

**NATIONAL DEBT AND SOVEREIGN CREDIT RATINGS**

DANIEL ORSMOND

61300839

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Supervisors: Prof Gavin Keeton & Ms N Cattaneo

## ABSTRACT

In recent years South Africa's foreign and local denominated debt has been downgraded by the three major global credit agencies, Moody's, Standard and Poor's (S&P) and Fitch. The foreign debt has been downgraded to speculative grade or 'junk' status by all three agencies. Local debt has been downgraded to 'junk' by S&P and Fitch, but Moody's currently maintains local debt at the lowest level of investment grade. Many economists believe that South Africa's rapidly rising debt levels are the major contributor to the decisions to downgrade South Africa's debt. Yet many countries with higher levels of debt continue to be rated investment grade. Clearly, factors other than the actual level of debt are important in determining the credit rating agencies' rating decisions.

The literature suggests several variables are important in determining a country's sovereign credit rating. These variables include not just the ratio of government debt to gross domestic product, but also a country's real growth rate, inflation, gross domestic product per capita, external balance to gross domestic product, default history and the level of economic development.

In examining the proposition that it is not a country's debt level *per se* that matters, but rather the dynamics surrounding that debt, this research also includes three additional variables that are not usually mentioned in the literature. These, based on van der Merwe (1993), are the real GDP growth rate less the real interest rate, the ratio of the fiscal balance to GDP, and the ratio of government interest payments to government expenditure. The purpose of this addition is to examine whether rather than a country's debt level (debt to GDP variable), it is the sustainability of a country's ability to service debt, as indicated by the three additional 'debt dynamic' variables, that is most important when determining sovereign credit ratings.

Panel data analysis for a sample of 12 countries over the period 1996Q1 to 2017Q4 indicates that of the broad macroeconomic variables mentioned in the literature, government debt to GDP, the real growth rate, inflation (*cpi*), and default history are all statistically significant, with the coefficients having the correct signs in all specification of the model, with the exception of the real growth rate in Models 2 and 3. With regards to the debt dynamic variables, the real growth rate less the real interest rate, as well as the interest payments to government expenditure variables are found to be significant determinants of sovereign credit ratings.

Thus, the findings of the research suggest that the level of debt alone is an inadequate determinant of sovereign credit ratings. The dynamics of debt along with other macroeconomic variables are also important determinants of a country's credit rating.

Concerning policy recommendations, it is evident that debt sustainability is important for sovereign credit ratings. Evidence of the direct importance of economic growth in determining credit ratings is mixed, but growth is a key driver of debt dynamics variables and therefore of ratings. This suggests that policy should focus on stimulating growth to reduce the gap between real growth and real interest rates as well as increasing the denominator of the debt to GDP ratio and increase the size of the tax base, which would improve government's ability to service the interest payments on its debt.

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## List of Abbreviations

GDP	Gross Domestic Product
IMF	International Monetary Fund
FB	Fiscal Balance
S&P	Standard and Poors
DEBT/GDP	Ratio of Government Debt to Gross Domestic Product
REAL	Real GDP Growth Rate
CPI	Consumer Price Index
INT/EXP	Ratio of Interest Payments to Government Expenditure
DEFAULT	History of Default on Debt
REALGAP	Real GDP Growth <i>minus</i> Real Interest Rate
FISGDP	Ratio of Fiscal Balance to Gross Domestic Product
EXTGDP	Ratio of External Balance to Gross Domestic Product
USA	United States of America
RSA	Republic of South Africa

# CHAPTER 1: INTRODUCTION

## 1.1. RESEARCH CONTEXT

In 2017, South Africa had both its locally and foreign denominated sovereign debt credit ratings downgraded to speculative or 'junk' status by all three major credit rating agencies. The one exception to this was the rating for local currency debt which continued to be rated at the lowest investment grade rating by Moody's. Unsustainable levels of debt are quoted as being contributors to the downgrade by both major credit rating agencies, S&P and Moody's, along with a variety of other factors such as political instability. South Africa's debt to GDP ratio has increased over time and sits at an all-time high of 53%, which although alarming, is not considered high by international standards. Countries such as Japan, Italy and Portugal have debt levels of 253%, 131%, and 126% of GDP respectively. This raises the question of whether debt levels truly matter, and to what extent debt is a key determinant of sovereign credit ratings. Having said that, the use of debt is undoubtedly relevant too in the sense that borrowed funds used for investment should be distinguished from borrowed funds used for consumption.

To investigate this question, the paper initially focuses on the history, definition, and importance of sovereign credit ratings. Mellios and Paget-Blanc (2006) refer to two theoretical 'models' or explanations as to why a country would or would not repay its debt, with the first explanation discussing a creditor's lack of legal recourse, and how a country would essentially weigh up the benefits and drawbacks of not repaying debt before making a decision to pay or to default. Of more importance to the thesis is the second theoretical explanation, which discusses how a country may not repay its debt, not out of choice but due to a deterioration in its ability to do so. Simply put, a country's debt climate becomes unsustainable to the point where it is no longer able to service its debt payments.

Thereafter, the study focuses on the determinants of sovereign credit ratings by reviewing the work of Cantor and Packer (1996), Mulder and Perelli (2001), Eliasson (2002), Rowland (2004), Afonso (2003), Mellios and Paget-Blanc (2006), Erdem and Varlie (2014), as well as Yildiz and Gunson (2012). The literature identifies four main broad macroeconomic indicators that are consistently found to influence sovereign credit ratings, namely, debt/GDP, real growth rate, inflation (*cpi*), and default history. Some of the literature also finds that GDP per capita and external debt/GDP have statistically significant relationships with sovereign credit ratings.

Having considered the work of Mellios and Paget-Blanc (2006) concerning a country's debt servicing capacity, i.e. a country being unable to repay its debt due to a deterioration in its ability to do so, the literature review examines the relationship between debt and GDP growth. The results appear consistent in the sense that Patillo, Poirson and Ricci (2004), Cantor and Packer (1996), and Reinhart and Rogoff (2010) find a negative relationship between the two variables, particularly at higher levels of growth.

Varma (2006) and Rivlin (2013) show how economic growth is essential to maintaining sustainable debt levels and ultimately maintaining a country's debt servicing capacity. This confirms that a positive relationship exists between real rates of GDP growth and the likelihood of being able to service debt payments.

Having established the importance of debt sustainability in a country's ability to repay its debt, and ultimately in its sovereign credit rating, van der Merwe (1993) highlights a number of tools or ratios that are useful to measure the sustainability of a particular country's debt climate. These measures include the real GDP growth rate less the real interest rate, a country's fiscal balance as a percentage of GDP, a country's deficit before borrowing, and lastly the "IMF equation". The "IMF equation" states that the government debt ratio will rise if the ratio of the so-called 'primary' fiscal surplus (income less expenditure, excluding interest payments on government debt) to GDP is smaller than the ratio of government debt to GDP, multiplied by the real interest rate, less the real growth rate of the economy.

Van der Merwe (1993) states that the level of real interest rates relative to the growth rate in real GDP is also used to determine the sustainability of government debt and addresses the adverse influence of inflation on measuring the sustainability of government debt. If the level of real interest rates exceeds the real growth rate in the economy for a relatively long period, this indicates that interest payments will increasingly have to be financed by an increase in public debt or at the cost of other essential government services.

A fiscal or primary budget balance shows the difference between government revenue in the form of taxation, and government expenditure (excluding interest payments). A positive value would imply that revenues exceed expenditure and a negative value would imply the opposite. Dividing the budget surplus/deficit by GDP enables one to make comparisons between countries and indicates whether a particular government saves or borrows money. Governments with high budget deficits generally have more difficulty raising funds to finance

expenditures, than those with lower deficits. Van der Merwe (1993) proposes that the ratio of interest payments to government expenditure is also used as an indicator in determining whether the level of government debt is sustainable. A rising trend in this ratio would indicate that contractual interest payments are made at the expense of increases in other government/non-interest expenditure, or are precluding a lowering of taxes.

Van der Merwe (1993) declares that the government debt/GDP ratio is a useful indicator for economic planning because it indicates whether debt is declining, increasing or remaining constant in relation to production. The rule of thumb for the sustainability of growing public debt is that the ratio to GDP should at least remain constant.

## **1.2. PROBLEM STATEMENT AND RESEARCH QUESTIONS**

The main questions regarding the determinants of credit ratings, or credit rating changes are the following.

- Is the level of debt an important determinant of sovereign credit ratings?
- Are the broad macroeconomic variables as mentioned in the literature key determinants of sovereign credit ratings?
- Can including the dynamics within debt, namely the real growth rate relative to real interest rate, fiscal balance as a percentage of GDP, or interest payments as a percentage of government spending, improve the goodness of fit of a model looking to explain the determinants of sovereign credit ratings?

Taking the above into account, this half thesis attempts to achieve the following goals:

- To determine the importance of national indebtedness in determining sovereign credit ratings.
- To investigate the role played in credit ratings by the dynamics of indebtedness and debt servicing rather than the level of debt alone. The objective therefore is to understand the effect of debt on credit ratings in a dynamic sense.

### **1.3. RESEARCH TECHNIQUE AND METHOD**

Drawing on the approach of Jaramillo and Tejada (2011) the method used is a panel data analysis in which the dependent variable *credit* is S&P's most recent credit rating on foreign debt. Credit ratings are obviously qualitative in nature and therefore a numerical system is used whereby a B- (the lowest credit rating offered by S&P) will be assigned a value of 1, while a AAA (the highest rating offered by S&P) will be assigned a 16. The regression analysis relates these numerical values initially to a number of broad macroeconomic variables as set out in the literature, namely debt to GDP, real growth rate, inflation and default history. The initial specification is then modified in accordance with the particular focus of this study. The second model therefore includes the 'debt dynamics' variables, namely the real GDP growth rate less the real interest rate, fiscal balance as a percentage of GDP, and a country's interest payments as a share of government expenditure. Finally, a combined regression is estimated and then two other variables highlighted in the literature, namely GDP per capita and external debt to GDP are also included.

The relevant data were collected for 12 countries selected by taking into account their government debt to GDP levels, as well as whether they are considered investment or speculative grade by S&P. Quarterly data is used for the period 1996-2017 and was collected from the Thomson Reuters database, as well as from the IMF International Financial Statistics database. Credit ratings were provided by S&P. The method is elaborated on further in section 3.4 below.

### **1.4. OUTLINE OF THE STUDY**

The study is structured as follows. Chapter 2 provides a framework for credit ratings. It begins by looking at the history of sovereign credit ratings, the methodology followed by a credit rating agency, and the theoretical explanations as to why a country might not repay its debt. Thereafter, Chapter 2 focuses on the determinants of sovereign credit ratings. These determinants provide the explanatory variables for Model 1, which allows for conclusions to be made concerning the validity of the literature. These variables include debt/GDP, the real growth rate, cpi, and default history.

The chapter then proceeds to build from the theoretical explanations provided by Mellios and Paget-Blanc (2006), by reviewing also the work of Patillo *et al* (2004), and Reinhart and Rogoff (2010), and their findings on the negative relationship between debt and growth. Thereafter,

the importance of growth in debt sustainability is discussed, with reference to the work of Rivlin (2013) and Varma (2006).

Having understood the importance of growth in debt sustainability, and the ability of a government to service its debt, the chapter reviews the work of van der Merwe (1993), particularly concerning debt sustainability and how it can be measured.

Chapter 3 provides a summary of the variables used, the sources of the data, the particular time period used, the manner in which the sample countries were chosen, and lastly the method that will be applied in Chapter 4 for the study's econometric modelling.

Chapter 4 provides an empirical analysis of the determinants of credit ratings for twelve nations for the period 1996Q1 to 2017Q4, presenting a panel data regression model which analyses the specific determinants that are perceived to affect credit ratings scores. Four different specifications are distinguished. The first includes broad macroeconomic variables highlighted in the literature, namely debt/GDP, real GDP growth, cpi, and default history, and the second the debt dynamic variables, namely real GDP growth less the real interest rate, fiscal balance/GDP, and lastly interest payments/government expenditure. The third specification combines the two sets of variables, while the final version of the model adds GDP per capita and external debt to GDP as determinants.

Chapter 5 concludes with a summary of the study's key findings, as well as relevant policy recommendations.

## **CHAPTER 2: LITERATURE REVIEW**

This chapter examines the literature related to sovereign credit ratings, what they are, their importance, as well as their determinants. Furthermore, the chapter seeks to establish a relationship between debt levels and sovereign credit ratings via its effect on economic growth, which influences a countries ability to service its debt.

### **2.1. THE ORIGIN AND ROLE OF CREDIT RATINGS**

According to Ridden (2017), credit ratings can be traced back to 1850 and more specifically to the development of a large market in US railroad companies' debt. Ridden (2017) goes on to say that although bond markets had already existed for around three centuries, prior to 1850 bonds mostly comprised the sovereign debt of a few countries, whom investors trusted as being willing and able to meet their commitments.

Bhatia (2002) believes that credit rating agencies became more prevalent in the 1900s, with Moody's established in 1900, issuing its first sovereign ratings just before World War I. During the 1920s, large expansion of the capital markets in the USA led to Moody's rating an increasing number of sovereign "Yankee bond" issues, as did the predecessors to S&P. By 1929, S&P rated Yankee bonds issued by 21 national governments, the majority of which were European, with the remainder South and North American, along with three Asian governments, namely China, Japan, and Australia (Bhatia, 2002). Bhatia (2002) highlights how the Great Depression of the 1930s, as well as World War II, led to a spike in sovereign defaults, with most national governments being downgraded. By late 1939 all European sovereigns, with the exception of the United Kingdom, were downgraded to speculative (junk) status.

According to Bhatia (2002) S&P and Moody's dominated the rating industry leading into the 21<sup>st</sup> century. Fitch only really became a major player through a number of successive mergers in the late 1990s, ultimately capturing the reputation in the market as the potential 'third opinion' on credit-worthiness, which has been carried forward to the present time.

Concerning the process undertaken by a credit rating agency, S&P (2017) notes that a credit rating typically begins with a request for a credit rating from the issuer. S&P provides a credit rating only when, in its opinion, there is information of satisfactory quality to form a credible opinion on creditworthiness, consistent with its quality of the rating process, and only after

applicable quantitative, qualitative and legal analyses are performed, taking into account information from both public and non-public sources (S&P, 2017).

In assessing a company or government credit rating, the analysis conducted by S&P will include historical and projected financial information, industry and/or economic data, peer comparisons, and details on planned financings. In addition, the analysis is based on qualitative factors, such as the institutional or governance framework, the financial strategy of the rated entity and the experience and credibility of management (S&P, 2017).

Furthermore, S&P (2017) primarily employs fundamental credit analysis, occasionally supplemented by quantitative models and a meeting with management is commonly undertaken as part of the credit rating process. The meeting is conducted to review key factors that might have an impact on the credit rating. These factors potentially include operating and financial plans and management policies. These meetings, according to S&P (2017), help analysts develop their assessment of management and corporate strategy, which are qualitative factors that are generally incorporated in the credit rating action.

Fundamental to the entire process, according to S&P (2017), is the rating committee which determines the credit ratings, not an individual analyst. S&P (2017) describes the rating committee as ‘central’ to analytical quality, in the sense that the individuals who comprise the committee have the knowledge and experience in developing and monitoring a credit rating for a specific type of rated entity.

## **2.2. THE IMPORTANCE OF SOVEREIGN CREDIT RATINGS**

Most of the existing theoretical models that deal with risk associated with sovereign lending can, according to Mellios and Paget-Blanc (2006), be divided in two main approaches. The first approach asks, ‘why do sovereign debtors repay their debt?’ The question is raised because if a sovereign borrower were to default, the lender may not have recourse to a bankruptcy code or to a legal procedure to enforce payment. Mellios and Paget-Blanc (2006) state that the desire to maintain a good reputation, as well as to preserve and maintain future access to credit markets, as well as the fear of economic, political, and legal sanctions are all incentives for countries to repay their debt. Mellios and Paget-Blanc (2006) note that countries as a result very rarely default in an outright sense but, rather, renegotiate their original debt. The choice made by the borrower is therefore based on an assessment of the costs and benefits of rescheduling rather than outright default.

Mellios and Paget-Blanc (2006) highlight that a country usually has both local and foreign debt obligations. They suggest three reasons why sovereign borrowers may be inclined to pay their external debt. Firstly, foreign or external creditors have the ability to seize foreign assets in the case of default. Secondly, default will affect a country's ability to gain access to future foreign loans. Lastly, defaulting on external debt may adversely affect international trade. Mellios and Paget-Blanc (2006) conclude that while the legal recourse of foreign creditors is limited, countries must nonetheless trade off the costs of making debt payments against the costs of defaulting.

The probability of default is thus an increasing function of variables leading a country to default and it is a decreasing function of variables raising the cost of default. Mellios and Paget-Blanc (2006) therefore suggest that it is the unintended deterioration of a country's capacity to service its debt (more so than its willingness) that is most likely to cause a country to default. Countries may be unable to repay their (internal/external) debt because they are either insolvent or illiquid. Therefore, it is ultimately the sustainability of debt obligations that determines a country's probability of defaulting. This has been described by Haque *et al* (1996) as the debt-servicing capacity approach to assessing sovereign credit risk.

According to Cantor and Packer (1996) sovereign credit ratings are assessments of the relative likelihood that a borrower will default on its obligations. Yildiz and Gunson (2017) describe sovereign credit ratings as an assessment of the creditworthiness of a country with respect to specific securities, financial instruments and debt obligations. Governments generally seek credit ratings to ease their own access to international capital markets, where many investors, particularly US investors, prefer rated securities over unrated securities of apparently similar credit risk. In the past, governments tended to seek ratings on their foreign currency obligations exclusively, because foreign currency bonds were more likely than domestic currency offerings to be placed with international investors. Having said that, international investors have increased their demand for bond issues in currencies other than traditional global currencies, leading more sovereigns to obtain domestic currency bond ratings as well (Cantor and Packer, 1996). Nonetheless, foreign currency ratings remain the more prevalent and influential in the international bond markets (Cantor and Packer, 1996).

According to Kuepper (2018), sovereign ratings are important not only because some of the largest issuers in the international capital markets are national governments, but also because these assessments affect the ratings assigned to other borrowers of the same nationality.

Kuepper (2018) states that sovereign ratings have become increasingly important as countries around the world tap into international bond markets. These sovereign credit ratings take into account political risk, regulatory risk and other unique factors to determine the likelihood of a default. This point is also emphasized by Mellios and Paget-Blanc (2006) who claim that a good credit rating is essential for developing countries to access funding in international bond markets, as well as to attract foreign direct investment. These ratings are said to provide further transparency and demonstrate a country's good standing not only as a borrower but also in an overall economic sense. Bozic and Magazzino (2013) agree that a credit rating is an indication of a government's capacity to repay debt. They support the point made by Mellios and Paget-Blanc (2006) that a sovereign credit rating on both local and foreign denominated debt is also an indication of the overall socio-economic and political situation of the country. Bozic and Magazzino (2013) suggest credit ratings facilitate access to international financial markets, attracting foreign investments (direct or portfolio investment) and lowering the interest rates at which a particular country borrows. They note too that sovereign ratings are similar to corporate ratings in most, but not all, aspects. While corporates have to declare default on their debt at the moment of insolvency, governments can access an additional source of funds, namely international emergency credit, and can therefore 'save themselves' from declaring a default (Bozic and Magazzino, 2013).

While credit ratings seek to measure the ability and willingness of a country to pay timeously its financial obligations, both principal and interest, lenders face the risk that governments may choose to default on some of their obligations, even when being financially capable to service their debt. This is mainly a political decision and depends on the difference between the money that would be saved by defaulting on debt repayments and the future cost that may arise as a result of future penalties imposed by lenders (Bozic and Magazzino, 2013). It is difficult to include such qualitative risks in the rating process, but as is the case of corporate bond ratings, rating agencies warn that they are neither giving recommendation for making investment decisions nor a measure of the rated obligation, but rather an opinion about the creditworthiness of the rated entity.

In an attempt to determine the importance of sovereign credit ratings, Jaramillo and Tejada (2011) look at whether a credit rating increase from sub-investment grade to investment grade would reduce bond spreads i.e. lower financing costs for the sovereign. Using a panel data framework for 35 emerging markets between 1997 and 2010, Jaramillo and Tejada (2011) find

that investment grade status reduces spreads by 36 percent, above and beyond what is implied by macroeconomic fundamentals, indicating that sovereign credit ratings play an important role in determining the financing costs of sovereigns.

### **2.3. THE DETERMINANTS OF SOVEREIGN CREDIT RATINGS**

Cantor and Packer (1996), Mulder and Perelli (2001), Eliasson (2002), Rowland (2004), Afonso (2003), Mellios and Paget-Blanc (2006), Erdem and Varlie (2014) and Yildiz and Gunson (2017), use a variety of techniques to examine the importance of the various macroeconomic and other factors used by the ratings agencies in determining sovereign credit ratings.

#### **2.3.1. GDP Growth**

Cantor and Packer (1996) note that a relatively high rate of economic growth suggests that a country's existing debt burden will become easier to service over time. Evidence from the literature mostly supports this claim, but the relationship is not always as significant as might be expected. Cantor and Packer (1996) find that GDP lacks a bivariate relationship with sovereign credit ratings as it is found to be statistically insignificant using Moody's rating, but statistically significant at the 5% level using the ratings of S&P. Their overall conclusion on whether GDP growth is a significant determinant of sovereign credit ratings is that the evidence is mixed.

Afonso (2003) uses a sample of both developed and developing countries, along with the ratings of both Moody's and S&P to examine the determinants of sovereign credit ratings. Afonso (2003) finds the rate of real economic growth to be a statistically significant determinant of sovereign credit ratings in both developed and developing countries for both major credit rating agencies. Rowland (2004) estimates the economic variables that determine the sovereign credit ratings and creditworthiness using the least squares method based on data from 49 developing countries rated B- and higher. Similar to the work of Afonso (2003), it is found that the rate of GDP growth is a statistically significant determinant of sovereign credit rating differences. Eliasson (2002) makes use of S&P credit ratings for emerging markets in both a static and dynamic context and uses only macroeconomic indicators as explanatory variables due to the unavailability of objective socio-political variables. Eliasson (2002) finds that a country's rate of economic growth is indeed a significant determinant of sovereign credit ratings.

Mellios and Paget-Blanc (2006) examine the determinants of the sovereign credit ratings provided by the three major rating agencies, Fitch, Moody's and S&P, employing a principal component analysis in order to identify the common factors affecting these ratings. Consistent with the previous results discussed above, Mellios and Paget-Blanc (2006) find that the rate of GDP growth is statistically significant in explaining sovereign credit ratings.

Reusens and Croux (2017), covering the period 2002-2015, compare the importance of the determinants of sovereign credit ratings of 90 countries before and after the 2009 European Debt Crisis. Their results show that the importance of GDP growth for credit ratings increased for highly indebted countries after the start of European Debt Crisis and government debt became much more important for the ratings of countries with low growth rates. Erdem and Varlie (2014) investigate the effects of macroeconomic variables on sovereign credit ratings in emerging markets using pooled OLS, fixed effects, random effects and ordered probit models. Their findings were inconsistent with the general view of the literature in the sense that GDP growth was not found to be significant in determining sovereign credit ratings.

In conclusion, with the exception of Cantor and Packer's (1996) findings for just Moody's credit ratings and Erdem and Varlie (2014) findings, GDP growth appears from the literature to be highly significant in determining sovereign credit ratings. This is unsurprising given its positive effect of increasing a country's ability to service its debt and lowering the measure of overall indebtedness relative to a growing GDP.

### **2.3.2. Inflation**

The *a priori* relationship between a country's level of inflation and its sovereign credit rating is arguably negative. This is because a high rate of inflation points to structural problems in the government's finances (Goldstein and Huang, 2017). When a government appears unable or unwilling to pay for current budgetary expenses through taxes or debt issuance, it often resorts to inflationary financing of its deficit through money creation (Goldstein and Huang, 2017). Public dissatisfaction with inflation may in turn lead to political instability, raising the risk of debt default.

Cantor and Packer (1996) find from a sample of 49 countries that lower inflation is consistently related to higher ratings. This finding is statistically significant at the 1% level for the ratings of both Moody's and S&P. Afonso (2003) likewise finds that the inflation rate is one of the

most important variables in determining sovereign credit ratings for both developed and developing countries.

Rowland (2004) finds the inflation rate to be statistically significant at the 1% level as a determinant of the sovereign credit ratings of 49 developing countries. Eliasson (2002), using S&P credit ratings for emerging markets, also finds a clear relationship between a country's level of inflation and the sovereign credit rating assigned to it. Mellios and Paget-Blanc (2006) and Yildiz and Gunson (2017) find inflation to be highly significant in determining sovereign credit ratings. However, Reusens and Croux (2017), using an ordered probit model and data from 2002-2015, did not find inflation to be a significant determinant of sovereign credit ratings.

In conclusion, most of the literature suggests there is a statistically significant inverse relationship between a country's rate of inflation and its sovereign credit rating. This supports the idea that credit rating agencies are concerned about the risk of budgetary expenses being financed through inflationary measures.

### **2.3.3. Per Capita Income**

Chee, Fah, and Nassir (2015) emphasise the significance of the 'level of economic development' (for which per capita income is a proxy variable) in determining credit ratings, while Cantor and Packer (1996) note that the greater the potential tax base of a country, the greater the ability of a government to repay debt. These suggest that a positive relationship will exist between countries' level of development as measured by per capita income levels and sovereign credit ratings.

Cantor and Packer's (1996) findings are consistent with these *a priori* expectations. They find per capita income to be statistically significant at the 1% level for the ratings provided by both Moody's and S&P. Eliasson (2002), Rowland (2004), Mellios and Paget-Blanc (2006), Erdem and Varlie (2014) and Yildiz and Gunson (2017) likewise all find per capita income to be a significant determinant of sovereign credit ratings.

#### **2.3.4. Default History**

Other things being equal, a country that has defaulted on debt in the recent past is likely to be perceived as a high credit risk (Cantor and Packer, 1996). Both theoretical considerations of the role of reputations in sovereign debt and related empirical evidence indicate that defaulting sovereigns suffer a severe decline in their standing with creditors (Cantor and Packer, 1996).

Cantor and Packer (1996) use a dummy variable to capture whether or not a country has in fact defaulted on its debt payments in the past. Default history is found to be statistically significant at the 1% level using the ratings of S&P and significant at the 5% level using the ratings of Moody's, indicating a strong bivariate relationship between a country's history of default and its sovereign credit rating.

Default history is also found to be highly significant in determining sovereign credit ratings by Afonso (2003), using a sample of both developed and developing countries, and the ratings and data of both S&P and Moody's.

#### **2.3.5. Other variables**

Cantor and Packer (1996) find the level of economic development in a country, measured as a dummy variable based on the IMF's determination of 'industrialized or not industrialized', to have a highly significant influence on its sovereign credit rating. The dummy variable would be one if the country was considered industrialized, and would be zero if the country was considered to not be industrialized. Using the ratings of S&P and Moody's, this could be said with 99% and 95% confidence. This idea was further solidified by Afonso (2003), using a sample of both developed and developing nations and by Eliasson (2002), who used just the ratings of S&P in both a static and dynamic context.

Along with the broader macroeconomic variables discussed above, Rowland (2004), as well as Chee, Fah, and Nassir (2015) find international reserves, as well as the level of economic openness to be significant contributors to sovereign credit ratings. Mellios and Paget-Blanc (2006) find sovereign credit ratings also to be significantly influenced by government income as a share of GDP, as well as by changes in the real exchange rate. Erdem and Varlie (2014) find that governance indicators as well as international reserves are important in explaining differences in sovereign credit ratings in emerging countries.

## **2.4. DEBT, DEBT-SERVICING AND GDP GROWTH**

In Section 2.2 two theoretical explanations for the risk of countries being unable to repay their debt were outlined. The first approach asked why countries would repay their debt in the first place when creditors have little ability to enforce their claims on a sovereign borrower and concluded that there are costs associated with default that must be weighed against the benefits. The second, and more relevant explanation, emphasized the importance of countries' capacity to service existing debt and concluded that a deterioration in this ability may lead to default even when a country desires to continue repaying its debt.

This explanation points to a bidirectional link between GDP growth and debt. GDP growth increases countries' tax bases and improves their ability to service debt. It also allows countries to 'grow out' of their indebtedness by increasing the denominator of the debt/GDP measure faster than the level of debt is growing. However, work by Reinhart and Rogoff (2010) warns that too high a level of debt may be harmful to economic growth. Varma (2006) and Rivlin (2013) emphasise the importance of GDP growth for countries' debt servicing capacity. As a result, it is necessary to look at debt not just in a static sense as measured using debt as a percentage of GDP, as in Section 2.3.1, but also in a dynamic sense. This is done in Section 2.4.2. Before that, the relationship between debt and growth is discussed in Section 2.4.1. These relationships are brought together in the ways in which the sustainability of debt levels can be measured in Section 2.4.3.

### **2.4.1. Impact of debt on GDP growth**

Patillo, Poirson, and Ricci (2004) investigate the manner and channels through which debt affects growth. Using a panel of 61 countries over the period 1969-1998, they find that the impact of high debt on growth is negative and that this negative impact occurs through a strong negative effect on physical capital accumulation and on total factor productivity growth.

These findings are consistent with the later results of Reinhart and Rogoff (2010) who conclude that there is a 'ceiling' or 'threshold' to the level of debt above which debt will have a negative effect on economic growth. Reinhart and Rogoff (2010) find the relationship between the level of debt and growth to be weak at 'normal' debt levels. However, median growth rates are several percentage points lower where debt levels increase above 90% of GDP. Furthermore, for emerging markets the adverse impact of debt on growth occurs at much lower levels of external debt as a percentage of GDP (60%).

Reinhart and Rogoff (2010) also note that countries very seldom ‘grow’ their way out of indebtedness. The nonlinear effect of debt on growth, according to Reinhart and Rogoff (2010), is reminiscent of ‘debt intolerance’ and is presumably related to a nonlinear response of market interest rates as countries reach debt tolerance limits. Sharply rising interest rates once the tolerance threshold is breached force painful fiscal adjustments in the form of tax hikes and spending cuts, or, in some cases, outright default.

At high levels of debt, there is a large negative impact. Reinhart and Rogoff (2010) find that, on average, doubling debt from any initial debt level at or above the threshold will reduce per capita GDP growth by about 1 percentage point. At low levels, the effect is generally positive but often not significant. The difficulty in identifying the relationship between debt and growth at low debt levels may, in part, be due to the small number of low-debt observations in the sample, given the relatively low debt turning point implied by their earlier results.

In a replication of Reinhart and Rogoff’s (2010) work, Herndon, Ash and Pollin (2013) show that coding errors, selective exclusion of data as well as unconventional weighting of summary statistics led to severe errors that misrepresented the relationship between public debt and GDP growth among twenty advanced economies in the post-war period. Their finding, after taking into account the relevant errors, is that the average real growth rate of GDP for countries with public debt to GDP ratios of over 90% is actually +2.2% as opposed to the proposed –0.1% claimed by Reinhart and Rogoff. Their findings suggest that the average rate of GDP growth for countries with debt to GDP ratios of more than 90% is in fact not significantly different from countries with lower levels of indebtedness.

In an ‘Errata’ memorandum responding to the work of Herndon *et al* (2013), Reinhart and Rogoff themselves correct their coding errors and include the relevant data for all countries. They then find that the difference in median economic growth rates falls by only 0.6 percentage points between countries whose public debt to GDP ratio is between 60-90% and those where the ratio is over 90% - from 2.9% to 2.3% median GDP growth.

These findings suggest that the impact of high levels of indebtedness on GDP growth may not be substantial, if at all. Nonetheless, GDP growth and in particular its relationship to other macroeconomic variables such as the real interest rate, has important implications for the servicing of debt. These are discussed in the following section.

#### **2.4.2 Debt Servicing and GDP growth – the Economic Growth Channel**

The deterioration in a country's ability to continue servicing its debt is an important determinant of the risk of default outlined in Section 2.2. Varma (2006) notes that debt sustainability, which is the ability of a country to meet its debt obligations without resort to exceptional financing or a major correction in its balance of income and expenditure, is an important precondition for a particular country's economic stability. Without such an ability to meet debt obligations, domestic and foreign investors will not continue to invest in the country and, without investment, economic growth and development will slow and stall, worsening the inability to service debt. The repayment of debt (debt servicing capacity) is therefore dependent on sustained economic growth and development (Varma, 2006).

This is reinforced by Rivlin (2013) who asserts that the future prosperity of the USA requires bipartisan political cooperation to achieve two goals simultaneously. These are, firstly, policies to support faster economic growth which will improve unemployment, and, secondly, a sustainable long-run budget plan that will halt the projected rise in the debt to GDP ratio. Rivlin (2013) argues that the two goals reinforce each other. Neither can be achieved without the other in the sense that weak economic growth reduces tax revenue and makes it far more difficult to stabilize the ratio of debt to GDP. On the other hand, the prospect of debt growing faster than the economy for the foreseeable future reduces consumer and investor confidence, raises a serious threat of high future interest rates, an unmanageable deferral of debt service and undermines growth. Economic growth is therefore vital not only to a country's ability to service its debt from increased revenues due to increased employment, and ultimately a larger tax base, but also for its overall economic stability.

According to van der Merwe (1993), the traditional measure of determining the health of public finances is the balance on the revenue and expenditure accounts of the government before borrowing and debt repayment. He notes that a balanced-budget approach was followed by most governments before WWII. Because borrowing was regarded as a means of raising revenue that allows the borrower to put off or postpone taxes, it followed that governments should only resort to debt financing for non-recurrent or extraordinary demands, or for public spending needs, that are expected to be temporary. Traditionally such demands were associated with wars or the financing of genuinely productive capital projects. However, after the general adoption of the Keynesian method of using deficit financing to keep economies at full

employment, many governments started to borrow to finance ordinary current expenditure and transfers.

Van der Merwe (1993) notes that a rule of thumb was developed during this period, whereby the ratio of the government deficit before borrowing to GDP should not exceed the potential growth rate of the economy because this inevitably leads to a rise in public debt (and interest thereon) relative to production, with ultimate negative effects on the rest of the economy. However, van der Merwe (1993) warns that the budget deficit may be influenced by ‘cosmetic’ changes such as the sale of state assets. If the sale of these assets is included as government revenue as opposed to the financing of the deficit, it results in a misleading reduction in the deficit before borrowing because such sales cannot be sustained. The deficit is also affected by cyclical conditions in the economy which impact on tax revenue making it difficult to determine the underlying state of government finance. Methods have been developed to account for cyclical influences, but van der Merwe (1993) warns that the budget deficit alone is not an adequate measure of fiscal or debt sustainability.

In line with the importance attached in later work by Mellios and Paget-Blanc (2006), Varma (2006) and Rivlin (2013) on countries’ ability to service debt, van der Merwe (1993) examines how a country’s ability to service its debt or its ‘debt servicing capacity’ can be measured. Van der Merwe (1996) identifies five measures of debt service sustainability – namely, the difference between real interest rates and real GDP growth, the primary budget deficit as a percentage of GDP, the ratio of interest payments (debt service costs) to government expenditure, the level of government debt as a percentage of GDP and what he terms ‘the IMF equation’. These are explained in detail in the following sections because these measures are incorporated into the economic modelling in Chapter 4.

#### **2.4.2.1 The level of real interest rates relative to economic growth**

Van der Merwe (1993) states that the level of real interest rates relative to the real GDP growth rate is an important measure of the sustainability of government debt. If real interest rates exceed the real GDP growth rate in the economy for a relatively long period, this indicates that interest payments will increasingly have to be financed by an increase in public debt or at the cost of other essential government services. The effect of compounded interest is to increase the debt level by ever-increasing amounts and at a rate faster than GDP is growing. This could imply that the economy is moving into a debt trap.

The problem with this indicator on its own is that a reduction in real interest levels brought about by irresponsible monetary policy easing would give the completely wrong impression that the sustainability of government finances is improving. On its own, this indicator provides no information on the level of public debt. The higher the public debt ratio to GDP, the more it will matter if real interest rate levels exceed the real GDP growth rate because an explosion in debt servicing costs then becomes more uncontrollable.

#### **2.4.2.2 Primary fiscal balance as a percentage of GDP**

The primary budget balance shows the difference between government tax revenue and expenditure excluding interest payments. A positive value implies that revenues exceed non-interest expenditure and a negative value the opposite. Dividing the primary budget surplus/deficit by GDP enables one to make comparisons between countries and indicates whether a particular government saves or borrows money. Governments with high primary budget deficits generally have more difficulty raising funds to finance expenditures, than those with lower deficits (van der Merwe, 1993).

#### **2.4.2.3 The ratio of interest payments to government expenditure**

Van der Merwe (1993) suggests that the ratio of interest payments to government expenditure is useful as an indicator of the sustainability of government debt. An increase in this ratio indicates that interest payments on debt are increasingly made at the expense of 'productive' non-interest expenditure. However, the erosion of interest and capital values as a result of inflation may disguise the true dimensions of the debt problem. In a scenario of negative real interest rates, it is then possible that interest payments will increase at a slower rate than other forms of government expenditure, resulting in a relatively stagnant ratio of interest payments to government expenditure, even though government debt is rising (van der Merwe, 1993).

#### **2.4.2.4 Government debt as a percentage of GDP**

Van der Merwe (1993) declares that the government debt/GDP ratio is useful because it indicates whether debt is declining, increasing or remaining constant in relation to production. The rule of thumb for the sustainability of public debt is that the ratio of debt to GDP should at least remain unchanged. The main advantage of this debt ratio as an indicator of debt sustainability, according to van der Merwe (1993), is that it is normally free of the artificial or cosmetic elements that may be present in the budget deficit before borrowing. However, the

debt ratio may not reveal the full indebtedness of a government if, for example, government enterprises or other levels of government have debts not reported by the central government.

#### **2.4.2.5 The IMF equation**

While no single indicator has yet been developed to measure the sustainability of government indebtedness conclusively, the International Monetary Fund (IMF) has developed an equation which can be used as a first test in determining whether a country is at least moving towards a sharply rising indebtedness. The equation shows that the government debt to GDP ratio will rise if the ratio of the primary budget surplus (income less expenditure, excluding interest payments on government debt) is smaller than the ratio of government debt to GDP, multiplied by the real interest rate minus the real GDP growth rate of the economy (Cantor and Packer, 1996).

(Government income – Government expenditure less interest payment) < Government debt/GDP x (real interest rate – real economic growth rate)

This equation combines the debt servicing sustainability indicators discussed above. According to van der Merwe (1993), it is based on the principle that the size of the fiscal deficit cannot be sustained indefinitely if government debt is increasing at a rate that is higher than the growth rate of the real economy, when real interest rates are higher than GDP growth.

### **2.5. CONCLUSION**

Chapter 2 initially outlined a brief history of sovereign credit ratings, as well as a summary of the process undertaken by a major credit rating agency to arrive at a particular credit rating. The focus then shifted to discussing what a credit rating is, but more importantly, why they are important. Mellios and Paget-Blanc (2006) provided the foundation at this point with their two theoretical explanations of why a country potentially would or would not repay its debt. The second explanation discussed a country's inability to service its debt, as opposed to an unwillingness. Thereafter, the determinants of sovereign credit ratings were outlined, with four variables appearing consistently in the literature as statistically significant in explaining sovereign credit ratings. These four broad macroeconomic variables included debt/GDP, real GDP growth rate, inflation (cpi), and any history of default.

Thereafter, the chapter looked at debt, debt servicing and GDP growth. Firstly, the link between debt and growth was examined by looking at the work of Patillo, Poirson, and Ricci (2004), as well as Reinhart and Rogoff (2010) who are consistent in their findings concerning a negative relationship between debt and growth, particularly at higher levels of debt. The chapter then moved to consider debt servicing and growth by looking at the studies conducted by Rivlin (2013) and Varma (2006) who highlight that economic growth is essential to maintaining sustainable debt levels and ultimately to a country's ability to service its debt.

This then led to a discussion of the work of van der Merwe (1993) on debt sustainability, but more specifically, on how it can be measured, with van der Merwe (1993) highlighting five major indicators. These are, a country's level of real growth versus its real interest rates, fiscal balance/GDP, interest payments/government expenditure, government debt/GDP, and lastly, the IMF equation.

## CHAPTER 3: DATA, METHOD AND TECHNIQUES

### 3.1. INTRODUCTION

Chapter 3 initially discusses the nature of the data, specifically its sources, the time period, as well as the panel of countries used. Thereafter, the variables used are discussed with reference to the models used in Chapter 4. Lastly, the chapter highlights each variable in depth and provides a theoretical explanation for the expected relationship with credit ratings. A graphical representation of these variables in relation to sovereign credit ratings is provided to visually examine whether the expected relationships are evident.

### 3.2. DATA SOURCES

Quarterly data were acquired from the IMF International Financial Statistics database, Thomson Datastream and the online database of the Reserve Bank of South Africa. The models in Chapter 4 use quarterly data from 1996Q1 to 2017Q4 for a panel of 12 countries, including Japan, Italy, Greece, Spain, France, Cyprus, Austria, USA, Germany, South Africa, China, and Romania.

The specific countries were chosen using purposive sampling to ensure a balance of countries within specific debt/GDP intervals i.e. 0-60%, 60-100%, and >100%.

**Table 1: Country Debt/GDP and Sovereign Credit Rating**

COUNTRY	DEBT/GDP RATING	S&P CREDIT RATING
Japan	254%	A+
Greece	179%	B+
Italy	132%	BBB
USA	108%	AA+
Spain	98%	A-
Cyprus	98%	BBB-
France	97%	AA
Austria	78%	AA+
Germany	64%	AAA
South Africa	53%	BB
China	48%	A+
Romania	35%	BBB-

The data for these countries were used to estimate a balanced panel data model with 12 cross sections, over 88 quarters, yielding 1056 observations. According to Gujarati and Porter (2009), this provides sufficient data points for the panel results to be meaningful. Quarterly data were not available for the debt to GDP and GDP per capita variables, so it was necessary

to interpolate the variables following the methodology of Aziakpono (2005) using the quadratic match average (QMA) method via EViews 10 to obtain quarterly data.

### 3.3. VARIABLES

The dependent variable for the regressions is sovereign credit rating. While the rating itself is qualitative in nature, using the method adopted by Cantor and Packer (1996), a numerical value was assigned to each credit rating notch assigned by S&P e.g. a AAA rating (the highest rating offered by S&P) was assigned a value of 16, while one notch lower at AA+ was assigned a numerical value of 15. This method is applied down to a B- rating which is assigned a numerical value of 1. The resulting quantitative variable is named *credit* in the present study. Only the credit ratings of S&P were used for the regression analysis. The explanation for this is simply that Cantor and Packer (1996) found that the difference between the ratings assigned by the three major rating agencies, namely S&P, Moody's, and Fitch, were not statistically different, with the largest discrepancy between agencies being one notch. Furthermore, S&P is one of the two major credit rating agencies in the industry. It has a reputation for generally being more pessimistic than Moody's in the sense that it is often the first agency to downgrade a sovereign rating, but not necessarily the first when ratings are upgraded.

Based on the literature surveyed, including Cantor and Packer (1996), Mulder and Perelli (2001), Eliasson (2002), Rowland (2004), Afonso (2003), Mellios and Paget-Blanc (2006), and Erdem and Varlie (2014), the explanatory variables can be assigned to one of two categories, namely broad macroeconomic variables, or debt dynamic variables. The broad macroeconomic variables that are consistently present in the literature and are used in Model 1 include debt to GDP, the real growth rate, consumer price index (inflation), and a dummy variable, namely 'default history' whereby a country is assigned a 1 if it has defaulted on an interest or principal payment at any point between 1996Q1 and 2017Q4 and 0 if it has not. Additional macroeconomic variables that appear less consistently throughout the literature, and are used in Model 3b, include external debt to GDP (the difference between foreign liabilities and foreign assets), as well as GDP per capita.

The debt dynamic variables used in Models 2 and 3a and 3b include the difference between the real GDP growth rate and the real rate of interest, fiscal balance to GDP and, lastly, the ratio of a nation's interest payments to government expenditure.

**Table 2: Explanatory Variables, Explanation and Source**

Variable	Variable Name	Explanation	Source
<b>Broad Macroeconomic Variables</b>			
Debt to GDP (%)	Debtgdp	Government Debt as a percentage of GDP	Thomson Datastream
Real Growth Rate (%)	Real	Quarterly rate of GDP growth (Inflation Adjusted)	Thomson Datastream
Inflation (%)	Cpi	The 12-month percentage change in the Consumer Price Index	Thomson Datastream
Default History (Dummy)	Default	Refers to whether a country has defaulted on a debt between 1996Q1-2017Q4.	International Financial Statistics – IMF
Per Capita Income (US\$)	Gdpcap	GDP divided by a country's population.	Thomson Datastream
External Debt to GDP (%)	Extgdp	Government Foreign Liabilities less Foreign Assets as a % of GDP.	International Financial Statistics – IMF
<b>Debt Dynamic Variables</b>			
Real Growth Rate – Real Interest Rate (%)	Realgap	Inflation adjusted economic growth less inflation adjusted 3-month government bond interest rate	Thomson Datastream
Fiscal Balance to GDP (%)	Fisgdp	The difference between government income and government expenditure as a % of GDP.	Thomson Datastream
Interest Payments to Government Expenditure (%)	Intexp	Refers to the portion of government expenditure that is used to cover interest payments, as a % of GDP.	International Financial Statistics – IMF

*debtgdp* is the ratio between a country's government debt (a cumulative amount) and its annual gross domestic product (GDP). A low debt-to-GDP ratio indicates an economy that produces and sells goods and services sufficient to pay back debts without incurring further debt. This data was collected using Thomson Datastream, but was unavailable on a quarterly basis. Economic theory suggests that the higher the level of debt in a particular country, the lower the credit rating, due to the effect that debt has on growth. A negative relationship would therefore be expected between this variable and sovereign credit ratings (Patillo, Poirson, and Ricci, 2004).

*real* measures growth in GDP from one period to another and is adjusted for inflation. It is expressed in real terms as opposed to nominal terms. The real economic growth rate is expressed as a percentage that shows the rate of change in a country's GDP, typically, from one

year to the next. This data is collected from Thompson Datastream in quarterly figures. The relationship between growth and sovereign credit ratings is unclear, with arguments on either side. Theory would suggest that the greater the rate of growth in the economy, the more likely a country is able to service its debt and ultimately meet its interest obligations, while opposing literature such as Olson (2003) argues that the fastest growing countries are always a subset of the poorest nations, which typically have lower credit ratings.

*cpi* represents the inflation rate. The inflation rate is calculated as the percentage change in the consumer price index over a period of 12 months, which provides an indication of the general level of prices for goods and services. This data was collected using Thomson Datastream. An increase in inflation could have the effect of consumers placing less reliance on local goods and according to Rowland (2004) should cause an increase in demand for the relatively cheaper foreign imports. This in turn has a negative effect on GDP and would widen an already existing current account deficit and hence we can expect a negative relationship between inflation and credit ratings. While this logic may apply for fairly large difference in inflation, it is uncertain whether only small differences in inflation at relatively low levels will in fact have a significant impact on sovereign credit ratings)

*gdpcap* is a measure of a country's economic output that accounts for its population size. It is often considered the best measurement of a country's average standard of living. This data was collected from Thomson Datastream but was unavailable on a quarterly basis. This variable is generally considered to be a proxy for the extent to which an economy is developed. A positive relationship between per capita income and sovereign credit ratings is expected as found by Rowland (2004).

*extgdp* specifically looks at the difference between a government's foreign liabilities and its foreign assets. To obtain the data for this variable, foreign government assets and foreign government liabilities were needed. The difference between these two figures gives the 'external debt' figure which was divided by GDP to obtain the measure of external debt as a percentage of GDP. This data was collected using the IMF International Financial Statistics database and was available on a quarterly basis. External debt in this particular case refers not to the total debt owed by a country to foreigners, but rather the difference between government foreign liabilities and foreign assets. A negative value would therefore imply that the country's net investment position is strong and is likely to result in a favorable/higher credit rating. A

negative relationship between external balance to GDP and credit ratings is therefore expected as found by Chee, S., Fah, C. and Nassir, A. (2015).

*default* refers to whether or not a particular country has defaulted on an interest payment between 1996Q1 and 2017Q4. It is a dummy variable and is equal to 1 if a country has a history of default and is equal to zero if there is no history of default. A credit rating is an indication of the likelihood of defaulting on interest payments and therefore any history of default is likely to deter potential investors. Cantor and Packer (1996) suggest a negative relationship between these variables is thus expected.

*realgap* is the difference between a country's real GDP growth and its real interest rate. Both variables were collected from Thomson Datastream, and were available on a quarterly basis. The larger the gap between a nation's real rate of growth and real interest rate (as measured using a 3-month government bond), the easier it will be for that particular nation to finance its borrowing, which is a favorable characteristic in the eye of a credit rating agency as it reduces the probability of default. According to van der Merwe (1993) a positive relationship is therefore expected between these variables.

*fisgdp* measures a country's fiscal balance (Government Income – Government Expenditure) as a percentage of GDP. Data was firstly collected from the fiscal balance of each nation on a quarterly basis. Secondly the GDP for each respective nation was collected on a quarterly basis and formed the denominator of the variable. Both variables were collected from Thomson Datastream. A positive value of this variable would imply that government revenue from taxation is larger than its level of expenditure, which van der Merwe (1993) suggests is an indication of stable fiscal policy and is thus likely to result in a favorable credit rating. It is therefore expected that this variable would have a positive relationship with credit ratings.

*intexp* is the ratio of interest payments by government to total government expenditure. These variables were collected from the International Financial Statistics database from the IMF and were available on a quarterly basis. The larger the portion of government expenditure that is being absorbed by interest payments, the smaller the portion available for non-interest items such as education, healthcare, etc. If such a position is sustained over a long period, van der Merwe (1993) suggests it is likely that growth will be hindered and ultimately an inability to finance borrowing will develop. We therefore expect a negative relationship between this variable and credit ratings.

### 3.3.1 Graphical representation of the empirical relationships:

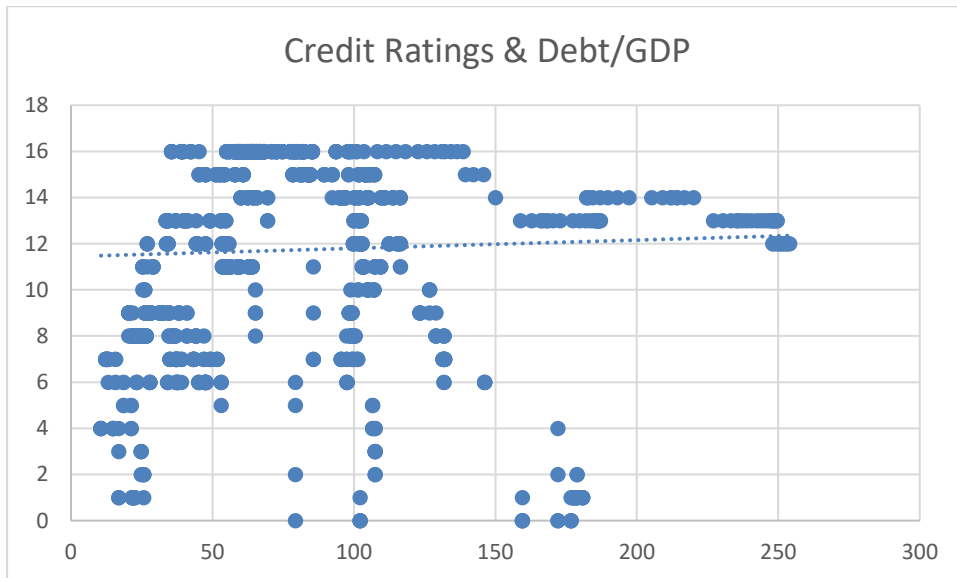


Diagram 1: Credit ratings and debt/GDP

Visually, the relationship between country debt and sovereign credit ratings is modestly positive, which is contrary to what is expected. It is clear that there are wide variations of indebtedness for the same credit rating, suggesting other factors are important in determining ratings.

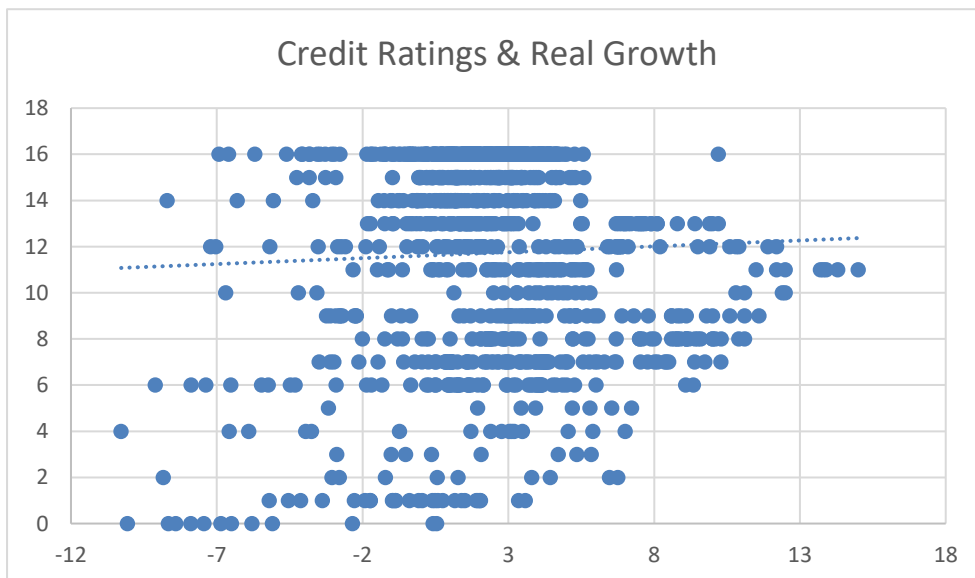


Diagram 2: Credit ratings and real GDP growth

Visually the relationship is moderately positive, which is in line with economic theory. Again, it is clear that for individual credit ratings, countries may be growing at very different rates.

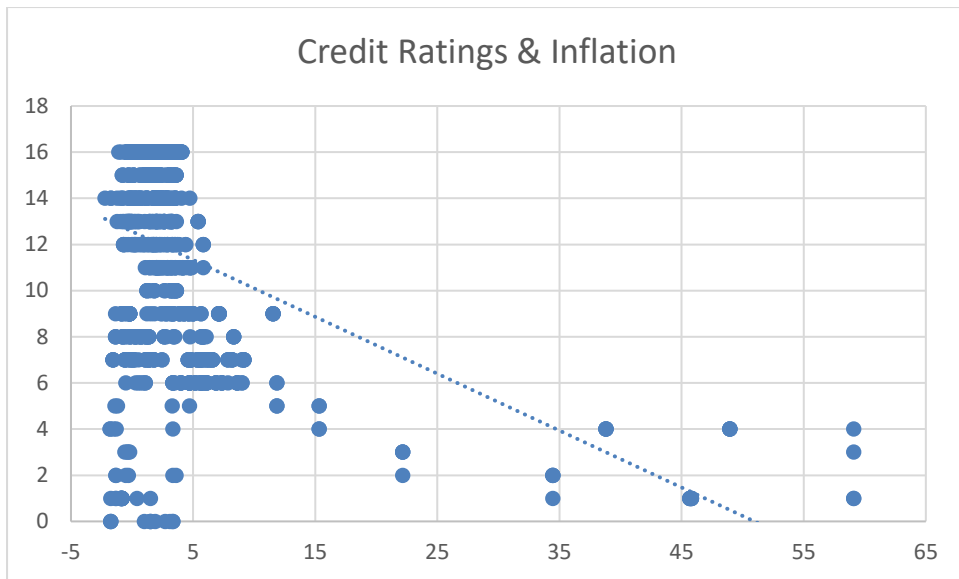


Diagram 3: Credit ratings and inflation

The visual relationship is negative which is in line with expectations. It is clear that inflation in most countries in the sample is quite low which may reduce the impact on credit ratings of what are mainly only small differences in this variable.

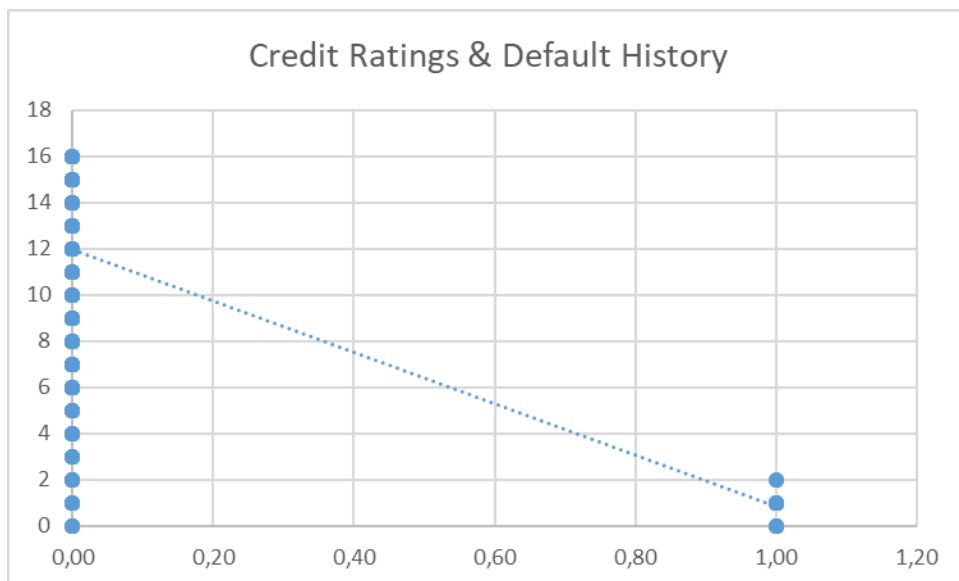


Diagram 4: Credit ratings and default history

Only 3 countries in the sample have a history of having defaulted. As expected, their credit ratings are all low.

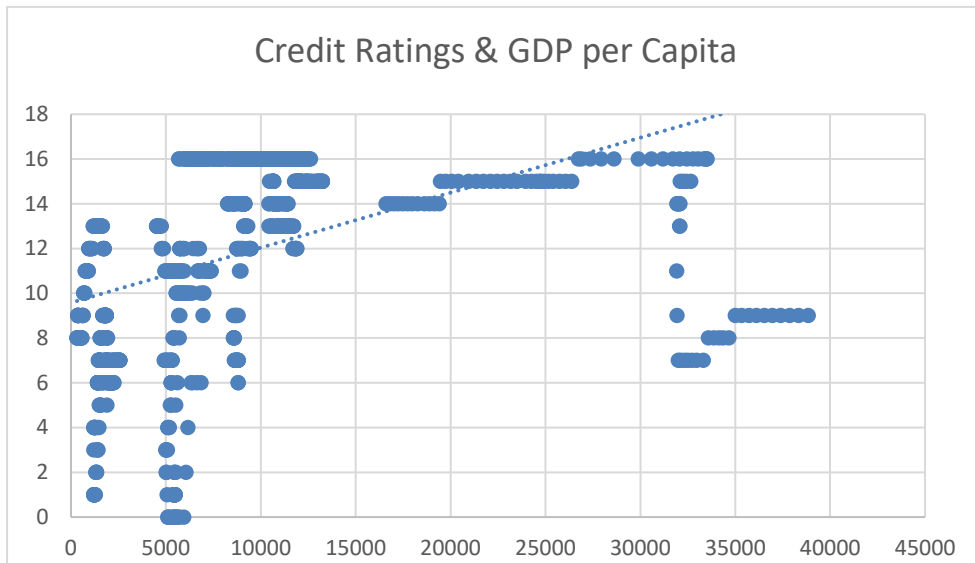


Diagram 5: Credit ratings and GDP per capita

The relationship is positive as expected. The wide range of ratings for similarly low and high levels of GDP per capita suggest that other variables are playing an important role in determining final credit ratings.

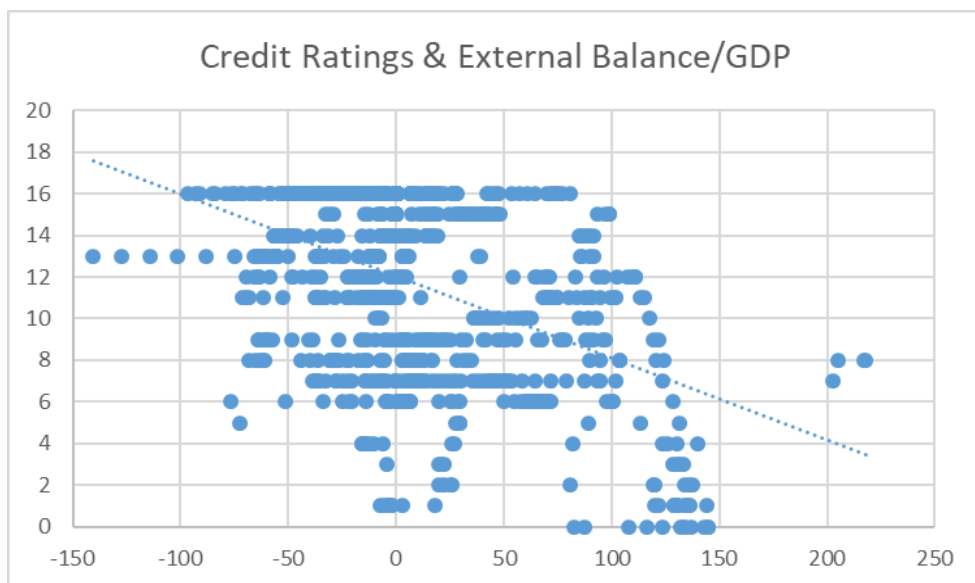


Diagram 6: Credit ratings and external balance to GDP

The relationship is visually strongly negative which is consistent with economic theory.

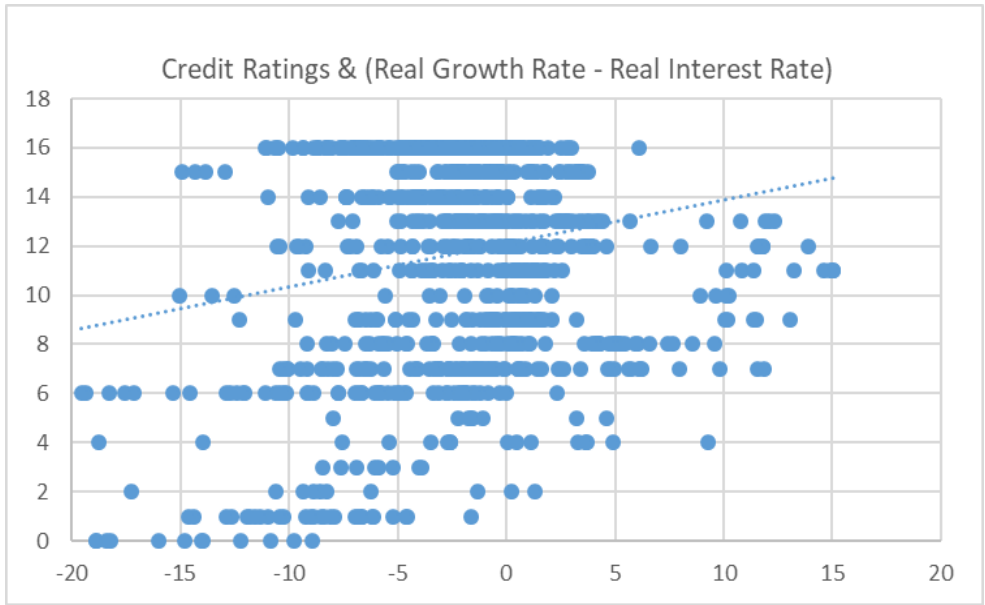


Diagram 7: Credit ratings and real growth rate – real interest rate

There is quite a strong visual positive relationship between these variables which is in line with expectations and suggests this measure of debt sustainability may be an important determinants of credit ratings.

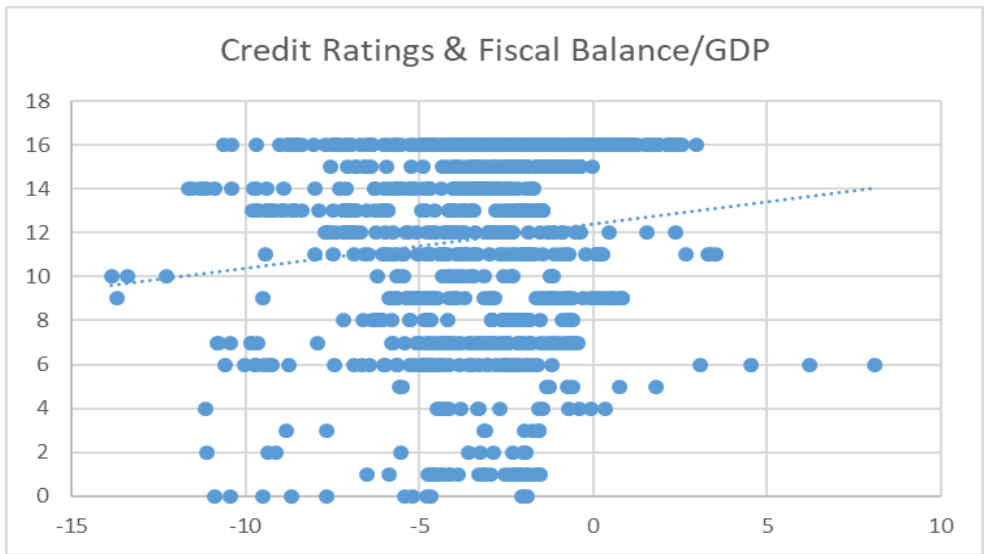


Diagram 8: Credit ratings and fiscal balance/GDP

The relationship appears to be positive, with countries who have a positive fiscal balance generally enjoying higher credit ratings than those with deficits. This is in line with expectations.

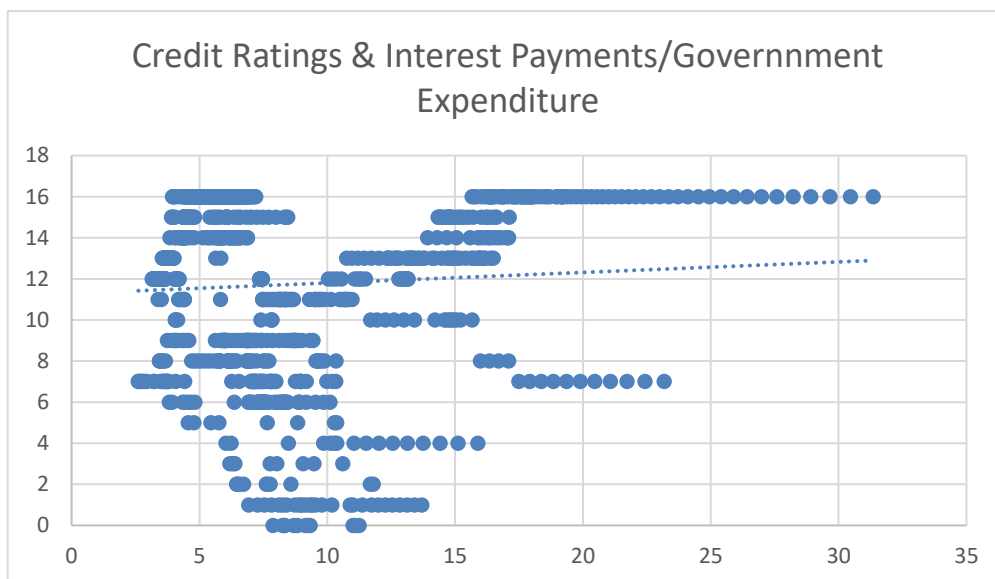


Diagram 9: Credit ratings and interest payments/government expenditure

The relationship is positive which is contrary to expectations. But this positive relationship is the result of the relatively high interest payments relative to government expenditure of a number of AAA rated countries included in the sample, and this appears to distort the visual outcome.

### 3.4. METHOD

Following the methodology of Jaramillo and Tejada (2011), a panel analysis is conducted on the identified major determinants of sovereign credit ratings. The identified determinants are investigated via panel data analysis to determine which (if any) have a significant impact on sovereign credit rating changes across the 12 sample countries between 1996Q1 and 2017Q4.

Model 1 focuses on the broad macroeconomic variables highlighted in the literature, whereas Model 2 examines only the debt dynamics variables. It must be noted that Model 2 should be understood as a first indication of potential relationships as opposed to a separate conclusive part of the overall research results. Model 3 combines the two sets of variables. The specifications may be summarized as follows:

$$\text{Model 1: Credit} = f(\text{debtgdp}, \text{real}, \text{cpi}, \text{default})$$

$$\text{Model 2: Credit} = f(\text{realgap}, \text{fisgdp}, \text{intexp})$$

$$\text{Model 3a: Credit} = f(\text{debtgdp}, \text{real}, \text{cpi}, \text{default}, \text{realgap}, \text{fisgdp}, \text{intexp})$$

$$\text{Model 3b: Credit} = f(\text{debtgdp}, \text{real}, \text{cpi}, \text{default}, \text{gdpcap}, \text{extgdp}, \text{realgap}, \text{fisgdp}, \text{intexp})$$

Both fixed effects and random effects models are estimated in each case. The Hausman test is used to assess which method is more valuable in the case of the final Model 3b.

Under the fixed effects method, the intercept of the regression model is allowed to differ among individuals in recognition of the fact that each individual or cross-sectional unit may have some special characteristics of its own, which is taken into account using dummy variables. The random effects method on the other hand assumes that the intercept of an individual unit is a random variable with a constant mean value. The individual intercept is then expressed as a random deviation from this constant mean value (Gujarati and Porter, 2009).

The advantages of using panel data as opposed to time series data, according to Gujarati and Porter (2009) are, firstly, that because panel data relates to individuals, firms, state, or countries over time, there is likely to be heterogeneity in these units. The techniques of panel data estimation can take such heterogeneity explicitly into account by allowing for subject specific variables. Secondly, by combining time series of cross-section observations, panel data allows for more informative data, increased variability, less collinearity, increased degrees of freedom, as well as more efficiency. Thirdly, panel data are better suited to studying the dynamics of change. Fourthly, panel data models can detect and measure effects that cannot be observed in pure cross-section or pure time series data. Furthermore, panel data allows for more complicated behavioural models to be studied. Finally, panel data can minimize the bias that might result if individuals or firms are aggregated into broad aggregates.

The properties of a time series, according to Gujarati and Porter (2009), may be modeled in terms of the following components or factors. Most time series contain one or more of the following: a trend, seasonal, cyclical, and irregular component. A trend component is a long run increase or decrease in a time series. A seasonal component is the idea that economic data is affected by the time of year. The cyclical component refers to the idea that the business cycle impacts on virtually all economic activity, while the irregular component factors in the impact of random events, which are unpredictable in nature.

A unit root test can be used to determine the stationarity of a time series which would imply that a shift in time does not cause a change in its distribution. A unit root according to Gujarati (2009) is a stochastic trend in a time series (also known as a random walk with drift). A time series is said to have a unit root if it shows a systematic pattern that is unpredictable.

### **3.5. CONCLUSION**

Chapter 3 initially outlined the sources of the data, namely Thompson Datastream and the IMF International Financial Statistics database. Further discussion was given to the period, as well as the time interval of each variable. Thereafter the panel of countries chosen, as well as the manner in which they were chosen was outlined.

In addition, the variables that were used in the regressions were discussed in depth, with a theoretical explanation given, as well as a graphical representation provided of the relationship between each explanatory variable and the dependent variable. Thereafter the method of analysis was discussed in detail, making reference to the panel analysis method used by Jaramillo and Tejada (2011), as well as to the structure of the particular models used in Chapter 4. Subsequently, the difference between the random and fixed effects method, as well as the advantages of using panel analysis compared to time series analysis was outlined.

## CHAPTER 4: RESULTS AND INTERPRETATION

### 4.1. INTRODUCTION

Chapter 4 provides the model specification, results (both fixed and random effects) and interpretation for each model investigating the determinants of sovereign credit ratings. Thereafter, a Hausman test is conducted for model 3b to determine whether the fixed or random effects is the preferred method in this context.

### 4.2. MODEL SPECIFICATION AND RESULTS: FIXED AND RANDOM EFFECTS

#### 4.2.1. Model 1: Broad Macroeconomic Variables – Specification and Results

The specification for Model 1 considers only the commonly used broad macroeconomic variables as set out in the literature review.

$$\text{Credit} = f(\text{debtgdp}, \text{real}, \text{cpi}, \text{default})$$

The results of both the fixed and random effects estimations of Model 1 appear in Table 3 below.

**Table 3: Model 1: Empirical Results**

Variable	Fixed Effects Coefficient	Random Effects Coefficient
(constant)	16.01306 ***	15.91353 ***
Debtgdp	-0.053062 ***	-0.051679 ***
Real	0.123031 ***	0.121929 ***
Cpi	-0.083019 ***	-0.084423 ***
Default	-4.748347 ***	-4.852050 ***
<b>Adjusted R-squared</b>	0.860328	0.485860
<b>F-Stat</b>	434.2258 ***	250.2429 ***

\* denotes significance at 10% level

\*\* denotes significance at 5% level

\*\*\* denotes significance at 1% level

**Source: Authors own estimation using EViews 10**

The results show that the coefficients of debt to GDP, the real growth rate, cpi, and default history are statistically significant at the 1% level. The signs of debt to GDP, cpi, and default history coefficients are negative which is in line with *a priori* expectations as higher levels of debt relative to GDP, higher inflation, and having a history of defaulting on debt payments are all unfavorable characteristics in the eyes of a credit rating agency. These findings are consistent with the findings of Patillo, Poirson, and Ricci (2004), Rowland (2004), as well as Cantor and Packer (1996). The real growth rate coefficient is positive which is consistent with

economic theory as higher growth would improve a country's ability to service its debt and will likely be looked at favorably by credit rating agencies. Having said that, Olson (2003) finds that developing countries tend to outperform developed countries in terms of GDP growth which could imply that negative relationship is possible,

The overall model is statistically significant at the 1% level, as indicated by the p-value of the F statistic, implying that overall the independent variables are jointly successful in explaining changes in the value of the dependent variable. The adjusted R-squared indicates that about 86% of the variation in credit ratings is explained by the explanatory variables together.

Concerning the random effects method, the results show that the coefficients of debt to GDP, the real growth rate, cpi, and default history are again statistically significant at the 1% level. The signs of the estimated coefficients are the same as in the fixed effects model and are therefore in line with *a priori* expectations.

The overall model is statistically significant at the 1% level, as indicated by p-value of the F statistic. The adjusted R-squared indicates that about 49% of the variation in credit ratings can be explained by the four broad macroeconomic explanatory variables together.

#### 4.2.2. Model 2: Debt Dynamic Variables – Specification and Results

The specification of Model 2 considers only the debt dynamic variables as set out in the literature review.

$$Credit = f(realgap, fisgdp, intexp)$$

where the variables are defined as before.

**Table 4: Model 2: Empirical Results**

Variable	Fixed Effects Coefficient	Random Effects Coefficient
<i>(constant)</i>	11.57315 ***	11.57549 ***
<i>Realgap</i>	0.218153 ***	0.217901 ***
<i>Fisgdp</i>	-0.011757	-0.011221
<i>Intexp</i>	0.068574 **	0.068448 **
<b>Adjusted R-squared</b>	0.759533	0.133002
<b>F-Stat</b>	239.0218 ***	54.94755 ***

\* denotes significance at 10% level

\*\* denotes significance at 5% level

\*\*\* denotes significance at 1% level

Source: Authors own estimations using EViews 10

The real growth rate less the real interest rate (*realgap*) coefficient is statistically significant at the 1% level, while the interest payments to government expenditure coefficient is statistically significant at the 5% level. The fiscal balance to GDP coefficient is insignificant. Concerning the signs of the *realgap* and *intexp* variables, we would expect the larger the difference between the rate at which a country is growing and the rate at which its debt must be serviced, the more likely a country is able to meet its debt obligations and the higher its credit rating would be. The positive coefficient of *realgap* is therefore consistent with economic theory as well as with van der Merwe (1993). The positive coefficient of the *intexp* variable on the other hand is contrary to economic theory as well as van der Merwe (1993). The smaller the portion of government expenditure that is allocated to making interest payments, the more productive non-interest spending can be made, which is expected to stimulate growth in the economy and ultimately contribute towards a higher sovereign credit rating. This unexpected result was evident in the graphical representations of the data in chapter 3. It was suggested that the relationship might be because of the high interest payments to government expenditure of a number of AAA countries included in the sample. It should also be recognized that this model ignores the mainstream variables to be included in Models 3a and 3b. The results at this stage therefore reveal potential relationships rather than final research results.

The overall model is statistically significant at the 1% level, as indicated by the p-value of the F statistic, implying that overall the independent variables are jointly successful in explaining changes in the value of the dependent variable. The adjusted R-squared indicates that about 76% of the variation in credit ratings is explained by the explanatory variables collectively.

The results under the random effects method are the same in terms of the sign and significance of the estimated coefficients. The overall model is statistically significant at the 1% level, as indicated by the p-value of the F-statistic. Under the random effects model the adjusted R-Squared indicates that only 13% of the variation in credit ratings can be explained by these 3 ‘debt dynamic’ variables on their own.

#### **4.2.3. Model 3a: Joint Significance – Specification and Empirical Results**

$$\text{Credit} = f(\text{debtgdp}, \text{real}, \text{cpi}, \text{default}, \text{realgap}, \text{fisgdp}, \text{intexp})$$

The specification of Model 3a considers both the broad macroeconomic variables from Model 1, as well as the debt dynamic variables from Model 2, with the variables defined as before.

**Table 5: Model 3a: Empirical Results**

Variable	Fixed Effects Coefficient	Random Effects Coefficient
<i>(constant)</i>	17.78984 ***	17.66062 ***
<i>Debtgdp</i>	-0.057770 ***	-0.056714 ***
<i>Real</i>	-0.056373 *	-0.060464 *
<i>Cpi</i>	-0.083261 ***	-0.084794 ***
<i>Default</i>	-4.278455 ***	-4.345269 ***
<i>Realgap</i>	0.163609 ***	0.165599 ***
<i>Fisgdp</i>	-0.016873	-0.015549
<i>Intexp</i>	-0.079344 ***	-0.071017 ***
<b>Adjusted R-squared</b>	0.871178	0.528756
<b>F-Stat</b>	397.3678 ***	170.1076 ***

\* denotes significance at 10% level

\*\* denotes significance at 5% level

\*\*\* denotes significance at 1% level

**Source: Authors own estimation using EViews 10**

Similar to Model 1 the coefficients of the broad macroeconomic variables are statistically significant. The coefficients of debt to GDP, cpi, and default history are significant at the 1% level, which are consistent with the findings of Patillo, Poirson, and Ricci (2004), Rowland (2004), and Cantor and Packer (1996). The coefficient of the real growth rate is significant at the 10% level. Furthermore, just as in Model 2, the coefficients of the real growth less the real interest rate, and interest payments to government expenditure are significant at the 1% level, as found by van der Merwe (1993). Again, similar to Model 2, the coefficient of fiscal balance to GDP is not significant at the 1%, 5%, and 10% levels. The signs of the coefficients for debt to GDP, cpi, default, and interest to government expenditure variables are negative. This is consistent with the literature in the sense that an increase in debt levels relative to GDP, in inflation, having a history of defaulting on debt, and an increase in the portion of government spending that is taken up by debt payments, would all increase the likelihood of defaulting on debt and ultimately lead to a lower credit rating. The sign of *realgap* is positive as expected. The sign of the coefficient for the real growth rate is negative however, which is not only inconsistent with Model 1, but is inconsistent with economic theory too. An increase in a country's real growth rate would increase its ability to service its debt payments and should ultimately contribute to a higher credit rating. It was noted, however, in Section 3.3 that the sign of this coefficient might be uncertain because Olson (2003) warns that the fastest growing countries are always a sub-set of the world's poorest countries and these typically have low credit ratings. A possible explanation for the change in the sign of the *real* coefficient is multicollinearity among the explanatory variables.

The overall model is statistically significant at the 1% level as indicated by the p-value of the F-statistic. An adjusted R-squared of 87% indicates that 87% of the variation in sovereign credit ratings can be explained by the broad macroeconomic variables as well as the debt dynamic variables set out in the literature.

Concerning the findings of the random effects model, the signs and significance of the estimated coefficients are the same as for the fixed effects model. The overall random effects model is statistically significant at the 1% level, as indicated by the F statistic. The adjusted R-squared indicates that 53% of the variation in sovereign credit ratings can be explained by the broad macroeconomic variables as well as the debt dynamic variables set out in the literature.

#### 4.2.4. Model 3b Specification: Including GDP per Capita and External Balance/GDP

$$\text{Credit} = f(\text{debtgdp}, \text{real}, \text{cpi}, \text{default}, \text{gdpcap}, \text{extgdp}, \text{realgap}, \text{fisgdp}, \text{intexp})$$

The specification of Model 3b considers both the broad macroeconomic variables from Model 1, and the debt dynamic variables from Model 2 i.e. Model 3a, with the inclusion of GDP per capita, as well as external balance to GDP, as set out in the literature, where the variables are defined as before.

**Table 6: Model 3b: Empirical Results**

Variable	Fixed Effects Coefficient	Random Effects Coefficient
<i>(constant)</i>	18.34447 ***	18.05414 ***
<i>Debtgdp</i>	-0.056393 ***	-0.055358 ***
<i>Real</i>	-0.066956 **	-0.073036 **
<i>Cpi</i>	-0.087989 ***	-0.089991 ***
<i>Default</i>	-4.336398 ***	-4.371236 ***
<i>Gdpcap</i>	-6.15E-05 *	-4.57E-05 *
<i>Extgdp</i>	-0.002226 ***	-0.002449 ***
<i>Realgap</i>	0.161681 ***	0.164915 ***
<i>Fisgdp</i>	-0.019093	-0.017270
<i>Intexp</i>	-0.089059 ***	-0.076511 ***
<b>Adjusted R-squared</b>	0.872765	0.532443 ***
<b>F-Stat</b>	362.8363 ***	134.4901 ***

\* denotes significance at 10% level

\*\* denotes significance at 5% level

\*\*\* denotes significance at 1% level

Source: Authors own estimations using EViews 10

The results show that the coefficients of debt to GDP, cpi, external balance to GDP, default history, and the real growth rate less the real rate of interest, as well as interest payments to government expenditure are all statistically significant at the 1% level. The real growth rate, and GDP per capita are found to be statistically significant at the 5% and 10% levels

respectively. The coefficients of debt to GDP, cpi, default history, the real growth rate less the real interest rate, external balance to GDP and interest payment to government expenditure have the expected signs and confirm our *a priori* expectations that they influence the particular credit rating assigned to a country. The relationships of the aforementioned variables are consistent with the findings of Patillo, Poirson, and Ricci (2004, Rowland (2004), Cantor and Packer (1996) and van der Merwe (1993).

The coefficients of real growth rate and GDP per capita, although significant, have signs that are contrary to *a priori* expectations and economic theory. One would expect that a higher rate of economic growth and a higher level of per capita income would be favourable characteristics in the eyes of a credit rating agency. The negative relationship found between the real growth rate and sovereign credit ratings can be explained by Olson (2003) who found that the fastest growing nations are usually comprised of a subset of developing or poor nations who have low sovereign credit ratings. As noted earlier, a possible explanation for the change in the sign of the *real* coefficient is multicollinearity among the explanatory variables. The coefficient of fiscal balance to GDP appears to be statistically insignificant at the 1%, 5%, and 10% levels. This is surprising given the importance attached to this variable in the literature.

The p-value of the F-statistic implies that the overall model is statistically significant at the 1% level. The adjusted R-squared indicates that 87% of the variation in sovereign credit ratings can be explained by all the variables collectively.

Under the random effects method, the results are the same in terms of the sign and significance of the estimated coefficients. As before, the coefficient of the real growth rate and GDP per capita, although significant, have signs that are contrary to *a priori* expectations and economic theory. The negative coefficients in the results may be due to correlation between GDP growth and GDP per capita, and/or between GDP growth and external debt to GDP. Another possible reason for the negative coefficients could simply be a lack of variability within the data over the specific period, given that GDP per capita changes only slowly over time.

Fiscal balance to GDP appears to be statistically insignificant at all levels. This is surprising given the importance attached to it in the literature.

The p-value of the F-statistic implies that the overall model is statistically significant at the 1% level. The Adjusted R-squared indicates that about 53% of the variation in sovereign credit

ratings can be explained by all the variables collectively. Furthermore, the size of the majority of estimates are the same which adds to the robustness and credibility of the results.

### 4.3. HAUSMAN TEST RESULTS

The Hausman test considers whether the fixed or random effects approach is more suitable in a given context.

**Table 7: Hausman Test Results for Model 3b**

Test Summary	Chi-Sq Statistic	Chi-Sq d.f.	Prob	
<b>Cross-section random</b>	26.811793	9	0.0015	
<b>Cross-section random effects test comparison:</b>				
Variable	Fixed	Random	Var. (Diff)	Prob.
<i>Debtgdp</i>	-0.056393	-0.055358	0.000000	0.0010
<i>Real</i>	-0.066956	-0.073036	0.000002	0.0001
<i>Cpi</i>	-0.087989	-0.089991	0.000000	0.0000
<i>Gdpcap</i>	-0.000061	-0.000046	0.000000	0.0026
<i>Extgdp</i>	-0.002226	-0.002449	0.000000	0.0000
<i>Default</i>	-4.336398	-4.371236	0.000365	0.0681
<i>Realgap</i>	0.161681	0.164915	0.000001	0.0010
<i>Fisgdp</i>	-0.019093	-0.017270	0.000001	0.416
<i>Intexp</i>	-0.089059	-0.076511	0.000015	0.0011

Source: Authors own estimation using EViews 10

The null hypothesis for the Hausman test is that the fixed effects and random effects results do not differ significantly (Gujarati and Porter, 2009). The Hausman test results indicate that the debt to GDP, real growth rate, cpi, GDP per capita, external balance to GDP, real growth less the real interest rate, and interest payments to government expenditure coefficients have significant differences (at the 1% level) to their fixed effects counterparts. Default history has a significant difference to its fixed effects counterpart at the 10% level. The chi-squared statistic is significant at the 1% level. The null hypothesis is thus rejected and it is concluded that the fixed effects model is preferable in this context. Gujarati and Porter (2009) note that this outcome suggests that there is correlation between the random effects and the explanatory variables, leading to the fixed effects approach being superior for this study.

#### 4.4. CONCLUSION

Model 1 under the fixed effects method confirmed the validity of the literature in the sense that the four broad macroeconomic variables that are consistently cited as having an influence on sovereign credit ratings are all found to be statistically significant at the 1% level. Furthermore, the overall regression is significant at the 1% level, with 86% of the variation in sovereign credit ratings being explained by debt/GDP, real growth rate, cpi, and default history in the fixed effects results.

Model 2 which looked solely at the debt dynamic variables, found both the real interest rate less the real growth rate, and the interest payments/government expenditure variables to be statistically significant and with the expected signs of the coefficients. Fiscal balance/GDP was found not to significantly contribute to sovereign credit rating differences. Furthermore, the fixed effects results were statistically significant overall, with 76% of the variation in sovereign credit ratings being explained by (real growth rate-real interest rate), and interest payments/government expenditure.

Model 3a is a combination of Model 1 (broad macroeconomic variables) and Model 2 (debt dynamic variables). The model found all the broad macroeconomic variables from Model 1 (debt/GDP, real growth, cpi, default history), as well as two of the three variables from Model 2 (real growth rate - real interest rate, and interest payments/government expenditure) to be statistically significant. However, the sign of the real growth coefficient is now not what is expected. The fixed effects model has a substantial degree of explanatory power with the explanatory variables, both macroeconomic and debt dynamic in nature, explaining 87% of the variation in sovereign credit ratings.

Model 3b looked to expand the macroeconomic variables from Model 3a to include GDP per capita, and external balance/GDP. The GDP per capita and external balance/GDP coefficients are both significant. Similarly to Model 2, the fiscal balance/GDP variable was found to be statistically insignificant, at the 1%, 5%, and 10% level. The coefficients of the variables that were initially used in Model 1, namely debt/GDP, real growth, cpi, and default history were all found to be statistically significant, as were two of the debt dynamic variables used initially in Model 2, namely the (real growth rate – real interest rate), and interest payments /government expenditure variables. The signs of all coefficients were as expected, except for GDP growth and GDP per capita which are negative, which is contrary to our *a priori* expectations. Possible

explanations for these outcomes were provided in Section 4.2.4. The overall model is significant at the 1% level, although it could be improved with the inclusion of additional variables.

Furthermore, the majority of estimates of the various coefficients within each model are similar in magnitude, which adds to the robustness and credibility of the results

Under the random effects method, the same four models were tested. The results in terms of sign and significance were the same as for the fixed effects model. Differences arose in the proportion of the variation in the dependent variable being explained by the independent variables collectively in the fixed versus random effects models.

Looking at the results of the Hausman test, the debt to GDP, real growth rate, cpi, GDP per capita, external balance to GDP, real growth less the real interest rate, and interest payments to government expenditure coefficients have significant differences (at the 1% level) to their fixed effects counterparts. Default history has a significant difference to its fixed effects counterpart at the 10% level. The Chi-squared statistic was significant at the 1% level, indicating that the fixed effects approach is preferred for the present study.

## **CHAPTER 5: CONCLUSION AND POLICY IMPLICATIONS**

The goal of this study was to ascertain the extent to which debt is a determinant of sovereign credit ratings. Furthermore, the study included a variety of broad macroeconomic variables that, according to the literature, significantly affect sovereign credit ratings. The aim of the study is to examine whether it is not necessarily a country's debt levels in isolation that influence credit ratings, but also the dynamics within debt that are important. This then provides room for policy recommendations that address issues such as growth, interest payments by governments, and fiscal deficits as opposed to trying simply to lower government debt as a proportion of GDP. In South Africa's case, although having increased relatively quickly, debt to GDP is not high by international standards, especially when compared to countries like Japan, and the USA whose debt levels exceed 200% and 100% of GDP respectively.

Furthermore, the study seeks to understand debt dynamics and how they may contribute to the unsustainability of debt levels and how this might force a country into a fiscal debt trap. A fiscal debt trap is described as an unsustainable level of and rate of increase in the government debt, where a continued rise in the ratio of government debt to gross domestic product cannot be prevented.

### **5.1. LITERATURE REVIEW, DATA AND METHOD**

The focus of Chapter 2 was to examine the literature on the determinants of sovereign credit ratings. The Chapter initially discussed the history of credit ratings and provided a brief explanation of the procedure undertaken by a credit rating agency in arriving at a particular rating. Chapter 2 went on to provide a definition of sovereign credit ratings, as well as to discuss their importance. Mellios and Paget-Blanc (2006) provide the theoretical explanations of why a country would potentially not repay its debt, with the second of their explanations referring to a deterioration in a country's ability to service its debt.

Thereafter, the determinants of sovereign credit ratings were looked at, covering a wide variety of literature, which yielded four major determinants of sovereign credit ratings. These variables included debt/GDP, real GDP growth, cpi, and default history. These variables were the explanatory variables used in Model 1.

Having established the determinants of sovereign credit ratings, the Chapter, taking into account the theoretical explanations provided by Mellios and Paget-Blanc (2006), looked to establish the bidirectional relationship between debt and growth. The literature review established that a country may not repay its debt due to a deterioration in its ability to do so and found a negative relationship between debt and growth. Reinhart and Rogoff (2010), and Patillo, Poirson, and Ricci (2004) established a negative relationship between the two variables. Rivlin (2013) and Varma (2006) indicate that growth is of the utmost importance when it comes to a country's ability to service its debt, and ultimately to maintain sustainable debt levels.

Having understood the effect that debt has on growth, and having understood the role that growth plays in maintaining sustainable debt levels and ultimately the ability to service debt, van der Merwe (1993) provides a number of ratios/tools that can be used to measure the sustainability of a country's debt climate.

Chapter 3 outlined the variables that are considered in the study, where the data was collected from, over what time period, as well as the specific intervals e.g., monthly, quarterly, semi-annually, or yearly. The variables chosen can be grouped into three categories, which ultimately form the three models used in Chapter 4. Firstly, the broad macroeconomic variables, secondly the debt dynamic variables, and thirdly the inclusion of the external balance to GDP and GDP per capita variables used less frequently in the literature. Data was collected on a quarterly basis where possible, while some annual variables required interpolation to make them quarterly. The Chapter then discussed the method used, which followed the methodology of Jaramillo and Tejada (2011). A panel analysis was conducted on the major determinants of sovereign credit ratings and the identified determinants were investigated via panel data analysis to determine which (if any) have a significant impact on sovereign credit rating changes across the 12 sample countries between 1996Q1 and 2017Q4.

## **5.2. FINDINGS OF THE THESIS**

Chapter 4 was dedicated to discussing the findings of the paper. Four separate models were used (under the fixed effects method, as well as the random effects method), namely, Model 1 which included only the broad macroeconomic variables that the literature suggested are fundamental determinants of sovereign credit ratings. The finding of Model 1 was that debt/GDP, the real growth rate, inflation, and default history are all statistically significant determinants of sovereign credit ratings, which is highly consistent with the literature.

Model 2 isolated the ‘debt dynamic’ variables that are said to be useful indicators or measurements of debt sustainability. It found that the difference between a country’s real interest rate and real growth rate, as well as its interest payments to government expenditure ratio are highly significant determinants of sovereign credit ratings. A fiscal deficit as a proportion of gross domestic product was found to be insignificant and therefore to not contribute to the changes in sovereign credit ratings.

Model 3a was a combination of the broad macroeconomic variables from Model 1 and the debt dynamic variables from Model 2. It found that, as in Model 1, the coefficients of debt/GDP, cpi and default history are significant at the 1% level. The coefficient of the real growth rate is now significant only at the 10% level. Furthermore, just as in Model 2 (debt dynamic variables), the coefficients of the real growth rate less the real interest rate, and interest payments/government expenditure are statistically significant at the 1% level. Again, similarly to Model 2, the coefficient of fiscal balance/GDP is not significant. The signs of the coefficients for debt/GDP, cpi, default, and interest/expenditure variables are negative which is consistent with the literature in the sense that an increase in debt levels relative to GDP, and increase in inflation, having history of defaulting on debt, and an increase in the portion of government spending that is taken up by debt payments, to increase the likelihood of defaulting on debt and ultimately lead to a lower credit rating. Surprisingly, the sign for real growth rate is now negative which is inconsistent with the literature and with the findings of Model 1. It was suggested that this might be due to the relatively small number of countries in the sample as well as the point made by Olson (2003) that the fastest growing countries are always a sub-set of the world’s poorest countries (who typically have low credit ratings).

Model 3b included the broad macroeconomic variables (Model 1) and the debt dynamic variables (Model 2) as well as the external balance to GDP, and GDP per capita. The findings show that the coefficients of debt to GDP, cpi, external balance to GDP, default history, and the real growth rate less the real rate of interest, as well as interest payments to government expenditure are all statistically significant at the 1%. The real growth rate, and GDP per capita are statistically significant at the 5%, and 10% level respectively. The coefficients of debt to GDP, cpi, default history, the real growth rate less the real interest rate, external balance to GDP and interest payment/government expenditure have the correct signs and confirm our *a priori* expectations that they are taken into account when assigning credit ratings. The variable real growth rate and GDP per capita, although significant, have the incorrect signs and are

contrary to our *a priori* expectations and economic theory. One would expect that a higher rate of economic growth and a higher level of per capita income, would be favourable characteristics in the eyes of a credit rating agency. The negative coefficients in the results may be due to the correlation between GDP growth and GDP per capita as well the reasons discussed for the negative sign of growth in Model 3a.

### **5.3. POLICY RECOMMENDATIONS AND FURTHER RESEARCH**

The findings of the thesis highlight the need for policy to focus on a wider variety of issues than simply the level of debt in a country. It was suggested that the negative sign for growth, which theory and the literature expect to play an important role in debt sustainability, might be the result of the relatively small number of countries used in this study. Expanding the coverage of countries used should therefore be the basis of further research. Other variables that might also be considered in future research include export/GDP, imports/GDP, economic development, degree of economic inequality, level of corruption, and central bank policy. Narrower debt to GDP brackets might be considered and credit ratings might be examined over a longer time period. Additional research could also be conducted in the area of debt sustainability, specifically looking at the effect of changes in credit ratings themselves on the debt climate of a country, in the sense that a credit rating downgrade/upgrade might worsen/improve sustainability of debt.

Despite the surprising negative sign of GDP growth in Models 3a and 3b, GDP growth was nonetheless still found to be important for credit ratings in Model 1 and through its importance for the difference between the real growth rate and real interest rate, which was found to be statistically significant in Models 2, 3a and 3b. From a policy perspective, increasing GDP growth is therefore useful in that it will reduce the gap between the real growth rate and the real interest rate. Higher GDP growth will also favourably impact on other variables found to be significant for credit ratings in this study, including debt/GDP and external balance/GDP. Understanding the factors that influence GDP growth should therefore form part of attempts to bring about improved sovereign credit ratings.

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