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National debt and corruption: evidence from SADC

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NATIONAL DEBT AND CORRUPTION: EVIDENCE FROM SADC

A Research Report submitted in partial fulfilment of the Degree of

Master of Commerce (Applied Development Economics)

In the School of Economics and Finance,

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by

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DECLARATION

I declare that this thesis herewith submitted to the University of the Witwatersrand for the degree of "**Master of Commerce in Applied Development Economics"** has not previously been submitted by me or anyone else for any programme at this university. Therefore, the work belongs to me by execution and design and all sources that are used in this study are properly acknowledged.

Mr. Mashaba KM — February 2022

(Title)Surname and initials — **Date**

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The accomplishment of this thesis would not have been possible without direct and indirect contributions from others. Hence, I would like to acknowledge the following individuals and organisations for their positive advice and feedback.

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- I also want to thank my family for their continued support in making sure I achieve what I want.
- Finally, I want to thank all those who are not mentioned here who played an important part by offering me spiritual and mental support.

ABSTRACT

The national debt burden is an economic issue which gained attention from scholars, economists, and the society. Increased national debt emerged after the financial crisis nationally and internationally.

There are many academic studies that investigate the nexus between national debt and Gross Domestic Product. However, it is rare to find academic research investigating the role played by corruption on debt. Due to this gap in the literature, the thesis examines the impact of corruption on national debt in the SADC region from the year 1995 to 2020. The Johansen test results for cointegration shows that there is cointegration among the variables employed in this thesis. The results for ARDL Bound test confirms cointegration, meaning that there is a long-run nexus between the variables. The ECM is used to measure the speed of adjustment to check how quickly the variables converge back to equilibrium in the long run. The results shows that the market will correct itself in the long run. Other tests, such as stability diagnostic check, were conducted indicating that the residuals are normally distributed.

SADC countries are known to be rich in minerals, but they lack capital, therefore, this thesis recommends that, SADC countries should continue borrowing from financial institutions to finance capital accumulation. However, anti-corruption programmes must be strengthened to ensure that borrowing does not lead to subdued economic growth.

Keywords: Corruption, national debt, government deficits, SADC, economic growth, South Africa and ARDL

LIST OF ABBREVIATIONS

SADC:	Southern African Development Community
ARDL:	Auto-Regressive Distributive Lag
ADF:	Augmented Dickey Fuller
PP:	Phillips Perron
FDI:	Foreign Direct Investment
USD:	United States Dollar
ECM:	Error Correction Model
GDP:	Gross Domestic Product

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1. INTRODUCTION

The relationship between corruption and national debt has always been a concern for both policy makers and academics (Mohanty and Misura, 2016). This thesis seeks to investigate this relationship. In situations where certain countries rely deeply on national debt to finance investments and development projects, economic growth could be discouraged. Public sector corruption can influence national borrowing too. Evidence has indicated that corruption in general can affect the economy negatively. According to Mauro (1995), Mo (2001), and Tanzi and Davoodi (2002), corruption is negatively related to economic growth, it discourages investments, lowers Foreign Direct Investment (FDI), and restricts productivity. This negative impact on economic growth leads to foreign debt to attempt to improve the economy, therefore, encouraging external debt.

Numerous studies investigate the effect of national debt on Gross Domestic Product (GDP). Most of them find an adverse relationship between national debt and economic development. However, it is rare to find a study investigating the role played by corruption on national debt. Realising this gap in literature, I try to assess the effect of corruption on national debt. Shleifer and Vishney (1993) describes government corruption as the selling by state bureaucrats of property belonging to government for personal benefits. For example, state officials in most cases take bribes for providing public services, such as licenses and customs passage. Such acts are evident in the Southern African Developing Community (SADC).

The SADC launched the protocol against corruption whereby a SADC head of state or government are concerned about the disrupting effect of corruption on member states' economic, cultural, social, and political foundations. It noted that corruption is a serious issue that undermines good governance, which includes principles of transparency and accountability. There are corrupt public officials tempted to loot taxpayer's money, which forces the state to borrow more money to finance public goods and other services. Such acts will in the long run affect economic growth as huge funds are directed to debt servicing.

As mentioned in the South African National Development Plan (NPA), the key aim is to reduce inequality and poverty (vision 2030). To achieve that, debt service cost should be reduced so that extra funds can be directed to reducing poverty and inequality by, for example, creating employment, funding small businesses, especially black owned, and investing in education. Corruption can restrict the likelihood of reaching these objectives. Hence the motivation for this thesis to investigate corruption's relationship with national debt. At the end of this thesis, policy recommendations are provided following the empirical results.

SADC relies heavily on international borrowing to finance domestic expenditure. Because of this continuous borrowing, SADC countries use funds that should be directed to domestic development to finance their debt. But because of corruption in government, funds borrowed to finance development projects are used by officials for personal use. According to Black, et al., (2015), the public debt of South Africa, a SADC country, that was due at the end of 2013 was R1,561 billion, which represents 47 percent of GDP. This implies that if the South African government were to pay back that debt instantly, each citizen would need to pay a tax of R29 000 (Black, et al., 2015). Because of corrupt officials who are involved in policy making that affects the national budget, after looting taxpayer's money, more funds are borrowed from abroad to finance public goods and services, which jeopardises economic growth (Black, et al., 2015).

To consider the nexus between corruption and nation debt in the SADC region between 1995 to 2020 the thesis will

a) Investigate the extent of the impact between corruption and national debt in South Africa vis-à-vis the rest of SADC countries.
b) Assess the impact of Foreign Direct Investment on the economic development in South Africa as an example of SADC countries.

Very few studies conducted are focusing on the relationship concerning corruption and national debt and analysing the determinants of corruption. For example, Cooray, Dzhumashey and Schneider (2017) studied the impact of corruption on public debt using Ordinary Least Squares (OLS) employing panel data of 106 countries. The results found states that corruption contributes to an increase in national debt. Other studies on the relationship among corruption and national debt found that public sector corruption increases government debt, but the impact appears to be heterogeneous in income-related samples while powerful for developed countries (Benfrantello, Del Monte and Pannacchino, 2016). However, none of these studies analyse the role played by corruption on national debt especially in the SADC region. Analysing the roles played by corruption on national debt can assist policymakers, researchers, economists, and government officials to develop policies that would discourage corrupt activities and reduce national debt in the SADC region to ensure that development strategies in place are not affected by competition. This thesis will add to the existing literature by analysing those areas that are not analysed in other studies. The results of the thesis show that there is a positive relationship between corruption and national debt. This is confirmed by the ARDL Bounds test of cointegration showing a long run relationship between the variables. Although, measures are needed to deal with the positive impact of corruption on national debt.

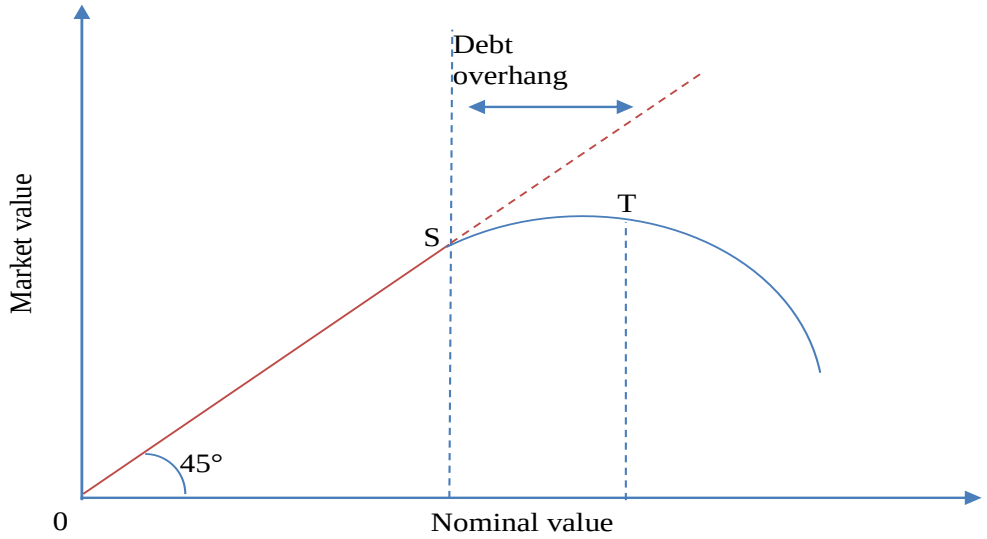
2. LITERATURE REVIEW

The relationship between corruption and national debt relationship has been investigated by different theories in the literature. Medeiros, Cabral, and Baghdassarian and Almeida (2005) states that in the past years national debt theories were focussed on the involvement of debt administration to stabilize macroeconomics. The size of corruption and national debt was a concern for creating constraints on the monetary policy. Borrowing is considered an alternative for taxes by government which allows for an increase in expenditure without immediate changes in tax rates.

Various definitions exist in research that evaluate the relationship between national debt and growth of the economy, but the debt overhang is the most common one. This theory was discussed first by Myers in 1977. His concept was grounded on a country's decision to borrow. This theory was later linked to the situation of debt by other writers such as Krugman (1989) and Sachs (1989) and the ability of a country to honour debt servicing obligations and the benefits of debt relief on a creditor who receives payment. The occurrence of debt overhang is due to external debt stock in a country exceeding the ability to repay with future possibilities of increasing debt servicing depending on the output level of a country. Therefore, servicing the debt is considered as an implicit tax, which discouraging investment and prevents growth in the economy making it difficult for countries which are highly indebted to eliminate poverty. Pattilio (2002) indicates that the hypothesis proposes that if there is a possibility of larger external debt in the future greater than its ability to repay the debt, the expected costs needed to service the debt will demoralize both foreign and domestic investment and damage the economy. The Laffer curve can be used to explain the occurrence of debt overhang. The burden of servicing the debt leads to an increase in tax rates in the future on the private sector, which discourages private investment. Funds which are meant for investment activities are used to finance the debt.

Figure 3.1 shows the debt presented on a Laffer curve. The curve, as stated by Sachs (1989) and Krugman (1989), explains the relationship between market value and face value of debt repayments that are expected. The vertical axis measures the current value of payments that are projected by creditors and the horizontal axis measures the nominal face value. Creditors expect that, at low external debt levels, the nominal claims will be serviced in full. The value of debt will lie along the 45-degrees line. When the levels of debt are high, the probability of partial repayments increases as the country has less incentives to invest; a fall in the value of the market is below the 45-degree line.

Figure 2.1: Debt Laffer curve.



Source: Claessens (1990)

The slope of line 0S will have an adverse relationship with the outstanding debt amount and it will decrease at an increasing rate below one when debt rises. The 0S line represents the ratio of expected repayment to nominal debt. When the debt overhang reaches point T, and the nominal debt acts as a significant deterrent to the borrower's efforts to change, modify, and invest, the market value of external debt begins to fall as the face value of debt rises. The theory prescribes that the best time to reduce debt is when the debt of the country is beyond point S before it reaches point T. So, at point S it is guaranteed that both the creditor and the debtor will benefit. Meaning the debtor country will pay less debt at that point and the value of the debt to the creditor will increase.

The Keynesian theory believes that a rise in government expenditure encourages economic activities domestically and crowds-in private investments (Biza, Kapingura and Tsegaye, 2013). The Keynesian theory of national debt claims that a rise in government spending is associated with high national production, which leads to creation of jobs in the economy (Makin, 2015). Nevertheless, money available for investment may be crowded-out by rising

government spending. To fill the saving gap in investment, the Keynesian framework suggests that Foreign Direct Investment should be attracted as well as foreign aid. However, Ncanywa and Masoga (2018) indicates that the Keynesian model shows that high levels of debt raise taxes which contradicts the positive impact of government expenditure by lowering investment,

reducing spending, lowering job creation, and decreasing the economic growth rate. Proper policies can be created by government to ensure that national debt is used for investing in the production of useful goods and services that could raise national income and economic development. Putting measures in place to deal precisely with corruption will ensure that national debt impact economic growth positively.

Classical theory of debt states that national debt would unnecessarily impose a burden on the shoulders of the citizens. According to Ricardo, national debt is one the most terrible sources of finance which was implemented to put stress on the nation. David Ricardo made an important point stating that the burden of the national debt is a continuing interest transfer of each year which leads to a loss of original capital. To cover the interest due on national debt, taxes must be increased. This leads to capital flight to other countries if taxes are directed to paying the interests due on national debt and weakening the currency. According to Smith (1937), national debt retards the national progress towards growth and accumulation of wealth. Furthermore, Smith (1937) proposed balancing the national budgets, whereby government spending is financed by taxes. Justifications can be provided for budget deficits to exist during emergencies and in unavoidable situations, such as natural disasters and wars.

Njimanted and Mukete (2013) indicates that public investment will discourage private investment if government raises its investments in the economy using external debt and increasing taxes. Kustepeli (2005) argues that using external debt to fund public investment will gutter the market's liquidity. Rising budget deficits must be joined with increasing taxes in the future. Therefore, future taxes are expected to finance public investments that are currently financed by national debt. The expectation of increasing taxes in the future by economic agents causes the interest rate and private investment to remain unchanged.

With an overview of debt theories into place, we can now consider theories of corruption. The principal-agent theory indicates the roles of individual decisions about whether to oppose or engage in corruption, the impact of transparency, sanctions and monitoring of decisions that could relate to corrupt activities. The theory specifically deals with the relation between corruption and GDP. This theory is known by anti-corruption programmes that are in place to prevent corruption activities. It helps us understand how corruption affects development programmes as well as economic growth. It originates from theories of the firm, in which the investor was the classical principal who did not have much confidence in the stockbroker. There are two assumptions which the principal-agent hinges on: the principal and agent have different opinions: and the principal has less information than the agent (information asymmetry). Because

of information asymmetry, it becomes difficult for the principal to monitor the moves of the agent, and therefore, the agent has an incentive to pursue their own interest (Ross, 1973; Harris & Raviv, 1979).

Marquette and Peiffer (2015) describe corruption as a double principal-agent problem. In the first place, a leader of a political organisation, known as the principal, has duties, among others, to monitor the actions of agents (bureaucrats) so that they can be held accountable. Another principal-agent problem happens when state bureaucrats or politicians are understood to be agents and the public is conceptualized to be the principal. Looking at corruption through a principal-agent clearly states the rational choices of individuals that are happening in secret leading to corruption. This view suggests that corruption can be solved by putting in place policies that change the extent to which the principal sanctions and monitors the agents. Anti-corruption programmes are designed to reduce the discretion of public officials, improving monitoring systems, encouraging transparency in government, encouraging civil society to form anti-corruption programmes and act as watchdogs and putting in place preventive measures to stop those who engage in corruption activities. The answer provided to the question of "why the results of anti-corruption programmes has been bad" is the fact that these programmes are created on a theoretical misinterpretation of the nature and the roots of corruption, meaning the principal-agent theory failed to provide feasible answers to the issue.

In the past decade developing countries have shown effort to fight corruption. This move received the support and attention of various institutions and programmes such as aid agencies, reform projects, anti-corruption programmes. Various authors states that despite the effort to reduce or eliminate corruption in developing countries, corrupt countries are still considered to be corrupt like they were before anti-corruption initiatives (Hough, 2013; Persson, Rothstein & Teorell, 2013). The principal-agent theory as discussed above was criticized by several authors (for example, Rothstein and Teprell, 2013) with a view that corruption should be viewed as a collective action problem.

The collective action theory of corruption is associated with the production of public goods. Public goods are non-excludable and non-rival. People who benefit from these goods are called free riders because they did not contribute anything towards their production. The issue of free riding is what is associated with collective action problem (Ostrom, 1992). Ostrom (1992) argued that when people cannot be excluded from benefiting from collective, this reduces the incentive for those people from contributing to the production of that collective benefit. People will always choose to free ride if they know that even if they do not contribute to the production of that

collective benefit, they can still enjoy those benefits especially when they know their contribution will be enjoyed by other people who did not contribute anything.

The free riding phenomenon is related to the collective action problem. The collective benefit of public goods is not provided to the maximum if there is free riding. If everyone decides not to contribute to the production of public goods and everyone free rides, the collective action benefit never occurs. In the case of a public good, which limits the number of users, abundant free riding can deplete the public good in question which will in the long run affect negatively all users of that good.

Seeing corruption in this perspective indicates the collective as opposed to individual nature of corruption and the challenges that are faced by various anti-corruption initiatives in altering the distrust levels in society and standards that strengthen tenacious patterns of systemic corruption.

Applying the collective action theory to corruption demonstrates that free riding as the motivation for taking part in corruption activities is normally portrayed as influenced by putting personal interest before collective interest of a larger group. The collective benefit of a group in this instance can be seen as being concrete. The decision to participate in corrupt activities robs the group from having an environment with no corruption or government of good quality. According to Rothstein (2011), a government of good quality is known to have tangible health and economic results, it is also associated with attractive foreign investments and developing its infrastructure. Corruption is known to be associated with depleting physical resources, it can cause a country to be bankrupt or better lessen its ability to produce public goods. In this case one can view collective action as being the percentage of government funds which are allocated for service delivery, and free riding being an engagement in corrupt activities which reduces the ability of the state to provide public goods and services to its citizens.

Let us now turn to the empirical literature by looking at the roles played by corruption on national debt in the SAD region.

The historical record indicates that corruption existed in all colonised countries before they gained independence and even in countries where democratic regimes were not present such as South Africa and other developing countries on the African continent (Makhumbe, 1999).

According to Sequeira, (2015), a rapid increase in national debt has led to policy makers, economists, academics, and citizens of SADC countries to engage in debate about the impact of national debt and whether the borrowed funds are used for their intended purposes. Policymakers believe that national debt causes subdued economic growth, especially in developing countries

(Bonga, et al, 2015). However, in most cases, subdued economic growth persuade countries to borrow more funds which becomes difficult to pay back in most cases. Many studies that try to investigate the relationship between national debt and corruption did not deal with the causality of national debt and corruption, especially after apartheid, hence the data used in this study span from 1995 to 2020. The a priori expectation of these two variables is that they have a positive relationship, but the causality relationship is not fully investigated.

A rapid increase in corruption activities especially in developing countries has led to a debate by politicians, economists, academics, and members of the community. Makhumbe (1999) states that corruption existed in all colonized countries before they gained independence and in countries where there was no democracy like South Africa (during colonialism and apartheid). Corruption activities take place in the dark, meaning they happen where there is a lack of transparency. Until today developing countries, particularly those in the SADC region, are still fighting the issue of public sector corruption. Government is the organisation responsible for the management of public funds through National Treasury. Corruption in most developing countries takes place in the public sector by the same officials who are responsible for proper management of funds. Due to low economic growth levels, developing countries are induced to borrow more funds to cover their budget deficits gap. Because of corruption, these funds are not used for their purpose, which makes it difficult to pay back the loan (Bonga et al., 2015). This is supported by various studies discussed below.

Many studies have disregarded the question of national debt in many countries focusing specifically on SADC, which is the main issue affecting economic development (Nanti and Erickson, 2016). Benfratello, Del Monte and Rannacchino (2016) states that when political stability exists in a country, public debt is reduced. They further indicate that an impact on corruption varies by levels of income in that country. Their study employed panel data from many countries over the period 1995 to 2015 to investigate the impact of corruption on national debt and found that corruption leads to a rise in national debt. The paper continued by suggesting the policy that improving measures used to fight corruption in the public sector can help achieve a significant decrease of sovereign debt.

There are three ways in which corruption can affect national debt. First, Del Monte and Papagni (2001), Marco (1995) and Mo (2001) state that corruption reduces the rate of economic growth which further increases the level of national debt. For example, the ability to service the debt is the key factor to national debt. Servicing debts with high levels of corruption can discourage

investments at the same time stifling economic growth, which makes countries which are highly indebted to move away or to combat poverty. Secondly, corruption affects national debt through revenue and expenditure. Public spending prices can be inflated by corrupt officials for their own personal and selfish gains. Prices are set above the market prices, paying more to produce public goods and services (Tanzi and Davoodi, 2002). This includes awarding tenders to families and friends without proper and fair process taking advantage of inflated prices. Poor quality of public goods and services is realised by communities due to cost cutting, sacrificing quality and the welfare of the people.

Kim, Ha and Kim (2017) investigated the impact of corruption on the national debt and economic growth relationship after noticing the gap in this line of research. For their study they estimated the pooled (OLS), the generalised method of moments (GMM) model and fixed effects models using data from 77 countries spanning from the year 1990 to 2014. Their empirical results indicate that the interaction term between national debt and corruption is significant which confirms the a priori expectation of the relationship between national debt and economic development that it is caused by corruption. They also state that countries that are not corrupt realise economic growth due to national debt. These results show the necessity to consider the issue of corruption when evaluating the effect of national debt on economic development. Many countries witnessed an increase in national debt levels after the previous economic crisis which forced officials to come up with strategies to sustain the economy. Many ideas were proposed, and borrowing was one of them to finance budget deficits, infrastructure development, to continue providing services to the people and to pay the labour force. Kim, Ha and Kim (2017) argue that an increase in national debt particularly after the 2007/2008 crisis was due to nationalisation of public debt. Their paper is known to be the first study that divulges the moderating impact of corruption on national debt and economic growth. Many studies have

recognised the significance of corruption globally and therefore, there are many studies investigating the importance of corruption coupled with other variables. Many of these studies investigate the impact of corruption on economic growth and many of them obtain negative results from this relationship. Other studies indicates that corruption lessens investments and FDI. It is also known that corruption can harm the economy through inflation and activities taking place in the shadow economy. It is therefore important to discourage the shadow economy. Corruption can also discourage the collection of taxes through tax avoidance and conducting informal markets. This will in the long run lead to excessive levels of budget deficits. When assessing this impact, it is important to consider another variable that is associated with

corruption: government expenditure. Kim, Ha and Kim (2017) examine the mechanisms of government expenditure and indicates that corruption reduces expenditure levels on education and health care services. Many items of government expenditure are attractive to illegal activities and bribes, which leads to corruption in the public sector. Corruption reduces government expenditure, which in developing countries affects mainly poor people.

Various authors view corruption as a lubricant for efficiency, saying that in government, corruption acts as a mechanism to soften red tape and hard regulations to get things done and to deliver services to the people. It is thus clear that corruption is viewed differently by various authors. Mo (2001) conducted a study about the impact of corruption on economic growth using OLS estimates and found that a 1% rise in corruption causes a 0,72% reduction in economic growth. Using a different expression, a 1 unit rise in the corruption index leads to a reduction in economic growth by 0,54 percentage points.

However, various studies show a positive effect of corruption on economic growth. According to Leff (1964), corruption has a tendency of minimising bureaucratic red tape while at the same time boosting economic growth. A reduction of administrative processes especially in the process of government spending by corruption, causes economic growth. One can argue that this will discourage fairness because proper processes will not be followed and therefore services will not benefit those who need them most. In this case, corruption will cause uncertainties about government policy. Makoto, Mumvuma and Kadange (2020) investigated the impact of public debt structure and debt policies on the economic growth of some of the SADC countries. These countries are Zimbabwe, Tanzania, and Mauritius. They used the Markov-switching technique to evaluate the debt growth method for the period of 1990 quarter 1 to 2016 quarter 4. In Tanzania high external debt compared to domestic debt had a positive

impact. Tanzania in fact is one of the countries that performs best while Zimbabwe had a negative effect, which is a debt distressed country compared to Tanzania. In Mauritius, a country which depends on domestic debt, high levels of domestic debt compered to external debt had an adverse effect on economic growth. Therefore, in the SADC countries, policies are important when deciding on the source of funds to ensure that those funds are used for their intended purpose. To mitigate or discourage corruption activities, these policies should provide a framework that is effective and guided by the constitution so that officials can be held accountable. Del Monte and Pannacchio (2020) investigated the impact of corruption on public debt by assessing the macroeconomic implications of corruption. They employed a panel data od OECD countries spanning from 1995 to 2015. Their findings shows that there is a positive relationship between

corruption and public debt and the impact does not depend on government spending. It is estimated that public debt can be reduced by 2% in the short run if corruption is reduced by 50%. Ibrahim (2020) also investigated the impact of corruption on public debt and economic growth focusing on developing countries over the period of 1996 to 2018 by employing autoregressive distributed lag method to test for long run relationship between these three variables. The empirical results shows that corruption leads to a rise in debt to GDP ratio and in the long run, the relationship between corruption and public revenues and between corruption public expenditure have a positive impact on public debt. Ibrahim (2020) corruption curb economic growth in the long run.

According to Mumvuma and Kadange (2020) a mixture of overhang, debt switch and debt reduction can advance the forecast of the connection between debt and economic development, some SADC countries reduced their external debt stock and raised domestic debt after reaching a completion stage of HIPC initiative. Switching between domestic debt and external debt by SADC countries was a way of finding an efficient route for sustaining economic growth. Hausman (2004) suggests that, in economies where there is a crisis, the burden of foreign debt might decrease economic growth more than domestic debt using the exchange rate channel. Claims made by other literatures indicates that it doesn't matter if the public debt was issued domestically or externally, it might stimulate economic growth assuming that government spending is productive in countries with lower economic growth.

3. THE RELATIONSHIP BETWEEN CORRUPTION AND NATIONAL DEBT, AND DETERMINANTS OF CORRUPTION.

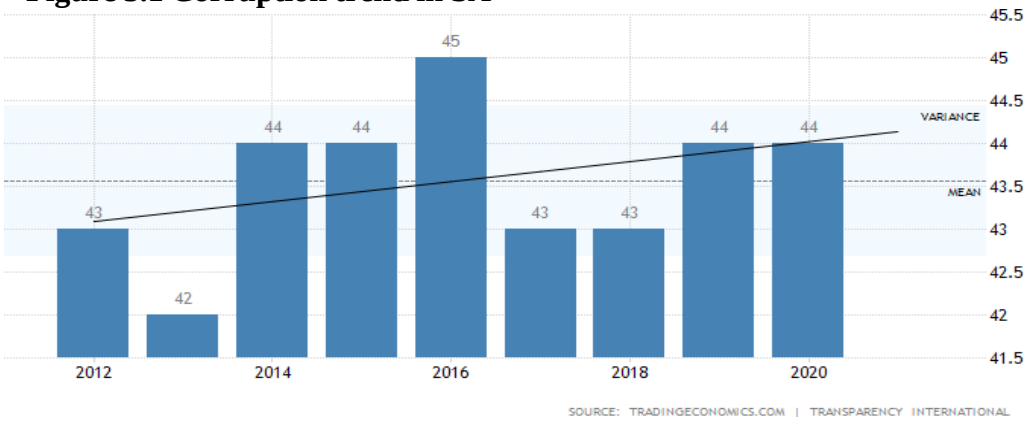
We begin the analysis by considering the role played by corruption on national debt on SADC region and its consequences on the economy.

The issue of corruption has brought different consequences within the political, social, and economic life. This phenomenon has been a major challenge that set back the South African economy and the rest of the SADC countries. Corruption happens in most cases in the public sector of the economy where government officials are having selfish personal interest: funds that are meant for the development of the economy are appropriated for private interest which includes awarding tenders to friends and family without proper procedure. For example, many African National Congress (ANC) members, Ministers and even those in the top six of the ANC leadership are implicated for engaging in corrupt activities. Most of these funds are borrowed from abroad and they must be paid back with interest. Therefore, persistent levels of corruption make it difficult to pay back the loans. This section compares the level of corruption in South Africa with other selected SADC countries.

To compare these trends among SADC countries, data from Transparency International (TI) will be used. The Corruption Perception Index (CPI) has been the world pointer when it comes to corruption in the public sector. CPI provides annual indicators of the relative degree of corruption levels where different countries are ranked from around the world. The results on corruption are provided on a scale of 0-100, 0 being highly corrupt and 100 being less corrupt.

Figure 3.1 illustrates corruption levels in South Africa from the year 2012 to 2020. It shows that levels of corruption fluctuate each reporting year.

Figure 3.1 Corruption trend in SA



Source: Transparency International (TI), Corruption Perceptions Index

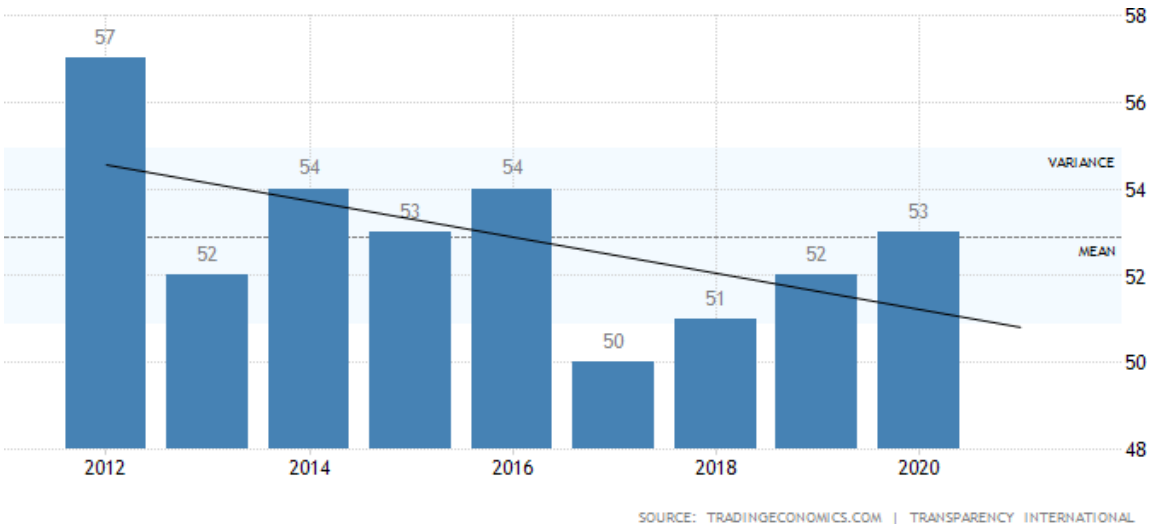
The horizontal axis indicates the year, while the vertical axis indicates the level of corruption in percent. South Africa's corruption score is 44 out of 100 as indicated by CPI and it is ranked 69 out of 180 countries. The trend over the period is upwards (Mean of 43.5) which indicates an improvement (the higher the score of the CPI number, the lower the perceived corruption).

The South African government has made a commitment to not tolerate corruption and to fight it in all sectors of the economy. To take a topical illustration, even during the COVID-19 pandemic various institutions were put in place to gather information used to fight corruption and fraud in the COVID-19 procurement of goods and services. The SIU (Special Investigating Unit was sanctioned to investigate corruption allegations and unlawful conduct related to COVID-19 procurement. The Commission of inquiry into state capture also plays a role in questioning individuals who are alleged to be involved in corruption relating to COVID-19 procurements. Testimonies made by individuals who appeared before the Commission has proved that the justice system for criminals in SA is weakened and compromised.

Corruption acts relating to COVID-19 procurement contracts has costed the government billions of rands of which some were borrowed from foreign financial institutions such as the IMF. Government is faced with pressure to recover all these funds. The 2021 Corruption Perceptions Index shows that graft levels have stagnated in South Africa for a decade.

Figure 3.2 represents corruption in Mauritius as one of SADC countries. It indicates a downward trend representing an increase in perceived corruption levels in that country. In 2012 corruption in Mauritius was ranked 57 out of 100 while in 2020 it was ranked no 53 which is an increase in perceived corruption levels. Still, compared to South Africa, Mauritius on the net a better perceived corruption ranking.

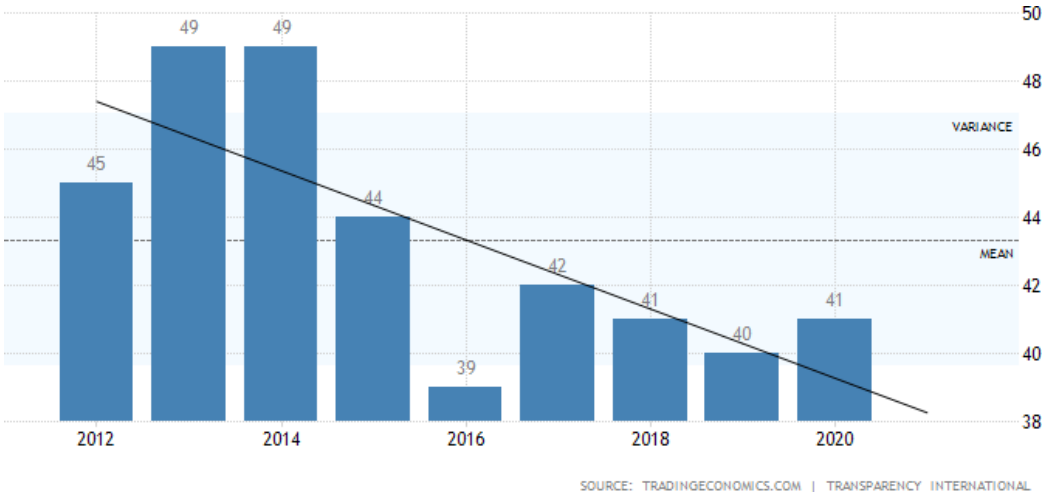
Figure 3.2 Corruption trend in Mauritius



Source: Transparency International (TI), Corruption Perceptions Index

According to Transparency International (TI), anti-corruption education and awareness should be prioritised. Jaunky et al. (2019) indicates that countries such as Mauritius are struggling to investigate or detect corruption activities because of lack of resources, agencies appointed to investigate corruption rely on public information regarding corruption.

Figure 3.3 Corruption trend in Lesotho



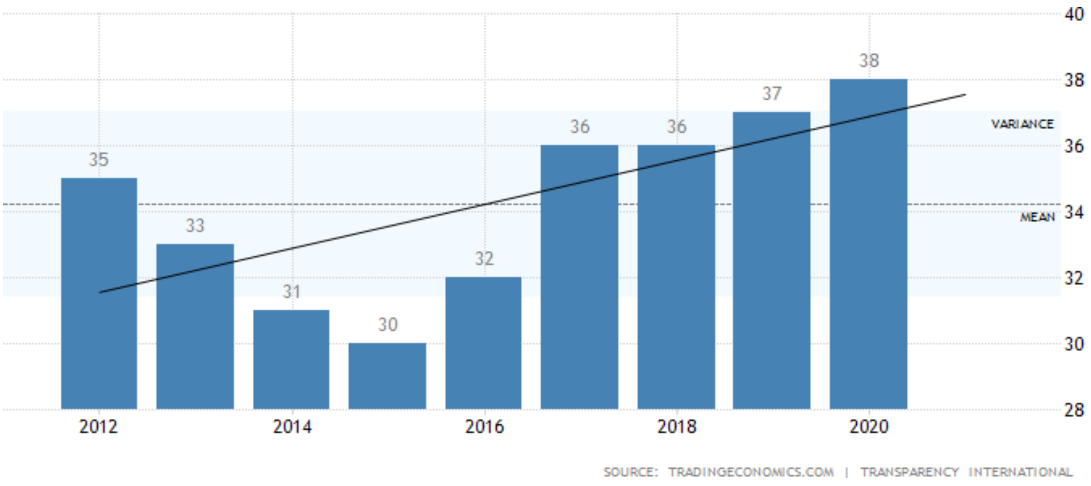
Source: Transparency International (TI)

From the year 2013 to 2020 Lesotho experienced a decrease in the level of corruption as indicated by figure 3.3 above from Corruption Perceptions Index.

Still, overall, compared to other countries, Lesotho has been doing well above other SADC

countries when it comes to fighting corruption. In 2016, however, Transparency International Corruption Perception Index reported a rise in corruption perceptions in Lesotho. Lesotho was ranked number 83 most corrupt state out of 176 other countries (Toeba, 2017).

Figure 3.4 Corruption in Tanzania



Source: Transparency International (TI), Corruption Perceptions Index

Figure 3.4 represents corruption levels in Tanzania from 2012 to 2020 as reported by TI. In 2015 Tanzania scored 30 out of 100, which is their highest level of corruption recorded between 2012 to 2020. From 2016 it started scoring highest numbers until it reached 38 in 2020 which is a good improvement and indicates better management of corruption activities. This shows

that anti-corruption methods implemented by the government are effective in maintaining corruption levels.

We begin by explaining in detail factors that can be considered as determinants of corruption, especially in developing countries. Glynn et al. (1997) states that no country or institution is immune to corruption. Corruption in fact affects the most important parts, such as the economy, politics, and other vital organs of the economy. The first step to take if you want to prevent corruption is to know what encourages people to take part in corrupt activities.

Income inequality in economic literature is known to be one of the determining factors of corruption in countries that are still developing. The theoretical relationship between income inequality and corruption comes from rent theory, in the context of this thesis, rent theory explains that people tend to engage in corrupt activities because of changes in their income and sometimes inability to afford basic goods and services. Empirically, the impact of income inequality is known to be U-shaped (Li, et al., 2000). Various studies show a significant positive

relationship between income-inequality and corruption, whereas others assert that there is no significant relation Brown et al. (2005). Financial decisions taken by government officials should address the issue of income inequality. If people feel like they are getting less than what they deserve, they will look for other means to cover the gap between their income and spending, which will lead to others engaging in corrupt activities.

Other authors argues that corruption and economic growth have a positive relationship because it enables firms and individuals to curb the inefficiencies of bureaucracies (Leff, 1964). However, many studies proved corruption to have a negative impact on economic development. Because it reduces the amount of labour in the economy (people are discouraged to look for work) and to decrease investment (Mauro, 1995; Mo, 2001).

Not being aware of negative externalities caused by corruption can also be a determinant of corruption. Denying the negative externalities of corruption is a conscious decision taken by individuals to justify their corrupt behaviour of engaging in corrupt activities. For example, when an employee steals from his or her employer, they do not consider the harm caused by their actions on those who benefit directly or indirectly from that organisation because they believe these organisations are insured or recover losses easily (Leff, 1964). Other factors such as social and personal norms can play a role in an individuals' decision to engage in corrupt activities. The level of education in a society can also be associated with corruption. A society that is educated cannot tolerate corruption and the negative externalities they cause. When people know their rights, possibilities of individuals to engage in corrupt activities is likely to be low. Unnecessary bureaucracies and centralized power of state officials can lead to corrupt activities. Authorities must be transparent in all their deeds and accountable for their actions will most likely reduce the level of corruption.

The national debt issue, especially external debt, has always been a significant for SADC countries. SADC countries are mostly in debt because they are still under development, they depend heavily on external borrowing to support their budget deficits. The following SADC countries are amongst those experiencing high levels of national debt.

a) **South Africa**- The South African external debt as a percentage of GDP accounted for 50.8% of the country's nominal GDP in 2020, when it was 47.8% in 2019. In the third quarter of 2021 the external debt was 165032 million USD. In December 2005, South Africa had a record low of 16.9% of external debt.
b) **Lesotho**- Lesotho's average external debt is 5931.44 million LSL from the year 1991

until 2021. In the third quarter of 2020. Lesotho's external debt reached an all-time high of 16409.27 million LSL and the lowest external debt ever recorded in the third quarter of 1991 of zero.

c) **Botswana**- external debt in Botswana reached 1.3 billion USD in March 2020 as compared to 1.4 billion USD in 2019. 2.0 billion USD is an all-time high external debt recorded in 2012 and a record low of 290.0 million USD.

d) **Tanzania-** the average external debt in Tanzania is 16947.68 million USD from 2011 to 2021, 28054.30 million USD was an all-time high reached in October 2021. A record low of 2469.70 million USD was reached in December 2011.

e) **Mauritius**- external debt in Mauritius has accounted for 2,062.5% of the country's nominal GDP, compared to 1,7396% ratio of external debt in 2019. The 2020 external debt ratio in Mauritius is a record high. The record low of 1,194.2% was accounted in December 2014.

f) **Mozambique**- the annual external debt data is provided by Bank of Mozambique. External debt in Mozambique reached an all-time high record of 95 billion USD in December 2017. Mozambique once recorded a record low of 2.8 billion USD in December 2018.

g) **Zimbabwe**- Zimbabwe's external debt has decreased to 13325 million USD in the year 2020 from 14324 million USD in 1019. It is expected that Zimbabwe's external debt would reach 20000.00 million USD by the end of 2021.

Table 3.1 Real Gross Domestic Product (% Change)

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
1. South Africa	3	3,2	2,4	2,5	1,4	1,3	0,7	1,2	1,5	0,1	-6,4
2. Lesotho	5,1	5,1	5,1	1,8	2,1	3,3	1,9	-2,7	-1	-1,5	-5,4
3. Botswana	8.6	6	4.5	11.3	4.1	-5,7	7	4	4	3	-8.5
4. Tanzania	6,4	7,9	5,1	6,8	6,7	6,2	6,9	6,8	7	7	4,8
5. Mauritius	4,4	4,1	3,5	3,4	3,7	3.6,	3,8	3,8	3,8	3	-14,9
6. Mozambique	6,5	7.4	7,3	7	7,4	6,7	3,8	3,7	3,4	2,3	-1,2
7. Zimbabwe	19.7	14.2	16.7	2	2.4	1,8	0,5	5	4.8	-6.1	-4.1

Source: Computation based on data from the IMF

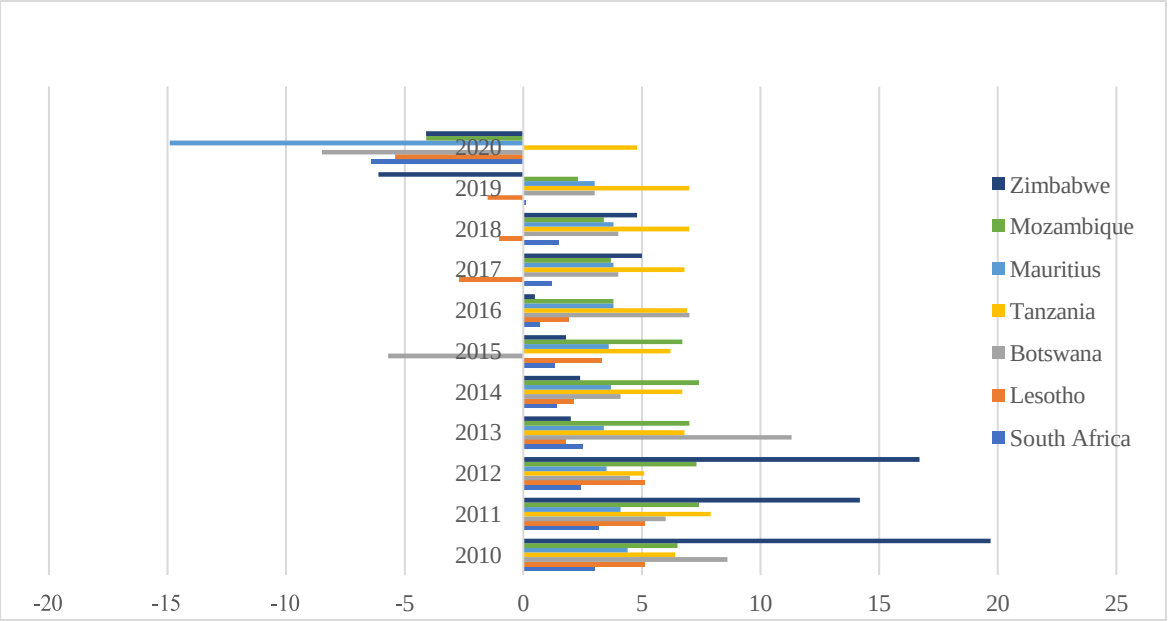
Table 3.2 General government gross debt (as a % of GDP) selected SADC countries

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
1. South Africa	31,2	34,7	37,4	40,4	43,3	45,2	47,1	48,6	51,6	56,3	69,4

2. Lesotho	34,1	36,4	39,8	41,2	41,3	45,6	40,4	39,9	49,6	50,6	50,4
3. Botswana	21,3	21,3	20	18,2	18,1	18,1	16,4	14,6	15,7	16,3	19,5
4. Tanzania	27,6	28,4	30	32,7	36,1	39,2	39,8	40,7	40,5	39	39,1
5. Mauritius	55,1	55,6	55,1	57,5	60,6	65	65	64,3	66,2	84,6	96,9
6. Mozambique	39,6	34,7	37,4	50,1	64,3	87,4	119,9	99,6	107,1	105,4	128,5
7. Zimbabwe	97,4	101,4	105,5	104	103,6	103,1	105,6	103,2	102,7	103,8	122,7

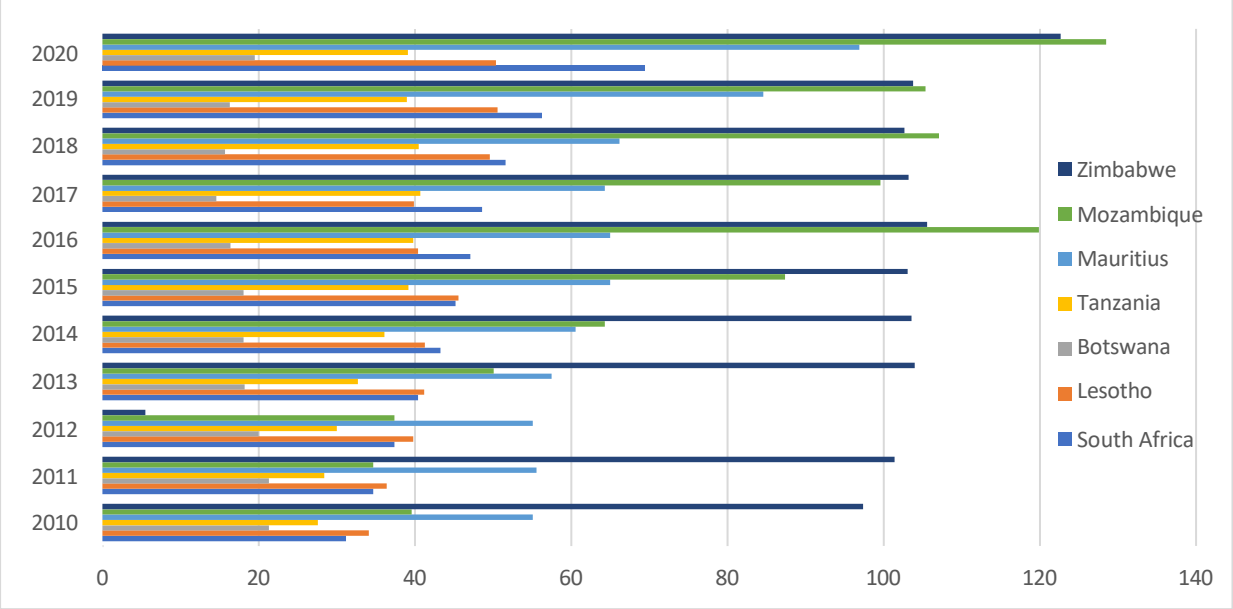
Source: Computation based on data from the IMF

Figure 3.5 Real Gross Domestic Product (as a % Change) selected SADC countries



Source: Author compilation (IMF data, 2021)

Figure 3.6 General government gross debt (as % GDP)



Source: Author compilation (IMF data, 2021)

Table 3.1 and figure 3.1 indicate the level of economic growth from seven selected SADC countries. Tanzania is a country which has been experiencing a rise in economic growth. From 2010 to 2012, Zimbabwe experienced high levels of economic growth. Tanzania is known to have the fastest growing economic growth in Africa with almost 7% annual national GDP since the year 2000. The worst performing countries in terms of economic growth are Lesotho and South Africa. Lesotho experienced negative economic growth for four consecutive years, 2017 to 2020. Even though South Africa is known to be the second largest economy in Africa, its economic growth, indicated in Figure 2.1, shows that, Botswana achieved better than South Africa.

Table 3.2 and Figure 3.2 presents the general government gross debt as percentage of GDP, which confirms that Mozambique is facing high levels of national debt. However, Zimbabwe is also facing high levels of national debt. National debt levels in Zimbabwe and Mozambique have gone beyond 100%.

This section proves that SADC countries are still faced with huge amounts of debt owed to foreign financial institutions. Discussing the level of debt and corruption in other SADC countries reveal that national debt and corruption harm economic growth and development. Countries with poor management of debt continues to borrow putting the burden on future generations.

4. METHODOLOGY

This section discusses the methodology used. The following variables will be used in this study: (GDP), National debt; corruption; and Foreign Direct Investment (FDI). FDI will be incorporated as an explanatory variable to eliminate omitted variable bias.

4.1. Data description

Secondary time series data is employed in this study. Yearly data spanning from the year 1995 to 2020 was collected from various institution's websites. Data for national debt and government deficit is sourced from the "South African Reserve Bank (SARB)", data for corruption is sourced from the Transparency Index (TI) and its proxy is Corruption Perception Index (CPI), data for "Foreign Direct Investment" (FDI) is sourced from the World Bank.

The method followed in this study is specified below, national debt being dependent variable is expressed as LNDBT, and the other three independent variables are also specified in the model.

4.2. Model specification

$$Yt = \alpha + \beta 1 + \beta 2 + \beta 3 + £t \quad (1)$$

$$LNDBT = \beta_1 LCPI_t + \beta_2 LFDI_t + \beta_3 LGBDF_t + \varepsilon_t \quad (2)$$

In equation (2), LCPI denotes corruption, LFDI denotes Foreign Direct Investment and LGBDF denotes government deficits. All variables used in this study are linearized using logarithms denoted by (L), hence log of national debt, log of corruption, log of FDI and log of government deficits. The a priori expectation is a positive relationship in line with the reviewed literature.

The procedure followed to estimate data starts by explaining unit root test, followed by cointegration test. This is followed by explaining Auto-Regressive Distributed Lag model (ARDL). ARDL Error Correction Model (ECM) will also be specified. The model is used to investigate the role played by corruption on national debt in the SADC region using yearly data spanning from the year 1995 to 2020.

4.1. Expected sign per variable

Model	Variable	Sign
Dependent variable	National debt	+
Control variable	Corruption	+
Control variable	Foreign Direct Investment	-
Control variable	Government budget deficits	+

Source: Author compilation

The initial step is to test for the unit root in the economic analysis of the time series data. The results can be presented formally and informally. The informal results for unit root test are presented in a visual form. The formal presentation of unit root test results can be explained by applying "Augmented-Dickey Fuller test and Phillips-Peron" test. The test for unit root is used to test for stationary of the data (time series). Another reason to conduct this test is to check if whether variables are integrated of the same order (Arltova and Fedorova, 2016).

Alam and Ahmed (2010) developed the following equation which is used to test for the occurrence of unit root using ADF.

$$\Delta Y_t = \beta_1 + \beta_2 t + \emptyset Y_{t-1} \alpha_i \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t \quad (3)$$

β_1 is constant on the equation, ε_t represents pure white noise error term.

The Phillips-Perron unit root test is used as a substitute to ADF unit root test to analyse time series data. ADF and PP deal with issues of heteroskedasticity and serial correlation differently. One of the advantages of using this test is that it does not consider functional form for the error process, meaning it applies to a very huge set of issues. Its drawback is that it depends on a huge sample to provide results that are reliable and therefore the performance will be poor when dealing with samples that are small in sizes. Phillips and Perron can be analysed using the following regression (Cheng and Annuar, 2012).

$$\Delta Y_t = \beta + \emptyset Y_{t-t} + \varepsilon_t \quad (4)$$

where

β equals the intercept, $\emptyset$ equals equilibrium parameter estimate, t equals trend variable or time, and ε is the disturbance term. The null and alternative hypothesis H_0: ΔY_t is stationary and H_1: ΔY_t is non-stationary respectively.

Following a test for stationarity using both ADF and PP assuming that all variables are integrated of the same order, Johansen cointegration test is conducted. The Johansen and Juselius cointegration test are undertaken between each variable in the relationship between corruption

and national debt. It is *"a maximum likelihood method that determines the number of cointegrating vectors in a no-stationary time series Vector Auto Regression (VAR) with restrictions imposed, known as vector error correction model VEC"* (Johansen and Juselius, 1990, pp169-210). The test needs the establishment of the Autoregressive Lag length (AR). To estimate the lag length which is usually denoted by p (Lag length p), different criteria to estimate lag length are used. They include Schwarz Information Criterion (SIC), Hannan-Quin Criterion (HQC), Aike's Information Criterion (AIC) and Final Prediction Error (FPE). Liew (2004) is the founder of HQC, which is the best criterion in identifying the lag length than the rest of the criteria for large observations of 120 and more. AIC and FPE are the better choice when working with smaller samples.

Autoregressive Distributive Lag approach (ARDL) was developed by Peseran and Shin (1995) before it was further revised by Peseran, Shin and Smith (2001). This method is used to examine the long run nexus in the variables. There are other alternative estimation and methods to test for hypothesis for I(1) variables, such as Engle and Granger (1987), but the ARDL approach is preferred because it can estimate the long run and short run constraints of the method among at the same time (Oyinlola et al., 2010). The ARDL method is applicable to variables that are "stationary at level I(0)" or variables that are "stationary at first difference I(1)". Therefore, this study will employ ARDL technique to evaluate the long-run and short- run nexus between variables. The nexus between variables when employing the ARDL method can be explained using the following regression:

$$Y_t = \emptyset + \alpha Y_{t-1} + \beta_0 X_t + \beta_1 X_{t-1} + \varepsilon_t \quad (5)$$

Where Y_t and X_t represents the dependent and independent variables and the present values of the variables from the previous periods.

Autoregressive Distributive Lag test for cointegration using bounds test is related to the F-statistic test (Wald-test). There are two important values for the ARDL cointegration test (Peseran and Shin, 2001). In the critical values bounds test, the lower bound critical value assumes that all variables are integrated at level I(0) which means that cointegration relationship does not exists in the examined variables and the upper bound critical value assumes that the variables are integrated at the first difference I(1), which shows the existence of cointegration between variables. If the value of F-statistic is more than the upper bound critical value, then the null hypothesis H_0 cannot be rejected, which means that cointegration exists in the variables. But if the F-statistic value is less than the critical value of the lower bound, then the null hypothesis

H_0 cannot be rejected, meaning that cointegration does not exists between the variables. If the value of the F-statistic is between the lower bound value and the upper bound value, then the results are uncertain, and therefore the relationship among the variables will not worked out.

Table 4.1 indicates the null hypothesis (H_0) when cointegration does not exist and the alternative hypothesis (H_1) when cointegration exists.

Table 4.1: Null Hypothesis (H_0) and the alternarive hypothesis (H_1)

Method	Null-Hypothesis (H_0)	Alternative Hypothesis (H_1)	Function
Equation	H_0: $\beta_1 = \beta_2 = \beta_3 = 0$	H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq 0$	LNDBT, LCPI, LGBD, LFDI

The F-statistic is meant to examine the hypothesis where there is no cointegration in the variables, against the variables which has no cointegration shown as:

$H_0 = \beta_1 = \beta_2 = \beta_3 = 0$

The above equation indicates that there is no cointegration in the variables.

$H_1 = \beta_1 \neq \beta_2 \neq \beta_3 \neq 0$

While the above indicates the existence of cointegration between variables.

The thesis uses ECM to test for the speed of adjustment. This method is also used to test how quick the variables converge back to the equilibrium in the long run. The equation below expresses the ARDL version of the Error Correction Model for national debt.

$$LNDBT_t = \beta_0 + \sum_{i-1}^{q} \beta_1 \, iLNDBT_{t-i} + \sum_{i-1}^{r} \beta_2 \, iLCPI_{t-1} + \sum_{i-1}^{s} \beta_3 \, iLGBD_{t-1} + \emptyset ECT + \epsilon_t$$

$\emptyset$ denotes the speed of adjustment and ECT represents the Error Correction Term.

Jung (1986) states that the objective of every empirical study using econometrics methods is to examine the causal relationship between variables. It is vital to forecast the usefulness of time series in empirical econometrics. Granger causality is used to determine the robustness of the results by predicting the causal relationship between variables. Granger causality can measure the occurrence of events happening after each other among variables and it is used to predict such events before they happen (Stern, 2011). The reason for causality test is to determine the reaction between variables, and to find out if there is correlation between the paired data or not (Mohd,

Nor and Hussain, 2012). To test for short run causality between variables, Wald test is used as a complementary test for causality.

The following test statistics are used in the econometric model: cointegration test, VECM, Wald test and Granger causality. These test statistics are not valid if there is contemporaneous among errors and regressors when estimating the model (Ekaterini, 1988). Therefore, it is important to do a diagnostic test between the variables such as correlation and heteroskedasticity. Diagnostic and stability testing is important to avoid the probability of getting spurious results.

Serial correlation is the most popular tool used for data analysis because it is always relevant in many situations. Even though this is the case, decisions taken from fitted methods can be affected by various risks. These risks are considered vital in applied econometrics. The risks contain the following: serial correlation, heteroskedasticity variations in coefficients and omitted variables. To solve serial correlation, Griliches (1961) proposed a usage of distributive lag model to increase Durbin-Watson and decrease serial correlation statistics.

The existence of serial correlation in the model means that something is not incorporated in the model (Griliches, 1961). It is important to deal with the issue of serial correlation to determine economic reasons behind it. When conducting research, it is important to eliminate serial correlation by determining its cause.

Griliches (1961) states that the term heteroskedasticity is used to describe a situation whereby adjustment of the residuals from a model is not persistent. A diagnostic test is applied to test for heteroskedasticity in disturbance autocorrelation in time series model.

Four tests are used to test for heteroskedasticity, namely: White test, Breusch-Pegan-Godfrey test, Hervey test and Glejser test. The White test is a special case for Breusch-Pegan to test for heteroscedasticity which is used on non-linear model of heteroskedasticity on non-linear model of heteroskedasticity (Williams, 2015). The Breusch-Pegan-Godfrey test is applied to test the null hypothesis which says that the error variance is all equal compared to the other. Breusch- Pegan-Godfrey test is applied to check for heteroskedasticity in the time series with White test. Harvey and Glejser are the two tests which will be used to confirm and complement results from Breusch-Pegan-Godfrey and White test. Sometimes heteroskedasticity is caused by improper specification of the model.

The a priori expectation depends on the type of methodology used in the study (Bilan and Ihnatov, 2015). It can also be influenced by various factors affecting the dependent and

independent variables. Agreeing with this, is Benfratello, Del Monte and Pannacchio (2017) indicating that the effect of corruption and national debt seems to be heterogeneous in income related sample splits. They also highlight that political instability can increase debt levels at the same time increasing levels of corruption. The priori expectation in this study is that national debt would be positively affected by corruption.

This section explains the methodology used in this thesis. To test for unit root, ADF and PP were used before specifying the model to test if the time series data is stationary. The test for unit root helps to determine if Johansen cointegration test can be used or not. Unit root test ensures that the correct methodology is used which Autoregressive Distributed Lag (ARDL) in this chapter. Granger Causality test is also discussed in this chapter which includes stability test, diagnostic.

5. EMPIRICAL RESULTS AND INTERPRETATION

This section provides empirical analysis and explanation of results from the tests conducted following the methodology discussed in the previous section. To check any possibility of existing statistical errors diagnostic test and stability test will be applied in the model. To conduct all these tests, E-views statistical package will be used.

5.1. Empirical test results

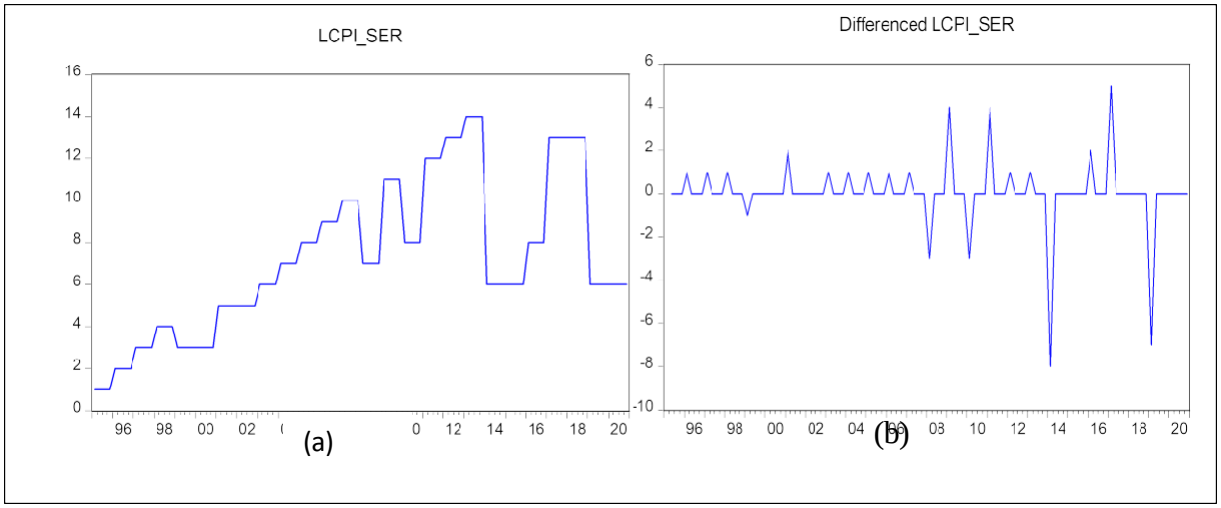
5.1.1. Results for stationarity test

To ensure that there is a proper analysis of econometric models, data used in this study need to be stationary. The bounds test procedure does not work with variables that are integrated of the second order. Unit root test results can be formally or informally presented. The informal presentation of unit root results makes use of visual presentation. A formal presentation makes use of ADF, and PP test as explained above (Pesaran et al., 2001).

5.1.1.1. Stationarity test results (Informal Presentation)

Figure 5.1 up to Figure 5.4 analyse the results from unit root test of variables at level and at first difference for integration before they can be tested using ADF and PP. Figure 5.1 shows unit roots results for log of corruption (LCPI) at level in panel (a) and at first difference in panel (b).

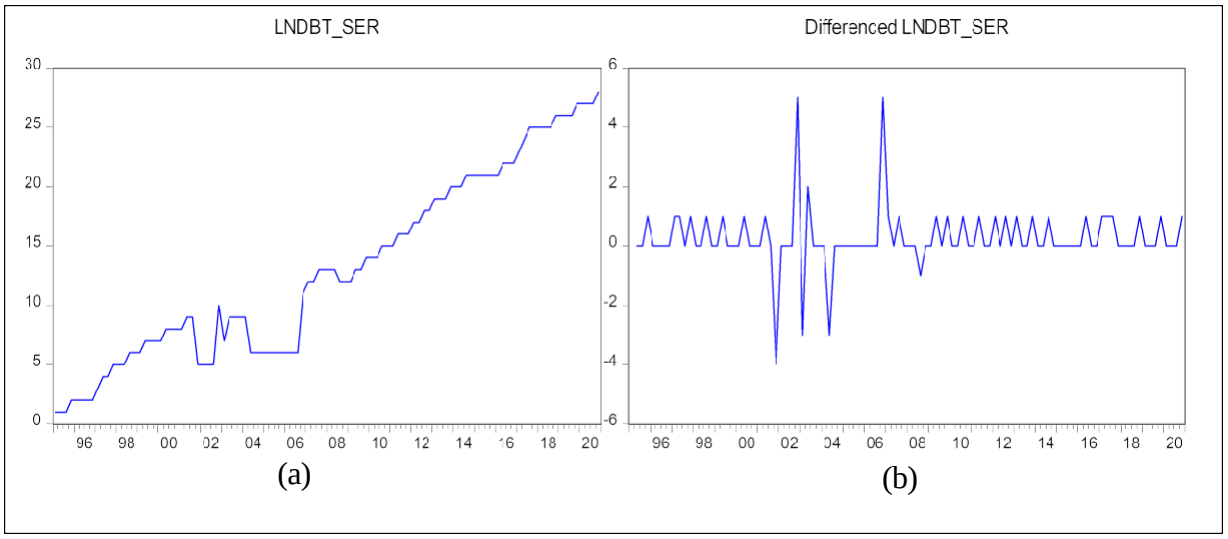
Figure 5.1 Corruption variable (LCPI)



Source: Author's compilation

In Figure 5.1, panel (a) indicates that corruption variable is not stationary as the trend moves up and down instead of wavering around the mean. Panel (b) shows that corruption is stationary after being subjected to first difference, meaning that the variable is integrated at the first difference. When corruption is stationary, the trend is wavering along the mean as shown in panel (b). This test will be confirmed in section 5.2.1.2 formally using ADF and PP.

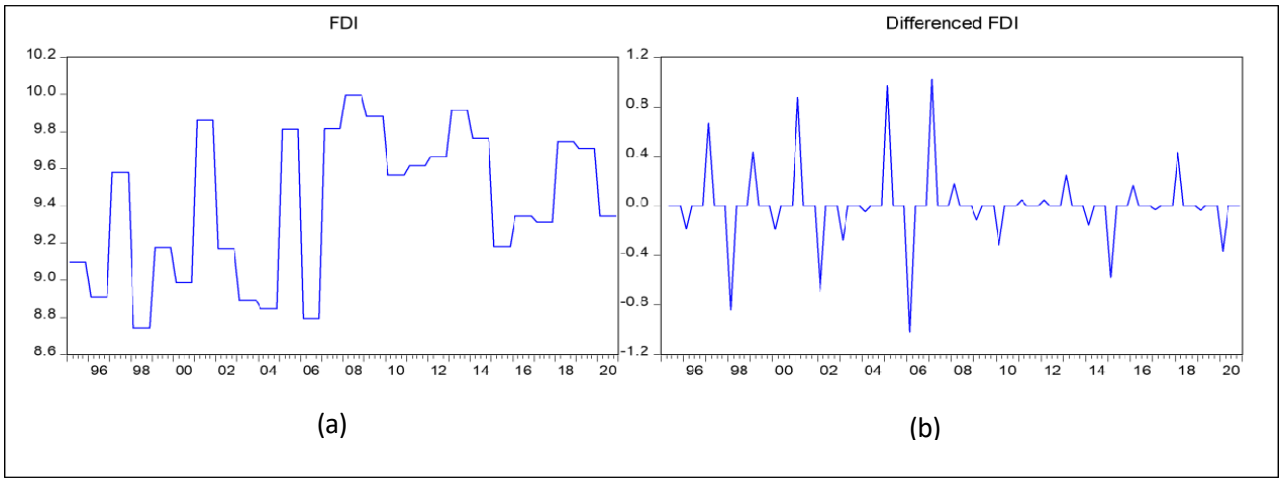
Figure 5.2 National debt (LNDBT)



Source: Author Compilation

In figure 5.2, the log of national debt in panel (a) is in level form while panel (b) is at first difference. Panel (a) demonstrates the level form which shows that the log of national debt is not stationary because the trends shows that the simple period is influenced by time. This is indicated by a positive trend, meaning it rises overtime. However, to eliminate the effect of time on the data, the log of national debt is subjected to first difference to make sure that the log of national debt wavers along the mean as shown in panel (b). The variable is stationary at panel (b) after being subjected to first difference. Therefore, the variable is integrated of the first order indicated by the wave along the mean. These results will be formally confirmed by using the ADF and PP test in the next section.

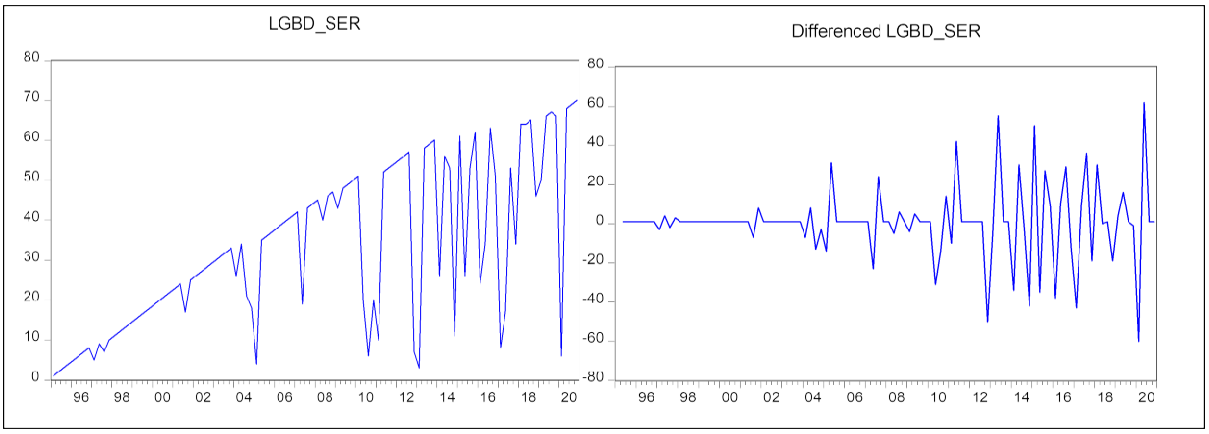
Figure 5.3 Foreign Direct Investment (LFDI)



Source: Author compilation.

Figure 5.3 panel (a) and (b) shows the log of FDI at level and at first difference. LFDI in panel (a) indicates that LFDI is not wavering along the mean at all, but rather it is greater than nil. Therefore, LFDI is not stationary at level, and it should be differenced so that it can be stationary. Panel (b) indicates that Foreign Direct Investment is wavering around the mean of zero after being differenced once. The results will be formally confirmed in section 5.2.1.2 using ADF and PP.

Figure 5.4 Government Budget Deficits (LGBD)



(a) (b)

Source: Author Computation

Figure 5.4 shows government budget deficits at level and at first difference in panel (a) and in panel (b) respectively. Panel (a) indicates that government budget deficits is not stationary at level, meaning it contains a unit root. To eliminate the influence of time on budget deficit, the variable will be subjected to first difference as indicated in panel (b). After differentiating the variable, panel (b) indicates that the variable is now stationary meaning it is integrated at first difference, and now the variable is wavering along the mean. These results will be confirmed formally by using ADF and PP in the next section.

5.1.1.2. Unit root test results (formal presentation)

This section is conducted to confirm results indicated informally in section 5.1.1.1. ADF and PP results are indicated in Table 5.1 and Table 5.2. Table 5.1 reports results at level using ADF and PP while the next table report results at first difference using ADF and PP. the results from these tables are extracted from the E-view 9 results and they are also presented in Appendix A at the end of the thesis.

Table 5.1 Unit root test using ADF and PP at level

Log of Variables.	Model specification	ADF t-statistic	PP t-statistic	Results
LNDBT	Intercept	-0.198457 (0.9341)	0.332854 (0.9790)	Non-stationary
	Trend and intercept	-2.627283 (0.2694)	-2.605812 (0.2788)	Non-stationary
LCPI	Intercept	-2.374329 (0.1515)	-2.436546 (0.1344)	Non-stationary
	Trend and intercept	-2.370887 (0.3924)	-2.446763 (0.3538)	Non-stationary
LFDI	Intercept	-2.533178 (0.1108)	-3.339839 (0.0156)**	Stationary
	Trend and intercept	-2.773372 (0.2106	-3.354633 (0.0634)*	Stationary
LGBDT	Intercept	-5.174125 (0.0000) ***	-5.221899 (0.0000) ***	Stationary
	Trend and intercept	-8.248713 (0.0000) ***	-8.137364 (0.0000) ***	Stationary

Source: Author Compilation

"*denotes the rejection of the null hypothesis at 10%" "**
denotes the rejection the null hypothesis at 5%" "***
denotes the rejection the null hypothesis at 1%"
"Probability values are in the brackets"

In Table 5.1, the null hypothesis which says that there is a unit root cannot be rejected at level form because all variables except government budget deficits have probability values of more than 0.05% at the intercept and trend and intercept. Government budget deficits is the only variable with no unit root at level according to ADF and PP. Log of Foreign Direct Investment is also stationary at level at trend and intercept. To make these variables stationary, they will be subjected to first difference for both as indicated in Table 5.2 below.

Table 5.2. Unit root test using ADF and PP at 1st difference.

Variables.	Model specification.	ADF t-statistic.	PP Adj. t-statistic.	Results
▲LNDBT	Intercept	-12.03244 (0.0000) ***	-12.67895 (0.0000) ***	Stationary
	Trend and intercept	-11.99669 (0.0000) ***	-12.86004 (0.0000) ***	Stationary
▲LCPI	Intercept	-10.01186 (0.0000) ***	-10.02573 (0.0000) ***	Stationary
	Trend and intercept	-6.519308 (0.0000) ***	-10.13710 (0.0000) ***	Stationary
▲LFDI	Intercept	-9.078211 (0.0000) ***	-19.84736 (0.0000) ***	Stationary
	Trend and intercept	-9.053323 (0.0000) ***	-22.24615 (0.0000) ***	Stationary
▲LGBDT	Intercept	-7.268864 (0.0000) ***	-48.02670 (0.0001) ***	Stationary
	Trend and intercept	-7.229387 (0.0000) ***	-46.00868 (0.0001) ***	Stationary

Source: Author Compilation

"*denotes the rejection of the null hypothesis at 10%"

"**denotes the rejection the null hypothesis at 5%"

"***denotes the rejection the null hypothesis at 10"

"Probability values are in the brackets"

The delta sign ▲ shows that the variables are differentiated

All variables in Table 5.2 becomes stationary after being tested at first difference. Consequently, the null hypothesis which says that there is unit root in the variable will be rejected, with probability values of less than 0.05 per cent as indicated in Table 5.2. Using both the ADF and PP, the requirements for stationarity has been satisfied at intercept and trend and intercept. Because

these variables become stationary after being subjected to first order, the variables are integrated of the first order. Following this is the Johansen cointegration test. We start by selecting thee lag order as show below in Table 5.3.

Table 5.3 Lag Order Selection Criteria

Lag	LogL	LR.	FPE.	AIC.	SC.	HQ.
0	-1064.547	NA	14770.65	20.95190	21.05484	20.99359
1	-735.9377	625.0022*	32.17254*	14.82231*	15.33701*	15.03073*
2	-727.5109	15.36652	37.37990	14.97080	15.89726	15.34596

Source: Author compilation

Schwarz Information Criterion (SC) is the lag order selection method used in this study is because it is known to be accurate in selecting the lag order. Even though HQ is known to be better than other criterion when dealing with lag length for large sample from 120 observations going up. However, this study seems to be supported by all criteria to select lag 1 as also indicated by Schwarz Information Criterion.

5.1.2. Johansen Cointegration test results

In section 5.2 when testing for unit root, ADF and PP showed that the variables used in this model become stationary after being subjected to first difference I(1). Therefore, Johansen Cointegration test is conducted to test for cointegration between variables. Johansen cointegration full results are presented in Appendix C.

Table 5.4 Trace test

Hypothesized No. of CE(s)	Eigenvalue.	Trace Statistic.	Critical Value 0.05	Probability**
None *	0.263587	65.60341	47.85613	0.0005
At most 1 *	0.238013	34.70100	29.79707	0.0126
At most 2	0.069228	7.246659	15.49471	0.5492
At most 3	8.29E-06	0.000838	3.841466	0.9779

Source: Author compilation

"Trace test indicates 2 cointegrating eqn(s) at the 0.05 level"

"* denotes rejection of the hypothesis at the 0.05 level"

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

Table 5.5 Maximum Eigenvalue test

Hypothesized No. of CE(s)	Eigenvalue	Maximum-Eigen value Statistic	Critical Value 0.05	Probability**
None *	0.263587	30.90241	27.58434	0.0180
At most 1 *	0.238013	27.45435	21.13162	0.0056
At most 2	0.069228	7.245821	14.26460	0.4605
At most 3	8.29E-06	0.000838	3.841466	0.9779

Source: Author compilation

Results for Johansen cointegration test are shown in Table 5.3 and Table 5.4. The null hypothesis says that there is no cointegration. Nevertheless, from the results we reject the null hypothesis because both the Trace test and Maximum at none and at most 1 are more than their critical values respectfully at 5% and at 1%. Therefore, it is evident that there is a long run relationship among variables. There are two cointegrating equations. However, at most 2 and most 3, the null hypothesis cannot be rejected because critical values for "Trace test and Maximum Eigenvalue" are greater than the trace test statistic and Maximum Eigen statistic.

To explain further the long run relationship, the study is presenting the long run cointegration model below in Table 5.5 using normalised equation.

5.1.3. ARDL Bounds test

Bounds testing results are presented in Table 5.6 and 5.7 following the bounds testing approach. Appendix D provides more details.

Table 5.6 Bounds test results

Variables	F-statistic	Cointegration
F(L_NDBT, CPI, FDI, GBD)	4.885721	Cointegration

Source: Author's calculations

Table 5.7 Bounds test critical values

Significance	I0 Bound	I1 Bound
10%	2.37	3.2
5%	2.79	3.67
2.5%	3.15	4.08
1%	3.65	4.66

Source: Peseran and Shin. (2001)

Bounds testing results are shown in Table 5.6 and 5.7. Appendix D indicates detailed results of bounds test. There are 3 independent variables in the model, therefore, k=5. At 1 % L.O.S, the

calculated F-statistic = 4,89 is bigger than the lower and the upper bound critical values of 6.65 and 4.66. This means that variables are cointegrated.

The coefficients of the model and long-run cointegration equation needs to be estimated because the Johansen cointegration and bounds testing approach shows that there is a long-run relationship among variables in the national debt method,

5.1.4. ARDL Cointegration and Long Run Form

Table 5.8 Long Run ARDL Coefficients

Variables	coefficient
LCPI	7.122559
LFDI	-46.851543
LGDB	0.111409
C	439.435447

Source: Author's calculations

Table 5.8 provides a summary for long run ARDL method results for the corruption-national debt equation. Appendix E provides more details on the ARDL results. LCPI with a coefficient of 7.122559 demonstrates that there is a positive long-run relationship between corruption and national debt. This implies that, *ceteris paribus* a 1% rise in corruption will lead to a 7.12% rise in national debt and a 1% decrease in corruption will lead to a 7.12% decrease in national debt.

These results are backed by corruption theories such as Principal-agent theory which states that investing more into anti-corruption programmes will encourage investments and crowd-out foreign loans. When domestic raised revenue is used effectively for development and service delivery, the demand for foreign debt will go down. This relationship is also consistent with the empirical literature discussed earlier. Kim, Ha and Kim (2017) studied the impact of corruption on the connection between national debt and economic development and found that there is a positive link between corruption and national debt. Therefore, corruption plays a big role when it comes to foreign loans in countries that are not developed.

As expected, Foreign Direct Investment with coefficient of -46.851543 indicates that there is a significant adverse long-run relationship between corruption and national debt. Meaning a 1% rise in FDI will cause a 46.85% decrease in national debt and a 1% decrease in FDI will lead to a 46.85% increase in national debt. The results suggests that FDI and national debt move in different directions. It is expected that this relationship exists. A country with high levels of FDI tends to develop and stabilise its economic growth which will therefore lead a decrease in the

demand for foreign loans mainly because these funds are borrowed to perform the same task as the FDI, such as infrastructure development, creating jobs, improving the GDP of a country. FDI is an important tool to deal with low levels of growth especially in the SADC region. Many countries including South Africa spend more on resources to attract FDI. The President of the Republic of South Africa always talks about attracting FDI to change the direction of this country and make it globally competitive.

The coefficient of government budget deficits (GBD) is 0.111409, signifying a positive correlation between LGBD and LNDBT in the long run. A 1% rise in government budget deficits will cause a 0.11% rise in national debt and a 1% reduction in government budget deficit will lead to a 0.11% decrease in national debt.

5.1.5. ARDL Error Correction Model

Table 5.9 ARDL Error Correction Model

Variables	Coefficient	t-statistic	Probability Value
$LNDBT_{t-1}$	-0.228988	-2.509510	0.0139
$LCPI_t$	0.021200	0.496498	0.6208
$LFDI_{t-3}$	-1.850342	-4.988365	0.0000
$LGBD_t$	-0.002091	-0.413977	0.6799
ECT_{t-1}	-0.010496	-0.928021	0.3559

Source: Author's compilation.

"*denotes significance at 10%"

"**denotes significance at 5%"

"***denotes significance at 1%"

Short-run relationship of national debt is presented in Table 5.9 above. The lags used on this model were selected automatically by E-views 9 statistical package. Appendix E presents the Autoregressive Distributive Lag short-run model. The ECT measures the adjustment speed, this is to check how quickly the variables converges back to equilibrium. The ECT coefficient is statistically significant at 5%, meaning the imbalance happened in the past years will correct itself to go back to long-run equilibrium at 10% in the current year. It is evident from the model that all the elasticities are statistically significant at different levels. As indicated in the results, national debt and corruption have a positive relationship and a negative relationship with FDI and GBDT in the short run. The elasticity for corruption is 0.021, implying that, *ceteris paribus*, a 1% rise in corruption will lead to a 0.021% increase in national debt while a 1% decrease in corruption will

lead to a 0.021% decrease in national debt. A 1% rise in FDI will lead to a 1.85 decline in national debt while a 1% decrease in FDI will lead to a 1.85 rise in national debt.

5.1.6. Stability diagnostic checks on ECM Table

5.10. Stability diagnostic checks on ECM.

Test	**Null Hypothesis.**	**t-statistic.**	**P-Value.**	**Conclusions.**
Breusch-Pagan Godfrey.	There is no Heteroskedasticity	0.779613	0.6356	"We fail to reject the null hypothesis as the Probability Value is more than the level of significance at 5%, which means that the residuals are distributed normally".
Jarque-Bera	Residuals are normally distributed	63.90787	0.00000	"We fail to accept the null hypothesis as P-Value is less than the level of significance at 5%, therefore, the residuals are not normally distributed".
Langrange Multiplier Test	There is no serial correlation	0.209452	0.9006	"We fail to reejct the null hypothesis as the Probability Value is more than the level of significance at 5%, meaning there is no serial correlation in the model".
Ljung-Box Q	There is no autocorrelation	42.200	0.221	"We fail to reject the null hypothesis because the P-Value is more than the level of significance at 5% which means that there is no correlation in the model".
Harvey	There is No Heteroskedasticity	23.59884	0.0050	"We fail to accept the null hypothesis as the Probability Value is less than the level of significance
				at 5%, therefore, there is Heteroskedasticity".
Glejser	There is No Heteroskedasticity	10.02096	0.3488	"We fail to reject the null hypothesis as the Probability Value is more than the level of significance at 5%, meaning the model does not have Heteroscedasticity".

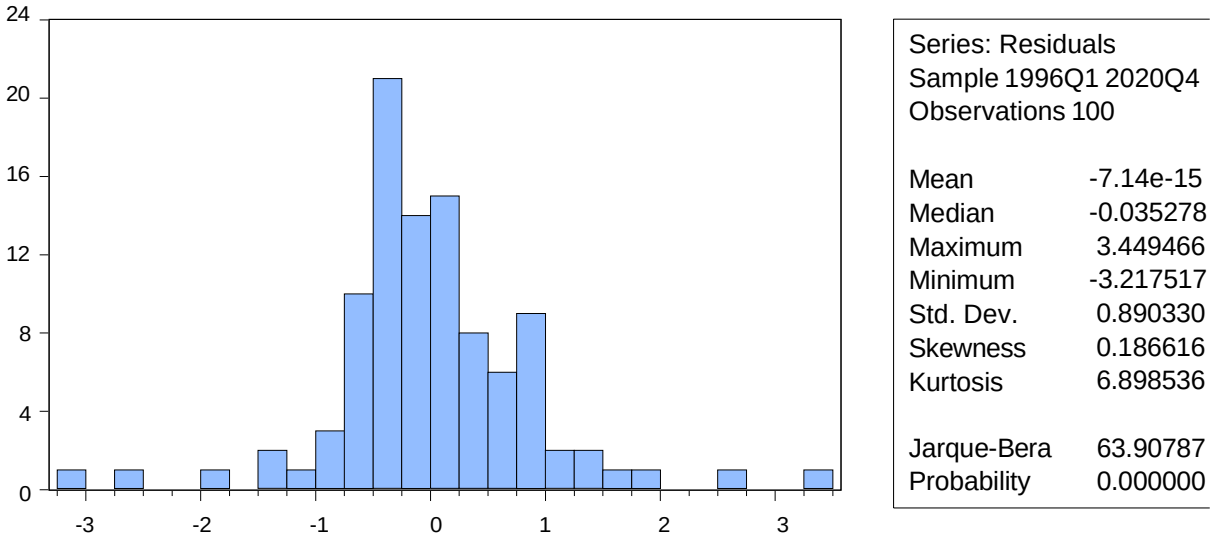
Arch	There is no Arch Heteroskedasticity	0.566157	0.4518	"We fail to reject the null hypothesis because the P-Value is greater than the level of significance at 5%, meaning the model does not have Heteroskedasticity".
White	There is no Heteroskedasticity	62.13809	0.0825	"We fail to reject the null hypothesis since the P-value is more than the level of significance meaning there is no Heteroskedasticity".

Source: Compiled by author

Residual diagnostics are presented in Table 5.10 above for national debt model. Full results are presented in Appendix E for all stability and diagnostic results of the tests conducted. Jarque- Bera indicates that residuals are not distributed normally as shown by rejecting the null hypothesis by applying Jarque-Bera test. The model has no auto correlation as reported by Ljung-Box Q statistic. Furthermore, the serial correlation null hypothesis cannot be rejected as confirmed by the Lagrange Multiplier which indicates that serial correlation does not exist. For Heteroskedasticity, the null hypothesis is not rejected because the Probability Value is more than the levels of Significance at 5% using Harvey, Breusch-Pegan-Godfrey, Arch, Glejser and White tests.

5.1.7. The diagnostic stability test results

Figure 5.10 Normality test



Source: Author's calculations

Diagnostic tests are used to confirm if the ARDL model did not produce results that are spurious in nature. The skewness of this graph is 0.186 and the probability value is statistically significant

at 1% level, and therefore we cannot reject the null hypothesis which says that the residuals are normally distributed.

5.1.8. Stability Test Results

After examining the diagnostic tests, this is followed by determining the stability of the short-run and long-run limits of our equation. Stability test also checks if there is any misspecification error. For this test, the thesis will use Ramsey RESET test, CUSUM and CUSUM of squares will also be conducted. Many studies have utilised the same procedures to determine if the ARDL model parameters are stable. Figure 5.12 and Figure 2.13 present the results. The CUSUM figure shows that the limitations of the ARDL model are constant, the CUSUM line lies between the 5% significant line. The CUSUM of squares lies outside the 5% significant line from 2004Q1 to 2013Q3.

Figure 5.12 CUSUM

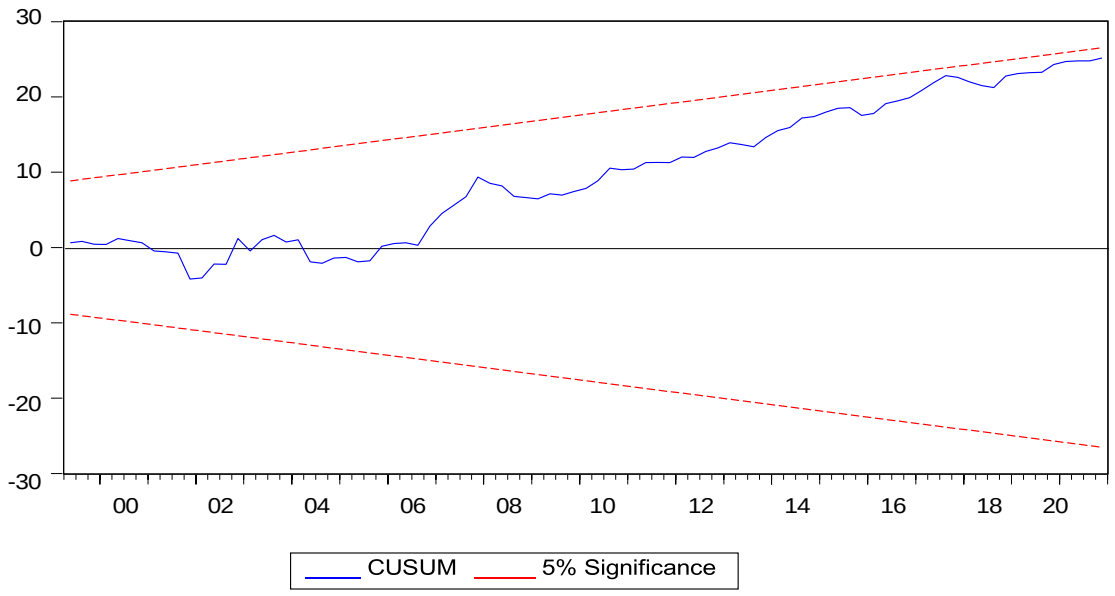
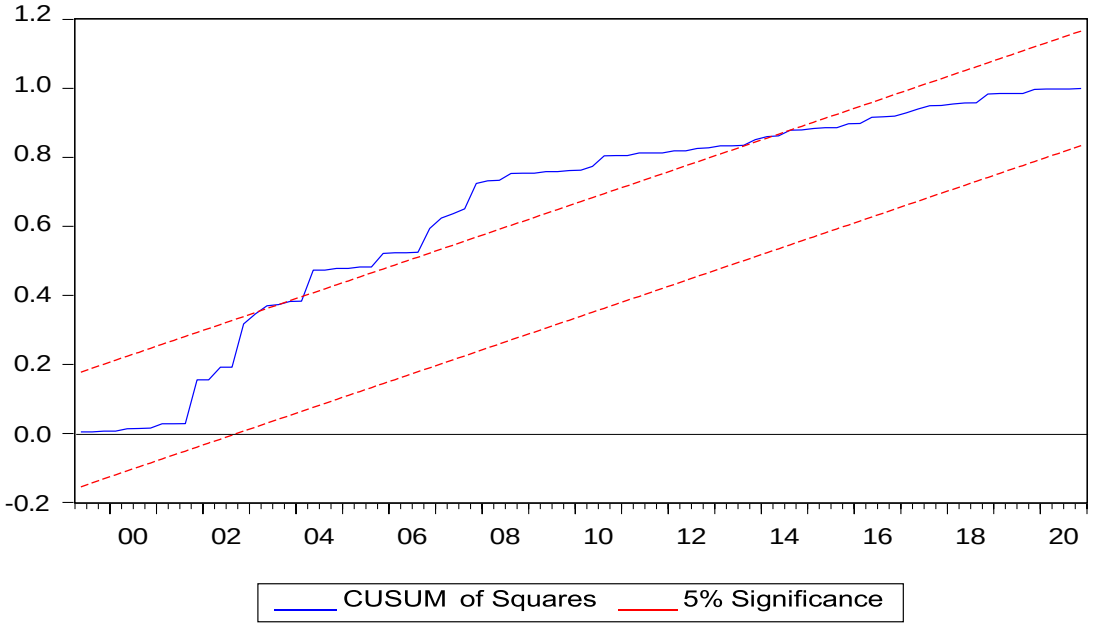


Figure 5.13 CUSUM of Squares



6. CONCLUSION AND RECOMMENDATIONS.

The thesis aimed to investigate the role played by corruption on national debt in the SADC region. For the analysis, the Johansen Cointegration test, Autoregressive Distributive Lag, Stability tests were employed. To achieve its objectives, the thesis employed quarterly data from various organisations such as the South African Reserve Bank, Corruption Perception Index and World Bank in the period from 1995 to 2020.

The results for cointegration test show that there is an existence of long-run relationship between the employed variables. Furthermore, the results indicate that there is a positive relationship between corruption and national debt in the long run. ARDL model confirmed that a short-run relationship exists between the variables employed, and the speed of adjustment to equilibrium is 10%.

From the results obtained in this thesis, we can conclude that corruption has a positive short- run and long-run relationship in the SADC region. The conclusion is that developing countries which are unable to domestically raise funds from internal sources can be encouraged to continue borrowing and falling deep into debt. These countries are mostly affected by corruption, which impacts the decisions made by officials regarding the need for funding. At the end, countries with high levels of debt will be faced with subdued growth.

The thesis recommends that, since most SADC countries are rich in minerals, they should invest more into manufacturing companies to process the natural resources domestically and sell finished products to boost their GDP. This will reduce the need for foreign loans. SADC countries should expand their capacity to produce and develop their infrastructure to encourage FDI and to raise exports which will enhance the economy, create jobs, and discourage SADC countries from relying on foreign loans. Officials must design policies that encourage capital investment, infrastructure development, attracting FDI, reducing informal business practices which causes corruption to expand the economic growth of developing countries.

The thesis also supports the policy recommendation, which was made by David Ricardo which says that, regardless of the current situation, government spending should not be financed by loans. Developing countries should borrow funds only if the borrowed funds will be used to develop infrastructure and to enhance the economy so that the proceeds can be used to repay the debt without putting a burden on already struggling citizens of developing countries. If it becomes evident that national debt does not help SADC countries to develop, Ricardo recommends that the already existing national debt should be serviced as soon as possible (Churchman, 2001).

Anti-corruption programmes must be implemented in the public sphere of developing countries as they proved to be effective in reducing corrupt activities. Policies should be developed which enforce transparency and accountability in government as well as amending the constitutional law which deals with prosecution of corrupt officials. South Africa was faced with many corruption cases during the Covid-19 pandemic by officials who were implicated and appeared before the Zondo Commission of Enquiry into the state capture after being alleged to be involved in tender corruption. Those found guilty must be liable for their action. This will discourage those who are thinking of committing same offenses which costs the country billions of rands.

This thesis concentrated on data limited to post-apartheid era from the year 1995 to 2020 to evaluate the corruption and national debt relationship in SADC countries. Therefore, factors affecting data collected for the years before 1995 and after 2020 were not taken into consideration. The study follows the Autoregressive Distributive Lag as well as testing for cointegration to come up with results. Therefore, is it possible for researchers to consider different other models in future to compute different results.

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APPENDICES

APPENDIX A: Unit root

Augmented Dickey Fuller (ADF)

National debt (Intercept)

Null Hypothesis: D(LNDBT_SER) has a unit root
Exogenous: Constant
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-12.67895	0.0000
Test critical values:	1% level	-3.495677	
	5% level	-2.890037	
	10% level	-2.582041	

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

Residual variance (no correction)	1.021287
HAC corrected variance (Bartlett kernel)	0.689036

Phillips-Perron Test Equation
Dependent Variable: D(LNDBT_SER,2)
Method: Least Squares
Date: 12/13/21 Time: 20:13
Sample (adjusted): 1995Q3 2020Q4
Included observations: 102 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNDBT_SER(-1))	-1.185172	0.098498	-12.03244	0.0000
C	0.311907	0.104131	2.995330	0.0035

R-squared	0.591469	Mean dependent var	0.009804
Adjusted R-squared	0.587384	S.D. dependent var	1.588916
S.E. of regression	1.020643	Akaike info criterion	2.898157
Sum squared resid	104.1713	Schwarz criterion	2.949627
Log likelihood	-145.8060	Hannan-Quinn criter.	2.918999
F-statistic	144.7797	Durbin-Watson stat	1.991116
Prob(F-statistic)	0.000000		

Corruption (Intercept)

Null Hypothesis: D(LCPI_SER) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.01186	0.0000
Test critical values:	1% level	-3.495677	
	5% level	-2.890037	
	10% level	-2.582041	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI_SER,2)
Method: Least Squares
Date: 12/13/21 Time: 20:42
Sample (adjusted): 1995Q3 2020Q4
Included observations: 102 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI_SER(-1))	-1.001185	0.100000	-10.01186	0.0000
C	0.049078	0.142457	0.344508	0.7312

R-squared	0.500593	Mean dependent var	0.000000
Adjusted R-squared	0.495599	S.D. dependent var	2.024601
S.E. of regression	1.437896	Akaike info criterion	3.583653
Sum squared resid	206.7546	Schwarz criterion	3.635123
Log likelihood	-180.7663	Hannan-Quinn criter.	3.604495
F-statistic	100.2374	Durbin-Watson stat	2.000003
Prob(F-statistic)	0.000000		

Foreign Direct Investment (Intercept)

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.078211	0.0000
Test critical values:	1% level	-3.497727	
	5% level	-2.890926	
	10% level	-2.582514	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FDI,2)
Method: Least Squares
Date: 12/14/21 Time: 15:33
Sample (adjusted): 1996Q2 2020Q4
Included observations: 99 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FDI(-1))	-1.559193	0.171751	-9.078211	0.0000
D(FDI(-1),2)	0.558901	0.148859	3.754554	0.0003
D(FDI(-2),2)	0.558609	0.121742	4.588450	0.0000
D(FDI(-3),2)	0.558317	0.086514	6.453492	0.0000
C	0.007836	0.022257	0.352073	0.7256

R-squared	0.654488	Mean dependent var	0.001863
Adjusted R-squared	0.639785	S.D. dependent var	0.368819
S.E. of regression	0.221357	Akaike info criterion	-0.128893
Sum squared resid	4.605906	Schwarz criterion	0.002173
Log likelihood	11.38022	Hannan-Quinn criter.	-0.075864
F-statistic	44.51501	Durbin-Watson stat	2.002054

Prob(F-statistic)	0.000000

Government budget deficits (Intercept)

Null Hypothesis: D(LGBD_SER) has a unit root
Exogenous: Constant
Lag Length: 7 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.268864	0.0000
Test critical values:	1% level	-3.500669	
	5% level	-2.892200	
	10% level	-2.583192	

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

Augmented Dickey-Fuller Test Equation
~~Dependent Variable: D(~~LGBD_SER,2)
Method: Least Squares
Date: 12/13/21 Time: 20:40
Sample (adjusted): 1997Q2 2020Q4
~~Included observations: 95~~ after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGBD_SER(-1))	-5.430568	0.747100	-7.268864	0.0000
D(LGBD_SER(-1),2)	3.750768	0.692434	5.416790	0.0000
D(LGBD_SER(-2),2)	2.985692	0.611183	4.885099	0.0000
D(LGBD_SER(-3),2)	2.375943	0.522270	4.549261	0.0000
D(LGBD_SER(-4),2)	1.751243	0.420332	4.166337	0.0001
D(LGBD_SER(-5),2)	1.319190	0.316760	4.164640	0.0001
D(LGBD_SER(-6),2)	0.668958	0.211157	3.168056	0.0021
D(LGBD_SER(-7),2)	0.333020	0.114210	2.915855	0.0045
C	3.058306	1.599986	1.911458	0.0593

R-squared	0.792456	Mean dependent var	0.042105
Adjusted R-squared	0.773149	S.D. dependent var	31.71848
S.E. of regression	15.10714	Akaike info criterion	8.358156
Sum squared resid	19627.41	Schwarz criterion	8.600102
Log likelihood	-388.0124	Hannan-Quinn criter.	8.455921
F-statistic	41.04623	Durbin-Watson stat	2.031151
Prob(F-statistic)	0.000000		

National debt (Trend and intercept)

Null Hypothesis: D(LNDBT_SER) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-11.99669	0.0000
Test critical values:	1% level	-4.050509	
	5% level	-3.454471	
	10% level	-3.152909	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNDBT_SER,2)
Method: Least Squares
Date: 12/13/21 Time: 20:48
Sample (adjusted): 1995Q3 2020Q4
Included observations: 102 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNDBT_SER(-1))	-1.186850	0.098931	-11.99669	0.0000
C	0.223095	0.208254	1.071263	0.2867
@TREND("1995Q1")	0.001700	0.003447	0.493068	0.6231

R-squared	0.592470	Mean dependent var	0.009804
Adjusted R-squared	0.584237	S.D. dependent var	1.588916
S.E. of regression	1.024528	Akaike info criterion	2.915312
Sum squared resid	103.9161	Schwarz criterion	2.992517
Log likelihood	-145.6809	Hannan-Quinn criter.	2.946575
F-statistic	71.96351	Durbin-Watson stat	1.992592
Prob(F-statistic)	0.000000		

Corruption (Trend and intercept)

Null Hypothesis: D(LCPI_SER) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 11 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.519308	0.0000
Test critical values:	1% level	-4.062040	
	5% level	-3.459950	
	10% level	-3.156109	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI_SER,2)
Method: Least Squares
Date: 12/13/21 Time: 20:49
Sample (adjusted): 1998Q2 2020Q4
Included observations: 91 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI_SER(-1))	-2.596884	0.398337	-6.519308	0.0000
D(LCPI_SER(-1),2)	1.577723	0.377714	4.177030	0.0001
D(LCPI_SER(-2),2)	1.558777	0.356270	4.375269	0.0000
D(LCPI_SER(-3),2)	1.540044	0.333832	4.613231	0.0000

D(LCPI_SER(-4),2)	1.231729	0.308315	3.995028	0.0001
D(LCPI_SER(-5),2)	1.211104	0.287472	4.212944	0.0001
D(LCPI_SER(-6),2)	1.190715	0.265538	4.484168	0.0000
D(LCPI_SER(-7),2)	1.170564	0.242193	4.833194	0.0000
D(LCPI_SER(-8),2)	0.787139	0.207112	3.800555	0.0003
D(LCPI_SER(-9),2)	0.763867	0.178038	4.290469	0.0001
D(LCPI_SER(-10),2)	0.741184	0.144371	5.133901	0.0000
D(LCPI_SER(-11),2)	0.719091	0.101574	7.079510	0.0000
C	0.576274	0.327771	1.758161	0.0827
@TREND("1995Q1")	-0.006714	0.005072	-1.323690	0.1895

R-squared	0.718330	Mean dependent var	-0.010989
Adjusted R-squared	0.670776	S.D. dependent var	2.131742
S.E. of regression	1.223152	Akaike info criterion	3.381378
Sum squared resid	115.1998	Schwarz criterion	3.767664
Log likelihood	-139.8527	Hannan-Quinn criter.	3.537220
F-statistic	15.10538	Durbin-Watson stat	2.054886
Prob(F-statistic)	0.000000		

Foreign Direct Investment (Trend and intercept)

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.053323	0.0000
Test critical values:	1% level	-4.053392	
	5% level	-3.455842	
	10% level	-3.153710	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FDI,2)
Method: Least Squares
Date: 12/14/21 Time: 15:34
Sample (adjusted): 1996Q2 2020Q4
Included observations: 99 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FDI(-1))	-1.562657	0.172606	-9.053323	0.0000
D(FDI(-1),2)	0.561221	0.149548	3.752780	0.0003
D(FDI(-2),2)	0.559800	0.122267	4.578495	0.0000
D(FDI(-3),2)	0.558393	0.086869	6.427965	0.0000
C	0.028229	0.047820	0.590323	0.5564
@TREND("1995Q1")	-0.000377	0.000783	-0.482376	0.6307

R-squared	0.655350	Mean dependent var	0.001863
Adjusted R-squared	0.636821	S.D. dependent var	0.368819
S.E. of regression	0.222266	Akaike info criterion	-0.111190
Sum squared resid	4.594411	Schwarz criterion	0.046090
Log likelihood	11.50391	Hannan-Quinn criter.	-0.047554
F-statistic	35.36785	Durbin-Watson stat	2.004776
Prob(F-statistic)	0.000000		

Government budget deficits (Trend and intercept)

Null Hypothesis: D(LGBD_SER) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 7 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.229387	0.0000
Test critical values:	1% level	-4.057528	
	5% level	-3.457808	
	10% level	-3.154859	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGBD_SER,2)
Method: Least Squares
Date: 12/13/21 Time: 20:51
Sample (adjusted): 1997Q2 2020Q4
Included observations: 95 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGBD_SER(-1))	-5.440647	0.752574	-7.229387	0.0000
D(LGBD_SER(-1),2)	3.760114	0.697508	5.390781	0.0000
D(LGBD_SER(-2),2)	2.993798	0.615625	4.863019	0.0000
D(LGBD_SER(-3),2)	2.381780	0.525808	4.529754	0.0000
D(LGBD_SER(-4),2)	1.755659	0.423120	4.149322	0.0001
D(LGBD_SER(-5),2)	1.322334	0.318824	4.147533	0.0001
D(LGBD_SER(-6),2)	0.671088	0.212540	3.157464	0.0022
D(LGBD_SER(-7),2)	0.333920	0.114914	2.905820	0.0047
C	3.785747	3.593899	1.053382	0.2952
@TREND("1995Q1")	-0.012905	0.057013	-0.226359	0.8215

R-squared	0.792581	Mean dependent var	0.042105
Adjusted R-squared	0.770619	S.D. dependent var	31.71848
S.E. of regression	15.19117	Akaike info criterion	8.378606
Sum squared resid	19615.58	Schwarz criterion	8.647435
Log likelihood	-387.9838	Hannan-Quinn criter.	8.487233
F-statistic	36.08871	Durbin-Watson stat	2.031250
Prob(F-statistic)	0.000000		

Phillips-Perron (PP)

National debt (Intercept)

Null Hypothesis: D(LNDBT_SER) has a unit root
Exogenous: Constant
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-12.67895	0.0000

Test critical values:	1% level	-3.495677
	5% level	-2.890037
	10% level	-2.582041

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

Residual variance (no correction)	1.021287
HAC corrected variance (Bartlett kernel)	0.689036

Phillips-Perron Test Equation
Dependent Variable: D(LNDBT_SER,2)
Method: Least Squares
Date: 12/13/21 Time: 20:52
Sample (adjusted): 1995Q3 2020Q4
Included observations: 102 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNDBT_SER(-1))	-1.185172	0.098498	-12.03244	0.0000
C	0.311907	0.104131	2.995330	0.0035

R-squared	0.591469	Mean dependent var	0.009804
Adjusted R-squared	0.587384	S.D. dependent var	1.588916
S.E. of regression	1.020643	Akaike info criterion	2.898157
Sum squared resid	104.1713	Schwarz criterion	2.949627
Log likelihood	-145.8060	Hannan-Quinn criter.	2.918999
F-statistic	144.7797	Durbin-Watson stat	1.991116
Prob(F-statistic)	0.000000		

Corruption (Intercept)

Null Hypothesis: D(LCPI_SER) has a unit root
Exogenous: Constant
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.02573	0.0000
Test critical values:	1% level	-3.495677	
	5% level	-2.890037	
	10% level	-2.582041	

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

Residual variance (no correction)	2.027006
HAC corrected variance (Bartlett kernel)	1.790247

Phillips-Perron Test Equation
Dependent Variable: D(LCPI_SER,2)
Method: Least Squares
Date: 12/13/21 Time: 20:53
Sample (adjusted): 1995Q3 2020Q4

Included observations: 102 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI_SER(-1))	-1.001185	0.100000	-10.01186	0.0000
C	0.049078	0.142457	0.344508	0.7312

R-squared	0.500593	Mean dependent var	0.000000
Adjusted R-squared	0.495599	S.D. dependent var	2.024601
S.E. of regression	1.437896	Akaike info criterion	3.583653
Sum squared resid	206.7546	Schwarz criterion	3.635123
Log likelihood	-180.7663	Hannan-Quinn criter.	3.604495
F-statistic	100.2374	Durbin-Watson stat	2.000003
Prob(F-statistic)	0.000000		

Foreign Direct Investment (Intercept)

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant
Bandwidth: 69 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-19.84736	0.0000
Test critical values:	1% level	-3.495677	
	5% level	-2.890037	
	10% level	-2.582041	

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

Residual variance (no correction)	0.065509
HAC corrected variance (Bartlett kernel)	0.004694

Phillips-Perron Test Equation
Dependent Variable: D(FDI,2)
Method: Least Squares
Date: 12/14/21 Time: 15:35
Sample (adjusted): 1995Q3 2020Q4
Included observations: 102 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FDI(-1))	-1.000091	0.100000	-10.00091	0.0000
C	0.002442	0.025596	0.095410	0.9242

R-squared	0.500046	Mean dependent var	0.000000
Adjusted R-squared	0.495046	S.D. dependent var	0.363768
S.E. of regression	0.258494	Akaike info criterion	0.151524
Sum squared resid	6.681913	Schwarz criterion	0.202994
Log likelihood	-5.727734	Hannan-Quinn criter.	0.172366
F-statistic	100.0182	Durbin-Watson stat	2.000000
Prob(F-statistic)	0.000000		

Government budget deficits (Intercept)

Null Hypothesis: D(LGBD_SER) has a unit root
Exogenous: Constant
Bandwidth: 58 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-48.02670	0.0001
Test critical values:	1% level	-3.495677	
	5% level	-2.890037	
	10% level	-2.582041	

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

Residual variance (no correction)	301.3200
HAC corrected variance (Bartlett kernel)	12.76165

Phillips-Perron Test Equation
Dependent Variable: D(LGBD_SER,2)
Method: Least Squares
Date: 12/13/21 Time: 20:54
Sample (adjusted): 1995Q3 2020Q4
Included observations: 102 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGBD_SER(-1))	-1.350123	0.093670	-14.41355	0.0000
C	0.900082	1.736980	0.518188	0.6055

R-squared	0.675061	Mean dependent var	0.000000
Adjusted R-squared	0.671812	S.D. dependent var	30.60221
S.E. of regression	17.53130	Akaike info criterion	8.585266
Sum squared resid	30734.64	Schwarz criterion	8.636736
Log likelihood	-435.8486	Hannan-Quinn criter.	8.606108
F-statistic	207.7504	Durbin-Watson stat	2.227001
Prob(F-statistic)	0.000000		

National debt (trend and intercept)

Null Hypothesis: D(LNDBT_SER) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-12.86004	0.0000
Test critical values:	1% level	-4.050509	
	5% level	-3.454471	
	10% level	-3.152909	

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

Residual variance (no correction)	1.018785
HAC corrected variance (Bartlett kernel)	0.625877

Phillips-Perron Test Equation
Dependent Variable: D(LNDBT_SER,2)
Method: Least Squares
Date: 12/13/21 Time: 20:55
Sample (adjusted): 1995Q3 2020Q4
Included observations: 102 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNDBT_SER(-1))	-1.186850	0.098931	-11.99669	0.0000
C	0.223095	0.208254	1.071263	0.2867
@TREND("1995Q1")	0.001700	0.003447	0.493068	0.6231

R-squared	0.592470	Mean dependent var	0.009804
Adjusted R-squared	0.584237	S.D. dependent var	1.588916
S.E. of regression	1.024528	Akaike info criterion	2.915312
Sum squared resid	103.9161	Schwarz criterion	2.992517
Log likelihood	-145.6809	Hannan-Quinn criter.	2.946575
F-statistic	71.96351	Durbin-Watson stat	1.992592
Prob(F-statistic)	0.000000		

Corruption (Trend and intercept)

Null Hypothesis: D(LCPI_SER) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.13710	0.0000
Test critical values:	1% level	-4.050509	
	5% level	-3.454471	
	10% level	-3.152909	

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

Residual variance (no correction)	2.009566
HAC corrected variance (Bartlett kernel)	1.523544

Phillips-Perron Test Equation
Dependent Variable: D(LCPI_SER,2)
Method: Least Squares
Date: 12/13/21 Time: 20:56
Sample (adjusted): 1995Q3 2020Q4
Included observations: 102 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI_SER(-1))	-1.009670	0.100488	-10.04765	0.0000

C	0.285953	0.292624	0.977201	0.3309
@TREND("1995Q1")	-0.004504	0.004859	-0.926920	0.3562

R-squared	0.504890	Mean dependent var	0.000000
Adjusted R-squared	0.494887	S.D. dependent var	2.024601
S.E. of regression	1.438910	Akaike info criterion	3.594619
Sum squared resid	204.9757	Schwarz criterion	3.671824
Log likelihood	-180.3256	Hannan-Quinn criter.	3.625882
F-statistic	50.47770	Durbin-Watson stat	2.000419
Prob(F-statistic)	0.000000		

Foreign Direct Investment (Trend and intercept)

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 66 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-22.24615	0.0000
Test critical values:	1% level	-4.050509	
	5% level	-3.454471	
	10% level	-3.152909	

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

Residual variance (no correction)	0.065464
HAC corrected variance (Bartlett kernel)	0.003552

Phillips-Perron Test Equation
Dependent Variable: D(FDI,2)
Method: Least Squares
Date: 12/14/21 Time: 15:36
Sample (adjusted): 1995Q3 2020Q4
Included observations: 102 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FDI(-1))	-1.000767	0.100503	-9.957596	0.0000
C	0.014391	0.052590	0.273640	0.7849
@TREND("1995Q1")	-0.000228	0.000874	-0.260469	0.7950

R-squared	0.500388	Mean dependent var	0.000000
Adjusted R-squared	0.490295	S.D. dependent var	0.363768
S.E. of regression	0.259707	Akaike info criterion	0.170447
Sum squared resid	6.677337	Schwarz criterion	0.247652
Log likelihood	-5.692796	Hannan-Quinn criter.	0.201710
F-statistic	49.57686	Durbin-Watson stat	2.000019
Prob(F-statistic)	0.000000		

Government budget deficits (Trend and intercept)

Null Hypothesis: D(LGBD_SER) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 57 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-46.00868	0.0001
Test critical values:	1% level	-4.050509	
	5% level	-3.454471	
	10% level	-3.152909	

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

Residual variance (no correction)	301.3052
HAC corrected variance (Bartlett kernel)	13.74741

Phillips-Perron Test Equation
Dependent Variable: D(LGBD_SER,2)
Method: Least Squares
Date: 12/13/21 Time: 20:57
Sample (adjusted): 1995Q3 2020Q4
Included observations: 102 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGBD_SER(-1))	-1.350152	0.094141	-14.34182	0.0000
C	0.682718	3.566828	0.191408	0.8486
@TREND("1995Q1")	0.004141	0.059252	0.069882	0.9444

R-squared	0.675077	Mean dependent var	0.000000
Adjusted R-squared	0.668513	S.D. dependent var	30.60221
S.E. of regression	17.61918	Akaike info criterion	8.604824
Sum squared resid	30733.13	Schwarz criterion	8.682029
Log likelihood	-435.8460	Hannan-Quinn criter.	8.636087
F-statistic	102.8440	Durbin-Watson stat	2.227072
Prob(F-statistic)	0.000000		

APPENDIX B: Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: LNDBT_SER LCPI_SER LGBD_SER FDI
Exogenous variables: C
Date: 12/27/21 Time: 20:08
Sample: 1995Q1 2020Q4
Included observations: 102

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1064.547	NA	14770.65	20.95190	21.05484	20.99359
1	-735.9377	625.0022*	32.17254*	14.82231*	15.33701*	15.03073*
2	-727.5109	15.36652	37.37990	14.97080	15.89726	15.34596

* 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 C: Johansen Cointegration Test

Date: 12/27/21 Time: 21:28
Sample (adjusted): 1995Q4 2020Q4
Included observations: 101 after adjustments
Trend assumption: Linear deterministic trend
Series: LNDBT_SER LCPI_SER FDI LGBD_SER
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.263587	65.60341	47.85613	0.0005
At most 1 *	0.238013	34.70100	29.79707	0.0126
At most 2	0.069228	7.246659	15.49471	0.5492
At most 3	8.29E-06	0.000838	3.841466	0.9779

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.263587	30.90241	27.58434	0.0180
At most 1 *	0.238013	27.45435	21.13162	0.0056
At most 2	0.069228	7.245821	14.26460	0.4605
At most 3	8.29E-06	0.000838	3.841466	0.9779

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LNDBT_SER	LCPI_SER	FDI	LGBD_SER
-0.130334	-0.104471	-0.750304	0.110179
-0.010302	-0.239605	3.457715	0.010016
-0.031179	0.314673	0.520477	-0.006342
-0.162457	0.144837	0.580025	-0.006352

Unrestricted Adjustment Coefficients (alpha):

D(LNDBT_SER)	0.134009	-0.207834	0.055473	0.002438
D(LCPI_SER)	-0.092549	-0.051765	-0.357397	0.001097
D(FDI)	0.000495	-0.117117	-0.008165	-0.000206

D(LGBD_SER)	-8.050795	-0.599536	0.912310	0.007479

1 Cointegrating Equation(s): Log likelihood -735.4011

Normalized cointegrating coefficients (standard error in parentheses)

LNDBT_SER	LCPI_SER	FDI	LGBD_SER
1.000000	0.801566	5.756792	-0.845358
	(0.57294)	(4.86093)	(0.12308)

Adjustment coefficients (standard error in parentheses)

D(LNDBT_SER)	-0.017466
	(0.01361)
D(LCPI_SER)	0.012062
	(0.01944)
D(FDI)	-6.45E-05
	(0.00345)
D(LGBD_SER)	1.049289
	(0.19387)

2 Cointegrating Equation(s): Log likelihood -721.6740

Normalized cointegrating coefficients (standard error in parentheses)

LNDBT_SER	LCPI_SER	FDI	LGBD_SER
1.000000	0.000000	17.94247	-0.840831
		(5.22854)	(0.11626)
0.000000	1.000000	-15.20234	-0.005648
		(2.76631)	(0.06151)

Adjustment coefficients (standard error in parentheses)

D(LNDBT_SER)	-0.015325	0.035798
	(0.01336)	(0.02670)
D(LCPI_SER)	0.012596	0.022072
	(0.01949)	(0.03897)
D(FDI)	0.001142	0.028010
	(0.00306)	(0.00613)
D(LGBD_SER)	1.055466	0.984726
	(0.19431)	(0.38848)

3 Cointegrating Equation(s): Log likelihood -718.0510

Normalized cointegrating coefficients (standard error in parentheses)

LNDBT_SER	LCPI_SER	FDI	LGBD_SER
1.000000	0.000000	0.000000	-0.746644
			(0.10984)
0.000000	1.000000	0.000000	-0.085451
			(0.06531)
0.000000	0.000000	1.000000	-0.005249
			(0.00528)

Adjustment coefficients (standard error in parentheses)

D(LNDBT_SER)	-0.017054	0.053254	-0.790306
	(0.01371)	(0.04172)	(0.36476)
D(LCPI_SER)	0.023739	-0.090392	-0.295565
	(0.01940)	(0.05903)	(0.51607)
D(FDI)	0.001397	0.025441	-0.409577

	(0.00315)	(0.00958)	(0.08377)
D(LGBD_SER)	1.027021	1.271806	4.442353
	(0.19934)	(0.60671)	(5.30401)

APPENDIX D: BOUNDS TEST ARDL

ARDL Bounds Test
Date: 01/16/22 Time: 22:39
Sample: 1996Q1 2020Q4
Included observations: 100
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	4.885721	3

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.37	3.2
5%	2.79	3.67
2.5%	3.15	4.08
1%	3.65	4.66

APPWNDIX F: ARDL Long Run and Short run coefficient

ARDL Cointegrating And Long Run Form
Original dep. variable: LNDBT_SER
Selected Model: ARDL(2, 0, 1, 0)
Date: 01/18/22 Time: 22:36
Sample: 1995Q1 2020Q4
Included observations: 102

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNDBT_SER(-1))	-0.218716	0.099247	-2.203759	0.0300
LCPI_SER	0.004622	0.038629	0.119661	0.9050
D(FDI)	0.338772	0.415700	0.814943	0.4171
LGBD_SER	-0.000805	0.005467	-0.147181	0.8833
CointEq(-1)	-0.007647	0.005350	-1.429412	0.1562

Cointeq = LNDBT_SER - (7.1226*LCPI_SER -46.8515*FDI + 0.1114 *LGBD_SER + 439.4354)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPI_SER	7.122559	16.547249	0.430438	0.6679
FDI	-46.851543	126.896313	-0.369211	0.7128
LGBD_SER	0.111409	0.799073	0.139422	0.8894

C	439.435441	1179.483373	0.372566	0.7103

Appendix E:

Breusch-Godfrey Serial Correlation LM Test:

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.092352	Prob. F(2,88)	0.9119
Obs*R-squared	0.209452	Prob. Chi-Square(2)	0.9006

Heteroskedasticity Test: Breusch-Pagan-Godfrey

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.779613	Prob. F(9,90)	0.6356
Obs*R-squared	7.232294	Prob. Chi-Square(9)	0.6129
Scaled explained SS	17.27728	Prob. Chi-Square(9)	0.0445

Heteroskedasticity Test: White

Heteroskedasticity Test: White

F-statistic	1.743750	Prob. F(48,51)	0.0261
Obs*R-squared	62.13809	Prob. Chi-Square(48)	0.0825
Scaled explained SS	148.4421	Prob. Chi-Square(48)	0.0000

Heteroskedasticity Test: Glejser

Heteroskedasticity Test: Glejser

F-statistic	1.113700	Prob. F(9,90)	0.3614
Obs*R-squared	10.02096	Prob. Chi-Square(9)	0.3488
Scaled explained SS	13.08941	Prob. Chi-Square(9)	0.1586

Heteroskedasticity Test: Harvey

Heteroskedasticity Test: Harvey

F-statistic	3.088806	Prob. F(9,90)	0.0028
Obs*R-squared	23.59884	Prob. Chi-Square(9)	0.0050
Scaled explained SS	27.05256	Prob. Chi-Square(9)	0.0014

Ljung-Box Q: Autocorrelation

Date: 01/22/22 Time: 21:00
Sample: 1995Q1 2020Q4
Included observations: 100
Q-statistic probabilities adjusted for 2 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.|. |	.|. |	1	0.002	0.002	0.0004	0.984
.|. |	.|. |	2	0.042	0.042	0.1802	0.914
.|* |	.|* |	3	0.080	0.080	0.8478	0.838
*|. |	*|. |	4	-0.099	-0.101	1.8846	0.757
.|* |	.|* |	5	0.094	0.090	2.8377	0.725
**|. |	**|. |	6	-0.308	-0.316	13.111	0.041
*|. |	*|. |	7	-0.172	-0.165	16.338	0.022
.|. |	.|. |	8	0.060	0.065	16.731	0.033
.|. |	.|* |	9	0.016	0.111	16.761	0.053
.|* |	.|. |	10	0.077	0.046	17.433	0.065
*|. |	*|. |	11	-0.102	-0.106	18.633	0.068
.|* |	.|. |	12	0.113	0.048	20.109	0.065
.|. |	*|. |	13	-0.012	-0.144	20.125	0.092
.|* |	.|* |	14	0.097	0.146	21.247	0.095
*|. |	*|. |	15	-0.089	-0.087	22.195	0.103
*|. |	*|. |	16	-0.161	-0.083	25.339	0.064
.|* |	.|* |	17	0.170	0.106	28.902	0.035
*|. |	.|. |	18	-0.075	-0.027	29.594	0.042
.|. |	*|. |	19	-0.035	-0.066	29.745	0.055
.|. |	.|. |	20	0.010	0.020	29.757	0.074
*|. |	*|. |	21	-0.113	-0.070	31.419	0.067
.|* |	.|. |	22	0.137	-0.022	33.883	0.050
*|. |	*|. |	23	-0.131	-0.071	36.148	0.040
*|. |	*|. |	24	-0.109	-0.089	37.753	0.037
.|. |	.|. |	25	0.011	-0.020	37.769	0.049
.|. |	.|. |	26	-0.003	0.028	37.770	0.064
.|. |	.|. |	27	0.026	-0.035	37.861	0.080
.|. |	.|. |	28	-0.011	0.014	37.879	0.101
.|. |	.|. |	29	0.042	0.018	38.127	0.120
.|. |	.|. |	30	0.026	-0.051	38.230	0.144
.|. |	.|. |	31	0.053	-0.020	38.652	0.162
*|. |	*|. |	32	-0.074	-0.081	39.471	0.171
*|. |	.|. |	33	-0.074	0.001	40.305	0.179
.|* |	.|. |	34	0.075	0.023	41.178	0.185
*|. |	.|. |	35	-0.079	-0.013	42.148	0.189
.|. |	.|. |	36	-0.018	-0.063	42.200	0.221

*Probabilities may not be valid for this equation specification .