previous studies by analysing the relationship between public debt and private investment in Namibia.

2.4 Conclusion

In summary, a number of arguments emanated from the economic schools of thought. The empirical literature yields varied outcomes, some studies confirmed the crowding-out effect of private investment, and others confirmed the crowding-in effect. Despite the fact that such contradictions exist, it is still unclear where Namibia lies in the midst of these contradictory opinions. Therefore, this study tends to fill a gap in the literature for Namibia by revealing the country's position in the midst of these opposing viewpoints.

CHAPTER THREE: RESEARCH METHODS

3.1 Introduction

In this chapter the empirical models used to achieve the objectives of this study are discussed. The variables used in the study, data collection sources and the analysis methods are presented.

3.2 Data Type and Sources

This study is quantitative in nature and analyses the relationship between public debt and private investment in Namibia using a statistical software EViews. Quarterly statistical time series data for period 2010Q1-2019Q4, 40 observations were used for the study. The secondary data used in this study was obtained from the Bank of Namibia. Furthermore, the following variables are used in the study, private gross fixed capital formation, domestic debt, external debt, gross domestic product and interest rate. The methodology involves the regression of the dependent variable, which is private gross fixed capital formation on the independent variables.

3.3 Model Specification

This study adapts the modified model approach used by (Akomolafe *et al.*, 2015) and is expressed as:

$$PGFCF = f\,(DD, EXD, GDP, IR) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where, variables *PGFCF, DD, EXD, GDP* and *IR* denoted respectively private gross fixed capital formation, domestic debt, external debt, gross domestic product and interest rate.

For analytical convenience and to capture the nexus between public debt and private investment the econometric model is specified as follows:

$$LNPGFCF_t = \beta_0 + \beta_1 LNDD_t + \beta_2 LNEXD_t + \beta_3 LNGDP_t + \beta_4 IR_t + \mu_t \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

The labels *LNPGFCF, LNDD, LNEXD* and *LNGDP* denotes the log of the private gross fixed capital formation, log of domestic debt, log of external debt, and log of gross domestic product, *IR* is the interest rate, μ is the white noise error term, *t* is the time period and the βs are parameters.

3.3.1 Definition of variables

3.3.1.1 Private Gross Fixed Capital Formation

Gross fixed capital formation measures the total value of a producer's acquisitions, less disposals, of fixed assets during the accounting period plus certain additions to the value of non-produced assets realized by the productive activity of institutional units. This study solely focuses on gross fixed capital formation by the private sector in the economy.

3.3.1.2 Domestic Debt

Domestic debt is the total government debt in a country that is owed to lenders within the country. The sign can be positive or negative, in the case the sign is positive, it means that there is a crowding-in effect, while if the sign is negative, it implies a crowding-out effect.

3.3.1.3 External Debt

External debt is the total government debt in a country that is owed to creditors outside the country. The sign can be positive or negative. If the sign is positive, it implies crowding-in effects, but a crowding-out effect if the sign is negative.

3.3.1.4 Gross Domestic Product

This is the value of all goods and services produced domestically at current prices. The expected sign is positive.

3.3.1.5 Interest rate

Interest rate is the user cost of capital. High interest rates would imply a high cost of capital, causing private investment to be crowded-out. The expected sign is negative.

The choice of the model and variables was motivated by the public debt and private investment in Nigeria study by (Akomolafe *et al.*, 2015).

3.4 Estimation Techniques

3.4.1 Stationarity Tests

Macroeconomic time series data are non-stationary with the existence of spurious regression problems. Equally, testing for unit root in the data is very crucial because of variables that are found to be integrated of order 2. Gujarati (2003) explains that the Augmented Dickey-Fuller (ADF) test adjusts the Dicky Fuller test to take care of possible serial correlation in the error terms by adding the lagged difference terms of the regressand. Another popular unit root testing technique is the Phillips-Perron (PP) test which uses non-parametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms.

The Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root test is more advanced and superior in comparison to the standard ADF and PP unit roots test and works well with small sample size. According to Kwiatkowski *et al.*, (1992) the ADF and PP unit root tests are not very powerful against relevant alternatives as these tests tend to fail to reject the null hypothesis of unit root for many economic time series.

Likewise, the KPSS unit root test does the opposite in comparison to the ADF and PP unit root tests, in the sense that KPSS reject the null hypothesis is rejected if the critical values are greater than the t-statistic value. Moreover, the KPSS unit root test does not provide a probability value and the hypotheses are as follow:

H_0: Variable is stationary (no unit root)

$H_{1:}$ Variable is non-stationary (has unit root)

Given the abovementioned limitations, this study used the PP test together with the KPSS test as a robustness check for unit root, since the KPSS test is more superior to the PP test.

3.4.2 Cointegration Test

There are numerous cointegration tests that could be employed to test for the existence of a long-run relationship between the explanatory variables and dependent variable. This study employs the Autoregressive distributed lag (ARDL) cointegration technique or Bound test of (Pesaran & Shin, 1997) to investigate the relationship between government debt and private investment in Namibia. The ARDL approach captures the short-run and long-run relationship simultaneously and make provision for the error correction mechanism. The ARDL test has a number of advantages as opposed to the traditional cointegration approaches (Belloumi, 2016); firstly, the ARDL cointegration technique does not require pretests for unit roots unlike other techniques, but it is still prudent to perform the unit root tests. Secondly, the ARDL accommodates variables that are of I (0) or I (1) or a combination of both, which overcomes the issues that come with traditional cointegration approaches, that necessitates the classification of the variables into I (0) and I (1). Thirdly, the ARDL test is relatively more efficient in the case of small (n≤30) or finite sample data sizes.

The ARDL cointegration equation is specified as follows:

$$\Delta LNPGFCF = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta LNDD_{t-p} + \sum_{i=1}^{n} \beta_2 \Delta LNEXD_{t-p} + \sum_{i=1}^{n} \beta_3 \Delta LNGDP_{t-p} + \sum_{i=1}^{n} \beta_4 \Delta IR_{t-p} + \gamma_1 pgfcf_{t-1} + \gamma_2 dd_{t-1} + \gamma_3 exd_{t-1} + \gamma_4 gdp_{t-1} + \gamma_5 ir_{t-1} + \mu_t \quad (3)$$

Where n is the number of optimum lag orders determined by the various information criterions; Δ denotes the first difference operator; β_0 represents the intercept; β_i are the short-run

parameters; γ_i are the long-run coefficients; μ_t is the error term and the variables are as previously defined.

Equation (2) null and alternative hypotheses are derived as follow:

H_0: $\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_4 = 0$ (null hypothesis)

H_1: $\gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_4 \neq 0$ (alternative hypothesis)

The hypotheses in equation (3) are tested by means of an F-test. If the computed F-statistic is greater than the upper bound critical value, then the null hypothesis is rejected implying that there is a long-run relationship. On the other hand, if the F-statistic is lower than the lower bound critical value, then there is no long-run relationship. However, in the case that the F-statistic lies between the lower and upper bound critical values, the test is deemed inconclusive. If cointegration is supported, the next step is to derive the Error Correction Term (ECT) which corrects for any deviations and adjustments back to the long-run in the model.

3.4.3 Granger Causality Test

A mere relationship between variables does not show the direction of causality. According to Granger (1969) a variable is said to granger cause another variable if past and present values of the variable can help predict values of another variable. The Granger Causality procedure was employed by numerous research to study the causal interactions that exists among macroeconomic variables. For instance, Kamundia *et al.*, (2015) used the Pairwise Granger Causality test and found a unidirectional causality from debt to private investment and GDP growth for Kenya.

3.4.4 Diagnostic Tests

The appropriate lag length for the underlying variables in the study for the ARDL model is key to ensure that the error terms do not suffer from non-normality, autocorrelation and

heteroskedasticity. It is therefore, imperative to determine the optimum lag length using the proper model order selection criteria such as the Akaike Information Criterion, Schwarz Bayesian Criterion or the Hannan-Quinn Criterion (Nkoro & Uko, 2016).

3.5 Research Ethics

This study adheres to all ethical behaviors of truthful reporting to enrich existing knowledge. Moreover, the data was not distorted in any way and all sources used in this study are accurately acknowledged.

CHAPTER FOUR: EMPIRICAL ANALYSIS AND RESULTS

4.1 Introduction

The empirical findings are presented in this chapter. To begin, the results of the stationarity test, which was performed to mitigate spurious regression results, are shown. The results of the cointegration estimation, causality test, diagnostic tests, and discussion are reported.

4.2 Time Series Properties

Table 1 provides a summary of the descriptive statistics of the macroeconomic variables used in this study. The average private gross fixed capital formation stood at N$27,125.23 million ranging from N$17,307.00 million to N$41,305.00. Similarly, the mean value of domestic debt, external debt, and gross domestic product stood at N$24,486.76 million, N$13,977.51 million, and N$33,796.58 million respectively. A critical look at Table 1 also shows that the mean value of Namibia's external debt is less than the domestic debt owed. Moreover, the minimum and maximum values range between N$8,876.00 to N$54,491.62 million for domestic debt, N$2,929.72 to N$32,155.64 million for external debt, and the gross domestic product ranged between N$19,895.00 to N$47,454.00. In addition, the average interest rate for the period under review stood at 10.13% and ranged between 9.25% and 11.25% for the period under review.

In terms of the degree of asymmetry of the series, the rule of thumb is that if the skewness is 0, the data's distribution is symmetric around the mean. If the value is greater than 0 then it exhibits positive skewness also known as the long-right tail and when the value is less than 0, illustrates negative skewness also called long-left tail. In Table 1, interest rate mirrors a normal distribution, external debt, domestic debt, and private gross fixed capital formation depicts positive skewness illustrating a long-right tail and gross domestic product is negative implying a long-left tail.

On the other hand, in terms of the kurtosis, according to the rule of thumb a normal distribution has a kurtosis of 3 that is mesokurtic but if the kurtosis is greater than 3 then it is leptokurtic and when it is less than 3 it is platykurtic. A critical look at the kurtosis coefficients of the variables in Table 1 indicates that all the variables are platykurtic.

The Jarque-Bera test shows whether the variables follow a normal distribution. All the variables are normally distributed as the probability values of Jarque-Bera are greater than the 5% significance level, thus the study fails to reject the null hypothesis of normal distribution.

Table 1: Descriptive Statistics of the Macroeconomic Variables

Measures	PGFCF	DD	EXD	GDP	IR
Mean	27125.23	24486.76	13977.51	33796.58	10.12825
Median	25903.13	19326.30	10955.28	35457.00	10.25000
Maximum	41305.00	54491.62	32155.64	47454.00	11.25000
Minimum	17307.00	8876.000	2929.720	19895.00	9.250000
SD	6925.690	13977.55	10031.48	9478.904	0.596334
Skewness	0.556403	0.748927	0.474569	-0.137891	0.002747
Kurtosis	2.368558	2.260769	1.634708	1.541924	1.996129
Jarque-Bera	2.728424	4.650047	4.608138	3.670070	1.679644
Probability	0.255582	0.097781	0.099852	0.159608	0.431787
Sum	1085009.	979470.4	559100.4	1351863.	405.1300

Sum of SD	1.87E+09	7.62E+09	3.92E+09	3.50E+09	13.86898
Observations	40	40	40	40	40

Source: Author's own computation using E-views econometric software. SD: Standard deviation.

Table 2: Correlation Matrix

Variable	LNPGFCF	LNDD	LNEXD	LNGDP	IR
LNPGFCF	1				
LNDD	0.147548	1			
LNEXD	0.259261	0.969083	1		
LNGDP	0.330327	0.946019	0.967263	1	
IR	-0.423061	0.341809	0.351302	0.330987	1

Source: Author's own computation using E-views.

The correlation matrix in Table 2 shows the correlation between the variables. The correlation coefficient ranges from a value of -1 to 1. A correlation coefficient value of closer to 1, like in the case of domestic debt and gross domestic product illustrates a positive relationship between these variables. A correlation coefficient value of less than 1 however, indicates a negative relationship, such as the relationship between interest rate and private gross fixed capital formation. Furthermore, a correlation coefficient value of close to 0 implies that there is no evidence of a relationship, like the in the case of interest rate and external debt.

4.2 Optimal Lag Length Criteria

Prior to carrying out the ARDL test for cointegration, it is important to determine the optimal length to be included in the model. Table 3 illustrates the test results obtained by the various information criteria.

Table 3: Optimum Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	28.32036	NA	1.88e-07	-1.295576	-1.075642	-1.218813
1	251.4846	371.9404	3.17e-12	-12.30470	-10.98510	-11.84413
2	292.3362	56.73832	1.43e-12	-13.18534	-10.76608	-12.34096
3	336.0948	48.62067	6.36e-13	-14.22749	-10.70856	-12.99929
4	389.4722	**44.48118***	**2.19e-13***	**-15.80401***	**-11.18542***	**-14.19200***

Source: Author's own compilation using E-views.

Note: *Indicates the lag order selected by the criterion
LR: sequential modified LR test statistics (each at 5% level)
FPE: Final prediction criterion
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion.

The results in Table 3 shows that LR, FPE, AIC, SC and HQ selected the optimal lag length as 4, thus this study uses 4 lags as the optimal lag length and adopts the AIC information criterion.

4.3 Stationarity Tests

As a pre-requisite for the cointegration test, the study employs the PP and KPSS unit root tests that includes the intercept alone and intercept with trend to establish the order of integration and the outcomes are outlined in Table 4:

Table 4: PP and KPSS Unit Root Tests

Variable	Model Specification	Unit root test				Order of integration
		PP		KPSS		
		Levels	First Difference	Levels	First Difference	
LNPGFCF	Intercept	-1.438385 -2.938987	-1.846712 -3.615588	0.235679** 0.463000	0.442582** 0.463000	I(0)

	Trend & intercept	-0.766410 -3.529758	-2.566159 -3.533083	0.215280*** 0.216000	0.084607** 0.146000	I(0)
LNDD	Intercept	0.274087 -2.938987	-3.624016** -2.941145	0.876099 0.463000	0.104775** 0.463000	I(1)
	Trend & intercept	-2.578490 -3.529758	-3.641709** -3.533083	0.080909** 0.146000	0.056045** 0.146000	I(0)
LNEXD	Intercept	-0.427942 -2.938987	-5.561875** -2.941145	0.855408 0.463000	0.084571** 0.463000	I(1)
	Trend & intercept	-2.708266 -3.529758	-5.474185** -3.533083	0.081579** 0.146000	0.084510** 0.146000	I(0)
LNGDP	Intercept	-1.079621 -2.938987	-7.487084** -2.941145	0.872653 0.463000	0.166936** 0.463000	I(1)
	Trend & intercept	-1.975333 -3.529758	-7.610693** -3.533083	0.169329 0.146000	0.094482** 0.146000	I(1)
IR	Intercept	-2.209066 -2.938987	-5.338347** -2.941145	0.288928** 0.463000	0.277090** 0.463000	I(0)
	Trend & intercept	-2.875014 -3.529758	-5.528136** -3.533083	0.147851*** 0.216000	0.172224*** 0.216000	I(0)

Source: Author's own computation using E-views.
Note *,**,***, denotes stationarity at 10%,5% and 1% respectively.

Table 4 indicates that with the PP test, majority of the variables after the first difference became stationary with the exception of the dependent variable, private gross fixed capital formation. The KPSS unit root, however, shows that the private gross fixed capital formation and interest rate variables are stationary at level, while domestic debt and external debt are stationary at after first difference at trend and intercept and stationery at levels at intercept respectively. Gross domestic product was only stationary after the first difference. The conclusion is based on the KPSS test, which is considered to be more powerful than the PP test, which is commonly criticized for having limited power. This may have been the case for the private gross fixed

capital formation as the variable only become stationary as per the results of the KPSS test. The ARDL Bound test is used in this study because of the mixture of I(0) and I(1) as shown in Table 4.

4.4 ARDL Cointegration Test

The ARDL model estimation technique is used to test both the short-run and long-run relationship between variables and Table 5 shows the ARDL Bound test results.

Table 5: ARDL Bound Test for Cointegration

Case 2: Restricted Constant and No Trend		
F-statistic	Value	k
	3.495782	4
Critical Value Bounds		
Significance levels	Lower Bound I(0)	Upper Bound I(1)
10%	2.2	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

Source: Author's own compilation using E-views.
Note: The results are from the ARDL model (2,3,3,3,4).

The results in Table 5 shows that there is cointegration among the variables, therefore the null hypothesis of no cointegration is rejected. This implies that a long-run relationship exists among the variables, because the estimated F-statistic for the private gross fixed capital formation model is greater than the upper critical bound at 5% level of significance. On that note, this answers objective 1 of the study. Moreover, the existence of the long-run relationship means that the short-run error correction term can be further investigated.

Table 6: Long-run Coefficient Estimation of ARDL Model (2,3,3,3,4)

Dependent Variable: LNPGFCF				
Variable	Coefficient	Std. Error	t-statistic	Prob.
LNDD	-0.945099	0.222779	-4.242317	0.0006
LNEXD	0.218188	0.322502	0.676548	0.5084
LNGDP	1.510902	1.367442	1.104911	0.2855
IR	-0.438918	0.096736	-4.537298	0.0003
C	6.221169	9.538767	0.652198	0.5235

Source: Author's own compilation using E-views.

From Table 6 it is evident that domestic debt has a negative relationship with private gross fixed capital formation in the long-run. The probability value of the coefficient is statistically significant at 5% level of significance. The results show that a 1% increase in domestic debt will lead to a 94.5% decline in private gross fixed capital formation. Notably, the negative effect of the domestic debt signifies the crowding-out effect of private gross fixed capital formation as a result of high public debt. This is consistent with the results found by (King'wara, 2014; Akomolafe *et al.*, 2015; Anoke *et al*., 2021). While, Ogunjimi (2019); and Ozdemir and Gomez (2020) found a positive and significant long-run relationship between public debt and private investment.

In the same vein interest rate was also found to have a negative long-run relationship with private gross fixed capital formation. The coefficient of the interest rate was statistically significant at the 5% level. This negative effect of interest rate asserts the crowding-out effect of private gross fixed capital formation as a result of an increase in interest rate. A 1% increase in interest rate results in a decrease of 43.89% in private gross fixed capital formation in the long-run. The finding of a negative long-run relationship between private investment and

interest rate is in accordance with (King'wara, 2014; Akomolafe *et al*., 2015; Ozdemir & Gomez, 2020).

Gross domestic product and external debt have a statistically insignificant positive long-run relationship with private gross fixed capital formation. The results in Table 7 indicates the presence of the short-run relationship between the variables and private gross fixed capital formation.

Table 7: Short-run Coefficient Estimation of ARDL (2,3,3,3,4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INPGFCF(-1))	0.514648	0.064865	7.934172	0.0000
D(INDD)	-0.095295	0.074127	-1.285557	0.2169
D(INDD(-1))	-0.031908	0.097115	-0.328562	0.7467
D(INDD(-2))	0.435749	0.093564	4.657237	0.0003
D(INEXD)	0.029435	0.018899	1.557463	0.1389
D(INEXD(-1))	-0.016832	0.019281	-0.872959	0.3956
D(INEXD(-2))	0.045573	0.019900	2.290044	0.0359
D(INGDP)	-0.054759	0.061301	-0.893275	0.3849
D(INGDP(-1))	-0.129280	0.066120	-1.955226	0.0683
D(INGDP(-2))	0.127038	0.047137	2.695115	0.0159
D(IR)	-0.036190	0.019468	-1.858891	0.0815
D(IR(-1))	0.052052	0.014816	3.513221	0.0029
D(IR(-2))	0.000437	0.015119	0.028894	0.9773
D(IR(-3))	-0.043800	0.013982	-3.132652	0.0064
CointEq(-1)*	-0.188380	0.035904	-5.246836	0.0001

Source: Author's own compilation using E-views.

The results in Table 7 shows that previous period private gross fixed capital formation has a positive effect on the current private gross fixed capital formation. The effect is positive (0.514648) and statistically significant at the 5% significance level. This implies that a 1% increase in private gross fixed capital formation in the first lag will result in a 51.50% increase in private gross fixed capital formation in the current period, ceteris paribus in the short-run. Kamundia et al., (2015); and Ozdemir and Gomez (2020) also found a positive relationship between current and previous private investments consistent to the finding of the current study. Equally, it is also evident that domestic debt has a statistically insignificant negative effect on private gross fixed capital formation in the short-run in the current period and the first lag ceteris paribus. However, the second lag was found to be positive and statistically significant in the short-run ceteris paribus, meaning that a 1% increase in domestic debt will lead to a 43.57% increase in private gross fixed capital formation. The study concludes that interest rate crowds in private investments in the shot-run due to the positive and statistical significant relationship, but interest rate was found to crowd out private investment by (Akomolafe *et al.*, 2015; Ozdemir & Gomez, 2020).

External debt was found to have a positive short-run relationship with private gross fixed capital formation. Notably, the short-run relationship was statistically significant at 5% level in the second lag, signifying that a 1% increase in external debt translates into a 4.50% increase in private gross fixed capital formation ceteris paribus. Similarly, this finding is supported by the studies of (Apere, 2014; Ogunjimi, 2019; Mabula & Mutasa, 2019) that assert that external debt in the short-run stimulates private investment provided that the public debt is invested in basic infrastructures.

Likewise, gross domestic product has positive short-run relationship with private gross fixed capital formation that statistically significant in the second lag. Private gross fixed capital

formation will increase by 12.7% in the second lag when gross domestic product increases by 1%. This finding is consistent with the study by (Akomolafe *et al.*, 2015) which found a positive short-run relationship between gross domestic product and private investment.

Interest rate has a positive and statistically significant effect on private gross fixed capital formation in the first lag, however the third lag is negative and also statistically significant at 5% level. A 1% increase in interest rate results in a 0.052% increase and 0.044% decrease in private gross fixed capital formation in the first lag and third lag respectively in the short-run ceteris paribus. The study found both positive and negative relationships that are statistically significant. The finding by Ozdemir & Gomez (2020) partially corresponds to the finding of a positive effect between interest rate and private investment in the short-run ceteris paribus.

The results in Table 7 further shows that the lagged ECT of the ARDL model exhibits a negative coefficient of 0.188 and statistically significant. This implies that the selected ARDL model adjusts all the short-run shocks back to the long-run equilibrium at an adjustment speed of approximately 20% each quarter, which entails 75.2% every year. The negative ECT coefficient means that there is convergence back to the long-run equilibrium after a shock.

4.5 Granger Causality Test

Numerous researchers used the Granger Causality procedure to study the causal interactions that exists among economic variables in various economies around the globe. The Granger Causality test addresses the shortcoming of the ARDL Bound Test analysis by illustrating the direction of causality between variables. According to (Granger, 1969) a dependent variable (Y) is caused by an independent variable (X), hence if variable Y can be predicted better by the past values of (Y) and (X) than the independent variable (X) than values of (Y) alone. There are four possible outcomes for the Granger Causality test which are:

i. Unidirectional causality running from the dependent variable to the independent variable.

ii. Unidirectional causality running from the independent variable to the dependent variable.

iii. Bi-directional causality

iv. No causality

Table 8 presents the Pairwise Granger Causality test results based on AIC information criterion and the 4 lags selection. This answers objective 2 of this study.

Table 8: Pairwise Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.	Conclusion
INDD does not Granger Cause INPGFCF	36	2.45777	0.0696	No Causality
INPGFCF does not Granger Cause INDD		0.10627	0.9793	No Causality
INEXD does not Granger Cause INPGFCF	36	4.35481	**0.0076****	Causality
INPGFCF does not Granger Cause INEXD		0.08281	0.9870	No Causality
INGDP does not Granger Cause INPGFCF	36	4.08540	**0.0102****	Causality
INPGFCF does not Granger Cause INGDP		4.76520	**0.0049****	Causality
IR does not Granger Cause INPGFCF	36	3.75763	**0.0148****	Causality
INPGFCF does not Granger Cause IR		3.16138	**0.0297****	Causality
INEXD does not Granger Cause INDD	36	0.54292	0.7056	No Causality
INDD does not Granger Cause INEXD		2.66950	0.0537	No Causality
INGDP does not Granger Cause INDD	36	0.83706	0.5137	No Causality
INDD does not Granger Cause INGDP		1.38805	0.2645	No Causality
IR does not Granger Cause INDD	36	3.56255	**0.0185****	Causality
INDD does not Granger Cause IR		1.32647	0.2855	No Causality

INGDP does not Granger Cause INEXD	36	1.63962	0.1932	No Causality
INEXD does not Granger Cause INGDP		4.09044	**0.0102****	Causality
IR does not Granger Cause INEXD	36	0.74074	0.5725	No Causality
INEXD does not Granger Cause IR		0.39990	0.8069	No Causality
IR does not Granger Cause INGDP	36	2.18729	0.0973	No Causality
INGDP does not Granger Cause IR		1.28205	0.3016	No Causality

Source: Author's computation using EViews and ** = significance at 5% level.

Table 8 indicates that at a 5% level of significance, the null hypothesis of domestic debt granger-causes private gross fixed capital formation is rejected. Equally, private gross fixed capital formation does not granger cause domestic debt. A study by Mabula and Mutasa (2019) also found no causal relationship between public debt and private investment. On the contrary, Kamundia et al., (2015) found a unidirectional causal relationship from public debt to private investment. External debt was found to granger-cause private gross fixed capital formation and is statistically significant at 5% significance level. This finding contradicts the study by Anoke *et al*., (2021) that found no causality between external debt and private investment for Nigeria.

In addition, a statistically significant bi-directional relationship exists between gross domestic product and private gross fixed capital formation. This finding is also supported by the study of Ashipila and Haimbodi (2003) that found a positive and significant relationship between private investment and gross domestic product for Namibia. Likewise, Afonso and Jalles (2011) solely found a one-way causal relationship between private investment and gross domestic product. In the same vein, another statistically significant bi-directional causality exists between interest rate and gross fixed capital formation at 5% level. However, Alhakimi

and Shama (2020) only found a unidirectional causal relationship from interest rate to private investment.

Moreover, interest rate granger-causes domestic debt and this one-way causal relationship is significant at 5% level. While, a study by Sabirin *et al*., (2019) found no causal, implying that public debt does not granger-cause interest rate and vice versa. Also, another unidirectional relationship was found between external debt and gross domestic product and significant at the 5% level. Sijabat (2020) found that for Indonesia, gross domestic product granger-cause external debt. In terms of answering objective 2 of this study there is no causal relationship between private gross fixed capital formation and domestic government debt for the case of Namibia.

4.6 Diagnostic Tests

Several diagnostic tests were conducted to ascertain if the model is fit and passes all the diagnostic scrutiny.

Table 9: Diagnostic Test Results

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.414911	Prob. F(4,12)	0.7948
Obs*R-squared	4.373997	Prob. Chi-Square(4)	0.3578
Normality Test			
Jarque-Bera	1.687230	Probability	0.430153
Breusch-Pagan Godfrey Heteroscedasticity Test			
F-statistic	0.895538	Prob. F(19,16)	0.5951

Obs*R-squared	18.55350	Prob. Chi-Square(19)	0.4858
Scaled explained SS	4.224018	Prob. Chi-Square(19)	0.9998
Ramsey RESET Test			
F-statistic	0.117653	Probability	0.7364

Source: Author's computation using E-views.

In Table 9 the probability value of the chi-square statistic for the private gross fixed capital formation equation in the Breusch-Godfrey test for serial correlation is higher than 0.05. The study thus fails to reject the null hypothesis of no serial correlation and implies that there is no existence of serial correlation. In terms of the Jarque-Bera Normality test, the probability value for the private gross fixed capital formation equation is higher than 0.05. The null hypothesis of a normal distribution is not rejected by the study, this implies that the error terms are normally distributed.

The Breusch-Pagan Godfrey test for heteroscedasticity further indicates that the error terms are homoscedastic, because the chi-square probability value is greater than 0.05. The null hypothesis of no heteroskedasticity is not rejected at 5% level of significance. The Ramsey RESET test that checks if the linear regression model was correctly specified as shown as the probability value that is greater than 0.05. This implies that the model has no specification errors.

4.7 Stability Tests

The stability of the coefficients was also tested using the cumulative sum (CUSUM) and the CUSUM of squares (CUSUMQ) of recursive residuals. Both the Cusum and the Cusum of the squares test presented in Figure 3 and Figure 4 reveals that, the estimated model is stable as the fitted lines lies within the 5% critical region.

Figure 3:CUSUM

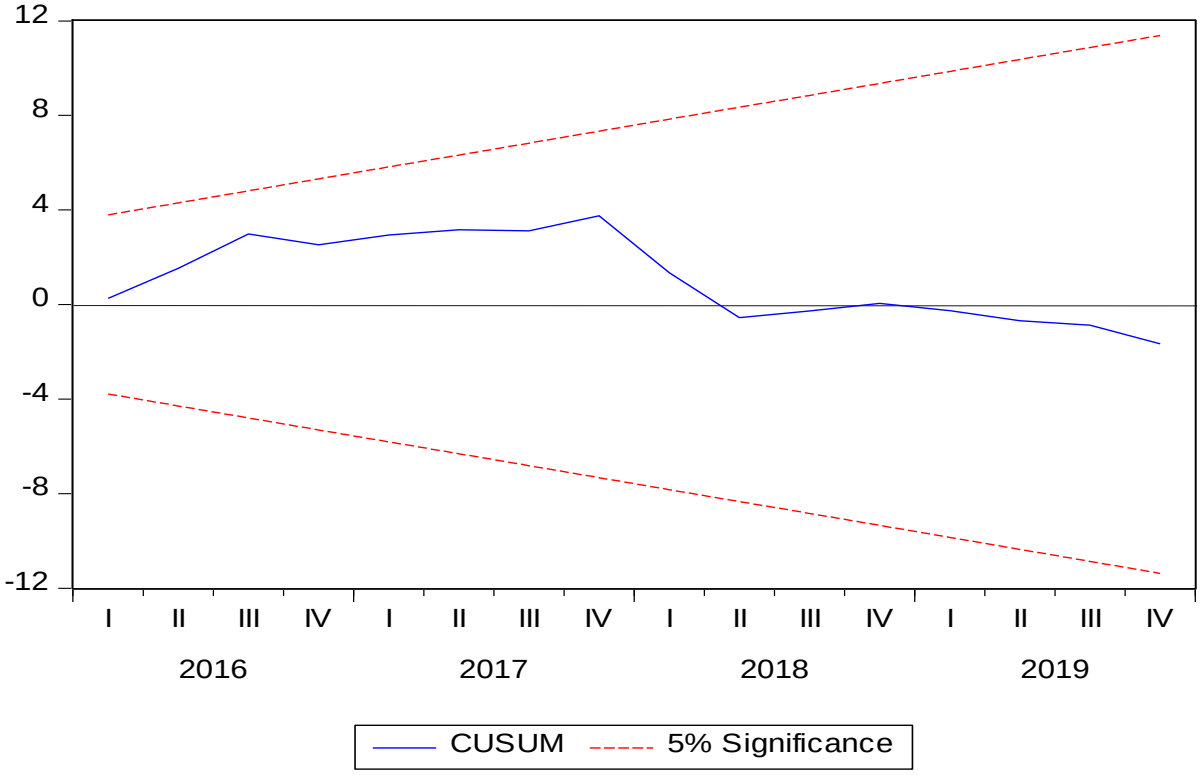
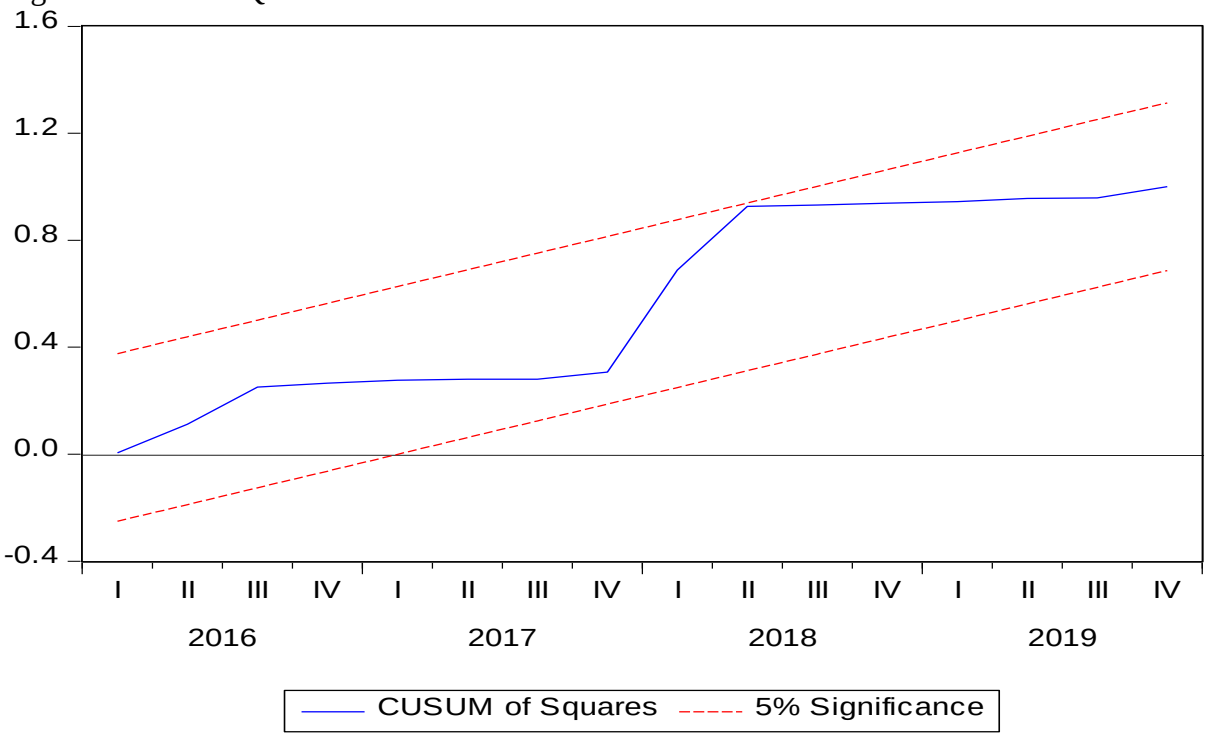


Figure 4: CUSUMQ



CHAPTER FIVE : CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The Namibian Sovereign Debt Management Strategy that was approved in 2005 governs the country's debt and this demonstrated the government's attempts to improve the country's debt management. The global economic crisis of 2008 caused the government to undertake a fiscal expansion and the debt-to-GDP threshold also increased from 25% to 35% in order for the government to implement countercyclical measures to cushion and shield the economy. Furthermore, prior to and during the global financial crisis, protracted periods of significant fiscal deficits contributed to the high debt levels. Debt is a key factor in determining the degree of private investment in a given economy, thus, when debt has a negative effect on private investment the level of private investment declines as a result of high debt levels.

The main thrust of this study is to analyse the relationship between public debt and private investment in Namibia using quarterly time series data for the period 2010Q1-2019Q4. The data used in the study was obtained from Bank of Namibia. The study revealed that in the short-run the previous period private gross fixed capital formation has a positive and statistically significant effect on the current private gross fixed capital formation. This finding concurs with studies by (Kamundia et al., 2015; Ozdemir & Gomez, 2020). Furthermore, the study discovered that domestic debt affects private gross fixed capital formation negatively in the long-run and is statistically significant at 5% level. Studies by Afonso and Jalles (2011); Putunoi and Mutuku (2013); Apere (2014); and Ebi and Imoke (2017) found a crowding in effect of private investment. Opposingly, Akram (2011); Asogwa and Chetachukwu (2013); King'wara (2014); and Ozdemir and Gomez (2020) found a crowding out effect between private investment and public debt similar to the finding of the current study. From a theoretical

centric-perspective the Classical school of thought is evident due to the crowding out effect. In the short-run however, domestic debt has a positive and statistically significant relationship with private gross fixed capital formation ceteris paribus at 5% level in the second lag. The study by Ozdemir and Gomez (2020) also found a positive short-run relationship between public debt and private investment.

In the same vein, interest rate was found to have a statistically significant negative long-run relationship with private gross fixed capital formation. The finding is in line with King'wara (2014); Akomolafe et al., (2015); and Ozdemir and Gomez (2020) that also found a negative long-run relationship between private investment and interest rate. From a theoretical standpoint, this evidence supports the Neoclassical View which asserts that high public debt as a result of budget deficits leads to higher interest rates and thus in turn reduces private investment. In the short-run interest rate have a statistically significant positive and negative relationship with private investment ceteris paribus. The finding of crowding-in of private investment partially concurs with (Ozdemir & Gomez, 2020). The continuous government borrowing from banks coupled with the huge outstanding domestic debt and the shortage of revenue could push up interest rates. The local banks would be willing to lend to the government at higher interest rates and this could result in the crowding-out of private gross fixed capital formation. The Keynesian, Ricardian Equivalence and other major contributions to the theoretical debate of the relationship between public debt and private investment do not exist in the case of Namibia for the period under review.

In regard to the causal relationship, the study found that private gross fixed capital formation does not granger cause domestic debt and domestic debt neither granger-causes private gross fixed capital formation. The finding is supported by Mabula and Mutasa (2019), however, Kamundia et al., (2015) found a reverse causal relationship from public debt to private

investment. A one-way relationship that is statistically significant at 5% level was found to exist between interest rate and domestic debt. On the contrary, Sabirin *et al*., (2019) found no causal relationship between interest rate and domestic debt. Also, external debt was found to granger-cause gross domestic product, while the gross domestic product did not cause external debt. However, Sijabat (2020) discovered that for Indonesia, gross domestic product granger - causes external debt.

A bi-directional statistically significant was found to exist between interest rate and private gross fixed capital formation. Alhakimi and Shama (2020) found a unidirectional causal relationship from interest rate to private investment. Equally, another bi-directional causal relationship was discovered between gross domestic product and private gross fixed capital formation respectively. This finding is supported by Ashipila and Haimbodi (2003), but partially as (Afonso and Jalles, 2011; Sijabat, 2020) found a unidirectional instead of a two-way causal relationship between gross domestic product and external debt.

5.2 Policy Implications

The results from the study conclude that there is a statistically significant negative relationship between public debt and private gross fixed capital formation in Namibia. Therefore, there is a need for proper debt management to support private gross fixed capital formation. The study, therefore, stresses the need for fiscal authority to continue to adhere to the consolidation policy measures so as to restore and strengthen long-run structural macroeconomic fundamentals and fiscal metrics. Notwithstanding these inevitable reforms, the study does acknowledge that the size of the private sector is relatively small and that the economy largely depends on public sector spending to drive growth. As such, these measures could potentially result in a significant slowdown in economic activity, particularly in the short-medium term, as was the case during the period 2016-2019.

The study found a positive long-run relationship between private gross fixed capital formation and external debt. Equally, a unidirectional relationship exist between external debt and private gross fixed capital formation and the relationship is statistically significant at 5% level. This implies that government could marginally increase its external exposure as far as borrowing is concerned. This is taking into account that external debt is vulnerable to external shocks such as exchange rate fluctuations, global interest rates all which have a bearing on debt service cost and sustainability. External borrowing, on the other hand, should be approached with caution to guarantee that it is sustainable.

The Namibian government through the newly established Namibia Revenue Agency could create new avenues to raise funds i.e., identify economic agents in the informal sector that may qualify to widen the tax base. This will reduce the reliance on domestic borrowing by the government.

5.3 Areas of Further Research

To the knowledge of the author, this study is the first of its kind to be carried in Namibia and invites further research to determine the optimal level of public debt in Namibia. This will aid determine the optimal level of public debt that promotes private investment which will inform government policy. This will be beneficial since government debt breached the threshold of 35%. Furthermore, this study suggests for further research looking at the non-linear relationship between public debt and private investment.

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APPENDICES

APPENDIX 1: STATIONARITY TEST

Appendix Table 1.1: PP Unit Root Test for LNPGFCF

Level: Intercept

Null Hypothesis: INPGFCF has a unit root

Exogenous: Constant

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.438385	0.5537
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Residual variance (no correction)	0.002600
HAC corrected variance (Bartlett kernel)	0.009021

Level: Trend and Intercept

Null Hypothesis: INPGFCF has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.766410	0.9602
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Residual variance (no correction)	0.001847
HAC corrected variance (Bartlett kernel)	0.005137

1st Difference : Intercept

Null Hypothesis: D(INPGFCF) has a unit root

Exogenous: Constant

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.846712	0.3531
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Residual variance (no correction)	0.000885
HAC corrected variance (Bartlett kernel)	0.000979

1st Difference: Trend and Intercept

Null Hypothesis: D(INPGFCF) has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.566159	0.2969
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Residual variance (no correction)	0.000802
HAC corrected variance (Bartlett kernel)	0.000809

Appendix Table 1.2: KPSS Unit Root Test for LNPGFCF

Level: Intercept

Null Hypothesis: INPGFCF is stationary

Exogenous: Constant

Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.235679
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.061430
HAC corrected variance (Bartlett kernel)	0.265411

Level: Trend and Intercept

Null Hypothesis: INPGFCF is stationary

Exogenous: Constant, Linear Trend

Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.215280
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.059193
HAC corrected variance (Bartlett kernel)	0.255538

1st Difference : Intercept

Null Hypothesis: D(INPGFCF) is stationary

Exogenous: Constant

Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.442582
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.002683
HAC corrected variance (Bartlett kernel)	0.009485

1st Difference: Trend and Intercept

Null Hypothesis: D(INPGFCF) is stationary

Exogenous: Constant, Linear Trend

Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.084607
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.001851
HAC corrected variance (Bartlett kernel)	0.005163

Appendix Table 1.3: PP Unit Root Test for LNDD

Levels: Intercept

Null Hypothesis: INDD has a unit root

Exogenous: Constant

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.274087	0.9739
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Residual variance (no correction)	0.002442
HAC corrected variance (Bartlett kernel)	0.005163

Level: Trend and Intercept

Null Hypothesis: INDD has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.578490	0.2916
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Residual variance (no correction)	0.002127
HAC corrected variance (Bartlett kernel)	0.004508

1st Difference: Intercept

Null Hypothesis: D(INDD) has a unit root

Exogenous: Constant

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.624016	0.0098
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Residual variance (no correction)	0.001938
HAC corrected variance (Bartlett kernel)	0.002015

1st Difference: Trend and Intercept

Null Hypothesis: D(INDD) has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.641709	0.0394
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Residual variance (no correction)	0.001924
HAC corrected variance (Bartlett kernel)	0.002048

Appendix Table 1.4: KPSS Unit Root Test for LNDD

Level: Intercept

Null Hypothesis: INDD is stationary
Exogenous: Constant
Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.876099
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.318207
HAC corrected variance (Bartlett kernel)	1.414923

Level: Trend and Intercept

Null Hypothesis: INDD is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.080909
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.009672
HAC corrected variance (Bartlett kernel)	0.030386

1st Difference: Intercept

Null Hypothesis: D(INDD) is stationary

Exogenous: Constant

Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.104775
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.002475
HAC corrected variance (Bartlett kernel)	0.005362

1st Difference: Trend and Intercept

Null Hypothesis: D(INDD) is stationary

Exogenous: Constant, Linear Trend

Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.056045
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.002396
HAC corrected variance (Bartlett kernel)	0.005036

Appendix Table 1.5 : PP Unit Root Test for LNEXD

Levels: Intercept

Null Hypothesis: INEXD has a unit root
Exogenous: Constant
Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.427942	0.8943
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Residual variance (no correction)	0.024357
HAC corrected variance (Bartlett kernel)	0.025837

Level: Trend and Intercept

Null Hypothesis: INEXD has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.708266	0.2390
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Residual variance (no correction)	0.020964
HAC corrected variance (Bartlett kernel)	0.028395

1st Difference: Intercept

Null Hypothesis: D(INEXD) has a unit root

Exogenous: Constant

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.561875	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Residual variance (no correction)	0.024119
HAC corrected variance (Bartlett kernel)	0.020571

1st Difference: Trend and Intercept

Null Hypothesis: D(INEXD) has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.474185	0.0003
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Residual variance (no correction)	0.024114
HAC corrected variance (Bartlett kernel)	0.020452

Appendix Table 1.6 : KPSS Unit Root Test for LNEXD

Level: Intercept

Null Hypothesis: INEXD is stationary

Exogenous: Constant

Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.855408
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.696278
HAC corrected variance (Bartlett kernel)	3.116185

Level: Trend and Intercept

Null Hypothesis: INEXD is stationary

Exogenous: Constant, Linear Trend

Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.081579
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.050654
HAC corrected variance (Bartlett kernel)	0.140560

1st Difference: Intercept

Null Hypothesis: D(INEXD) is stationary

Exogenous: Constant

Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.084571
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.024465
HAC corrected variance (Bartlett kernel)	0.025646

1st Difference: Trend and Intercept

Null Hypothesis: D(INEXD) is stationary

Exogenous: Constant, Linear Trend

Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.084510
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.024430
HAC corrected variance (Bartlett kernel)	0.025789

Appendix Table 1.7: PP Unit Root Test for LNGDP

Level: Intercept

Null Hypothesis: INGDP has a unit root
Exogenous: Constant
Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.079621	0.7142
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Residual variance (no correction)	0.002649
HAC corrected variance (Bartlett kernel)	0.001352

Level: Trend and Intercept

Null Hypothesis: INGDP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.975333	0.5962
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Residual variance (no correction)	0.002420
HAC corrected variance (Bartlett kernel)	0.002256

1st Difference: Intercept

Null Hypothesis: D(INGDP) has a unit root

Exogenous: Constant

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.487084	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Residual variance (no correction)	0.002718
HAC corrected variance (Bartlett kernel)	0.001794

1st Difference: Trend and Intercept

Null Hypothesis: D(INGDP) has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.610693	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Residual variance (no correction)	0.002679
HAC corrected variance (Bartlett kernel)	0.001602

Appendix Table 1.8: KPSS Unit Root Test for LNGDP

Levels: Intercept

Null Hypothesis: INGDP is stationary
Exogenous: Constant
Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.872653
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.087763
HAC corrected variance (Bartlett kernel)	0.390812

Level: Trend and Intercept

Null Hypothesis: INGDP is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.169329
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.005240
HAC corrected variance (Bartlett kernel)	0.016765

1st Difference: Intercept

Null Hypothesis: D(INGDP) is stationary

Exogenous: Constant

Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.166936
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.002727
HAC corrected variance (Bartlett kernel)	0.001415

1st Difference: Trend and Intercept

Null Hypothesis: D(INGDP) is stationary

Exogenous: Constant, Linear Trend

Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.094482
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.002703
HAC corrected variance (Bartlett kernel)	0.001282

Appendix Table 1.9: PP Unit Root Test for IR

Levels: Intercept

Null Hypothesis: INIR has a unit root
Exogenous: Constant
Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.145146	0.2289
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Residual variance (no correction)	0.000580
HAC corrected variance (Bartlett kernel)	0.000843

Level: Trend and Intercept

Null Hypothesis: INIR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.818418	0.1996
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Residual variance (no correction)	0.000503
HAC corrected variance (Bartlett kernel)	0.000493

1st Difference: Intercept

Null Hypothesis: D(INIR) has a unit root

Exogenous: Constant

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.346730	0.0001
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Residual variance (no correction)	0.000650
HAC corrected variance (Bartlett kernel)	0.000712

1st Difference: Trend and Intercept

Null Hypothesis: D(INIR) has a unit root

Exogenous: Constant, Linear Trend

Bandwidth: 4 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.531892	0.0003
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Residual variance (no correction)	0.000622
HAC corrected variance (Bartlett kernel)	0.000684

Appendix Table 1.10: KPSS Unit Root Test for IR

Level: Intercept

Null Hypothesis: INIR is stationary
Exogenous: Constant
Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.296997
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.003397
HAC corrected variance (Bartlett kernel)	0.013096

Level: Trend and Intercept

Null Hypothesis: INIR is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.147570
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.002993
HAC corrected variance (Bartlett kernel)	0.010238

1st Difference: Intercept

Null Hypothesis: D(INIR) is stationary
Exogenous: Constant
Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.275546
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000643
HAC corrected variance (Bartlett kernel)	0.000848

1st Difference: Trend and Intercept

Null Hypothesis: D(INIR) is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Used-specified) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.172002
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.000613
HAC corrected variance (Bartlett kernel)	0.000711

APPENDIX II: OPTIMUM LAG SELECTION CRITERIA

Table 2: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: INPGFCF INDD INEXD INGDP IR
Exogenous variables: C
Date: 11/05/21 Time: 11:22
Sample: 2010Q1 2019Q4
Included observations: 36

Lag	LogL	LR	FPE	AIC	SC	HQ
0	28.32036	NA	1.88e-07	-1.295576	-1.075642	-1.218813
1	251.4846	371.9404	3.17e-12	-12.30470	-10.98510	-11.84413
2	292.3362	56.73832	1.43e-12	-13.18534	-10.76608	-12.34096
3	336.0948	48.62067	6.36e-13	-14.22749	-10.70856	-12.99929
4	389.4722	44.48118*	2.19e-13*	-15.80401*	-11.18542*	-14.19200*

* 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 III: ARDL BOUND TEST RESULTS

Appendix Table 3.1: Long-run Results

ARDL Long Run Form and Bounds Test
Dependent Variable: D(INPGFCF)
Selected Model: ARDL(2, 3, 3, 3, 4)
Case 2: Restricted Constant and No Trend
Date: 11/13/21 Time: 18:44
Sample: 2010Q1 2019Q4
Included observations: 36

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.171946	1.665874	0.703502	0.4919
INPGFCF(-1)*	-0.188380	0.083104	-2.266814	0.0376
INDD(-1)	-0.178038	0.100923	-1.764106	0.0968
INEXD(-1)	0.041102	0.059801	0.687322	0.5017
INGDP(-1)	0.284624	0.327791	0.868311	0.3981
IR(-1)	-0.082684	0.048334	-1.710683	0.1065
D(INPGFCF(-1))	0.514648	0.123242	4.175923	0.0007
D(INDD)	-0.095295	0.104176	-0.914748	0.3739
D(INDD(-1))	-0.031908	0.154070	-0.207102	0.8385
D(INDD(-2))	0.435749	0.138874	3.137717	0.0064
D(INEXD)	0.029435	0.030564	0.963058	0.3498
D(INEXD(-1))	-0.016832	0.043395	-0.387868	0.7032
D(INEXD(-2))	0.045573	0.038323	1.189165	0.2517
D(INGDP)	-0.054759	0.115650	-0.473486	0.6423
D(INGDP(-1))	-0.129280	0.168363	-0.767865	0.4538
D(INGDP(-2))	0.127038	0.106876	1.188648	0.2519
D(IR)	-0.036190	0.040993	-0.882826	0.3904
D(IR(-1))	0.052052	0.027391	1.900301	0.0756
D(IR(-2))	0.000437	0.025160	0.017364	0.9864
D(IR(-3))	-0.043800	0.021542	-2.033194	0.0590

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INDD	-0.945099	0.222779	-4.242317	0.0006
INEXD	0.218188	0.322502	0.676548	0.5084
INGDP	1.510902	1.367442	1.104911	0.2855
IR	-0.438918	0.096736	-4.537298	0.0003
C	6.221169	9.538767	0.652198	0.5235

EC = INPGFCF - (-0.9451*INDD + 0.2182*INEXD + 1.5109*INGDP -0.4389*IR + 6.2212)

Appendix Table 3.2: Short-run Results

ARDL Error Correction Regression
Dependent Variable: D(INPGFCF)
Selected Model: ARDL(2, 3, 3, 3, 4)
Case 2: Restricted Constant and No Trend
Date: 11/05/21 Time: 12:02
Sample: 2010Q1 2019Q4
Included observations: 36

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INPGFCF(-1))	0.514648	0.064865	7.934172	0.0000
D(INDD)	-0.095295	0.074127	-1.285557	0.2169
D(INDD(-1))	-0.031908	0.097115	-0.328562	0.7467
D(INDD(-2))	0.435749	0.093564	4.657237	0.0003
D(INEXD)	0.029435	0.018899	1.557463	0.1389
D(INEXD(-1))	-0.016832	0.019281	-0.872959	0.3956
D(INEXD(-2))	0.045573	0.019900	2.290044	0.0359
D(INGDP)	-0.054759	0.061301	-0.893275	0.3849
D(INGDP(-1))	-0.129280	0.066120	-1.955226	0.0683
D(INGDP(-2))	0.127038	0.047137	2.695115	0.0159
D(IR)	-0.036190	0.019468	-1.858891	0.0815
D(IR(-1))	0.052052	0.014816	3.513221	0.0029
D(IR(-2))	0.000437	0.015119	0.028894	0.9773
D(IR(-3))	-0.043800	0.013982	-3.132652	0.0064
CointEq(-1)*	-0.188380	0.035904	-5.246836	0.0001

R-squared	0.956450	Mean dependent var	0.004032
Adjusted R-squared	0.927416	S.D. dependent var	0.054502
S.E. of regression	0.014684	Akaike info criterion	-5.309825
Sum squared resid	0.004528	Schwarz criterion	-4.650026
Log likelihood	110.5769	Hannan-Quinn criter.	-5.079537
Durbin-Watson stat	2.142498		

APPENDIX IV: GRANGER CAUSALITY TEST

Appendix Table 4: Pairwise Granger Causality Tests

Pairwise Granger Causality Tests
Date: 11/05/21 Time: 11:25
Sample: 2010Q1 2019Q4
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
INDD does not Granger Cause INPGFCF	36	2.45777	0.0696
INPGFCF does not Granger Cause INDD		0.10627	0.9793
INEXD does not Granger Cause INPGFCF	36	4.35481	0.0076
INPGFCF does not Granger Cause INEXD		0.08281	0.9870
INGDP does not Granger Cause INPGFCF	36	4.08540	0.0102
INPGFCF does not Granger Cause INGDP		4.76520	0.0049
IR does not Granger Cause INPGFCF	36	3.75763	0.0148
INPGFCF does not Granger Cause IR		3.16138	0.0297
INEXD does not Granger Cause INDD	36	0.54292	0.7056
INDD does not Granger Cause INEXD		2.66950	0.0537
INGDP does not Granger Cause INDD	36	0.83706	0.5137
INDD does not Granger Cause INGDP		1.38805	0.2645
IR does not Granger Cause INDD	36	3.56255	0.0185
INDD does not Granger Cause IR		1.32647	0.2855
INGDP does not Granger Cause INEXD	36	1.63962	0.1932
INEXD does not Granger Cause INGDP		4.09044	0.0102
IR does not Granger Cause INEXD	36	0.74074	0.5725
INEXD does not Granger Cause IR		0.39990	0.8069
IR does not Granger Cause INGDP	36	2.18729	0.0973
INGDP does not Granger Cause IR		1.28205	0.3016

APPENDIX V: DIAGNOSTIC TEST RESULTS

Appendix Table 5.1 : Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.414911	Prob. F(4,12)	0.7948
Obs*R-squared	4.373997	Prob. Chi-Square(4)	0.3578

Appendix Table 5.2: Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.895538	Prob. F(19,16)	0.5951
Obs*R-squared	18.55350	Prob. Chi-Square(19)	0.4858
Scaled explained SS	4.244018	Prob. Chi-Square(19)	0.9998

Appendix Table 5.3: Ramsey RESET Test

Ramsey RESET Test
Equation: UNTITLED
Specification: INPGFCF INPGFCF(-1) INPGFCF(-2) INDD INDD(-1) INDD(-2) INDD(-3) INEXD INEXD(-1) INEXD(-2) INEXD(-3) INGDP INGDP(-1) INGDP(-2) INGDP(-3) IR IR(-1) IR(-2) IR(-3) IR(-4) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.343007	15	0.7364
F-statistic	0.117653	(1, 15)	0.7364

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	3.52E-05	1	3.52E-05
Restricted SSR	0.004528	16	0.000283
Unrestricted SSR	0.004493	15	0.000300

Appendix Figure 1: Normality Test