INVESTMENT-GRADE OR "JUNK" STATUS: DO SOVEREIGN CREDIT RATINGS REALLY MATTER?

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DECLARATION OF ORIGINAL WORK

This page declares that the work produced in this thesis is my own and was conducted whilst completing the degree of Master of Commerce in Financial Markets whilst at Rhodes University. Any work that is not my own has been credited accordingly. This thesis has not been submitted to other universities, Technikons or colleges for degree purposes.

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ABSTRACT

Credit ratings play a well-established part in modern financial markets, reducing asymmetric information between investors and borrowers. In particular, sovereign credit ratings allow the world's lesser-known economies to access a wider pool of international capital, while simultaneously allowing international investors to access a more diverse set of investment opportunities. The importance of sovereign credit ratings in terms of the cost of government debt in developing nations was observed. The relationship between sovereign credit ratings and average bond spreads over the time period spanning 2006 – 2017 was examined in 25 emerging economies. Regression analysis in the form of fixed-effects and random-effects models was used to determine the impact of changes in sovereign credit ratings on the cost of sovereign debt, controlling for certain macroeconomic factors. It was concluded that sovereign credit ratings are relevant in helping to determine the cost of sovereign debt for developing economies, but that they are not the only factor considered by global markets. The thesis therefore recommended further research into the factors affecting the cost of sovereign debt as well as further refinements to the methodologies that ratings agencies use to assign ratings.

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> *"Never think that success is down to your own performance alone. If you start listening only to yourself, you take the first step back towards the bottom.* ***The flowers of victory belong in many vases****."*
>
> - MICHAEL SCHUMACHER, SEVEN-TIME FORMULA 1 WORLD DRIVER'S CHAMPION (1994, 1995, 2000, 2001, 2002, 2003, 2004)

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CHAPTER 1: INTRODUCTION

1.1. Research background

Sovereign credit ratings may be defined as a "condensed assessment by credit rating agencies of a government's ability and willingness to repay its public debt both in principal and in interest on time" (de Vries and de Haan, 2014). Sovereign credit ratings play a crucial role in globalized financial markets. The purpose of sovereign credit ratings is to provide investors with a signal that alerts them to the risks associated with sovereign debt funded with bonds. The value of this role is linked to the phenomenon of asymmetric information, a situation that occurs when one party in a transaction (the sovereign seeking to issue debt) has more information than the other (the potential investor) (Akerlof, 1970). White (2002) notes the effect that asymmetric information has on lenders, given the necessity to ascertain the continued creditworthiness of borrowers after a loan has been granted. White (2002) observes that while specialist lenders, such as large banks or pension funds, may be able to gather the necessary information to judge the feasibility of the investment themselves, non-specialist lenders are unlikely to be able to do so. Requiring every investor to perform their own risk assessments and assess the creditworthiness of each debt-issuing sovereign would be a costly and ultimately futile exercise. This would be especially problematic for smaller, lesser-known nations. As a result, investors would be likely to focus on safer, larger and more familiar investment opportunities, i.e. the debt of developed nations. Access to funds for emerging markets would be greatly reduced and the costs of funding debt would increase as a consequence**.** The primary function of credit ratings agencies revolves around eliminating asymmetric information between the parties in a lending relationship (Ligeti and Szőrfi, 2016).

Hence, the role of credit ratings agencies is to specialize in the collection and analysis of large amounts of public and private information and to condense it into a single, universally understood and easily obtainable signal in the form of either a corporate or sovereign credit rating (Pennartz and Snoeij, 2012). White (2002:5) states that, in this way, credit ratings allow lenders to "pierce the fog of asymmetric information that surrounds lending relationships".

Furthermore, White (2002:4) refers specifically to bonds as instruments where the "public good" nature of information means that information-gathering efforts are not duplicated, which would be inefficient. This outcome also benefits borrowers because it exposes them to a wider variety of potential lenders, thus allowing them a greater opportunity to attract funds by means of issuing debt. This should result in lower interest rates and potentially greater borrowings in a larger, more liquid market.

The concept of credit ratings began at least as early as 1909, when John Moody (founder of Moody's Investor Services) began analyzing the credit-worthiness of the stocks and bonds of American railroad companies based on their operations, managerial expertise and financial position (Moody's Investor Services, 2015). This idea was expanded to include US municipal bonds in 1914, with Moody's covering the majority of the US bond market by 1924.

The concept of assigning a rating to sovereign debt is a relatively new idea, with Moody's and rating only three (Canada, USA, Australia) and Standard and Poor's (S&P) two (Canada, USA) nations respectively as recently as 1975 (Bhatia, 2002). In 1993 only 12 emerging markets carried sovereign ratings (Kräussl, 2003). However, sovereign credit ratings have grown rapidly since the turn of the century. As of 2018, 149 nations carry a rating from at least one of the three leading ratings agencies, which are Moody's, S&P and Fitch Ratings (Trading Economics, 2018).

Cantor and Packer (1996) point out that the demand for sovereign credit ratings has increased dramatically since their introduction. This is because more and more nations with relatively unfavourable risk profiles wished to borrow in the international bond markets, while many investors, particularly those from the USA, preferred to invest only in rated securities rather than unrated ones, regardless of whether or not they in fact have similar credit risks.

Furthermore, Cantor and Packer (1996) note that credit rating agencies rarely assign a higher rating to businesses or municipalities within a country than to the sovereign itself. This observation is based on the idea that no business or municipality can be considered to have a higher creditworthiness than the government of its nation of origin. In other words, sovereign credit ratings affect not only the ability of a sovereign to borrow, but also affect other borrowers

of the same nationality. Thus, it may be inferred that sovereign ratings are no longer merely a useful tool to help a sovereign secure credit, but rather a non-negotiable pre-requisite for any sovereign and corporate wishing to secure international funds.

A number of studies (for example, Cantor and Packer, 1996, Elliason, 2002 and González-Rozada and Levy-Yeyati, 2010) have examined the question of whether or not differences in assigned credit ratings, in particular between investment-grade and speculative-grade, have any bearing on the market for government bonds, and in particular bond yields. Given that higher government bond yields imply higher debt service costs for governments, a significant inverse relationship between ratings and bond yields would indicate that countries with poor credit ratings should struggle to fund their debt given the higher financing costs involved.

Existing literature shows that there is disagreement concerning the significance of sovereign credit ratings and whether or not they significantly affect financial markets. Cantor and Packer (1996) find that differences in credit ratings have strong explanatory power with regards to differing bond yields across different panels of nations. A more recent study by Jaramillo and Tejada (2011) likewise finds that crossing the "threshold" between investment-grade and speculative-grade ratings categories has a significant effect on bond spreads.[1] In contrast, González-Rozada and Levy-Yeyati (2010) do not agree that credit ratings are significant in determining spreads for emerging markets. They suggest instead that ratings changes actually lag changes in bond spreads. Their findings support those of Mora (2006), and Eliasson (2002) had already questioned the claimed long-term, forward-looking properties of credit ratings, concluding that the sovereign credit ratings appear to be pro-cyclical, rather than bringing concerns hidden in macroeconomic fundamentals to the attention of investors. However, in a more recent study on the peripheral countries of the Eurozone, de Vries and de Haan (2014) find that sovereign credit ratings do have a significant ability to predict bond spreads. However, they note that the predictive relationship is present only since the European debt crisis of 2012.

[1] In this context, bond spreads are the difference in between a given country's US dollar bond yields and the yields on bonds of a similar maturity issued by the US government.

In light of the above-mentioned uncertainty and the relative shortage of information on how emerging market bond spreads are affected by sovereign credit ratings, it is clear that there is scope for more research on the importance of sovereign credit ratings for this group of countries. This research examines the effect of sovereign credit ratings on bond spreads for a group of mainly emerging market economies, to examine the question of whether differences in sovereign credit ratings have an effect on the cost of sovereign debt over and above the effects of macroeconomic factors. The research will draw on the work of Jaramillo and Tejada (2011), which covers the period spanning 1997 – 2010. However, given that their (Jaramillo and Tejada, 2011) work ends shortly after the occurrence of the global financial crisis, the research will be relevant for examining the relationship between spreads and sovereign ratings in a post-crisis world and how this relationship may have changed in the current decade.

1.2. Goals of the research

Against this backdrop, the remainder of this thesis seeks to analyze the impact of changes in sovereign credit ratings on the cost of sovereign debt, in particular for emerging markets. The focus will be on whether in the cost of sovereign debt changes when a nation's credit rating crosses the investment-grade/speculative-grade threshold. In pursuit of this goal, the research aims to answer the following key questions:

- Do changes in sovereign credit ratings correlate significantly with changes in the cost of sovereign debt?
- Does crossing the investment-grade/speculative-grade threshold affect the cost of sovereign debt in a more substantial way than a one-notch ratings movement within the same ratings range?

1.3. Data, methods and techniques

To investigate the effect of changes in sovereign credit ratings on the yields of sovereign debt it is necessary to analyse the cost of sovereign debt for a sample of countries based upon the number of credit ratings changes undergone by each nation over the relevant time period, as

well as the proximity of each nation's average rating to the investment-grade/speculative-grade threshold. Since the crossing of this threshold is of key interest to the research, the sample of countries is restricted to include only emerging market nations that have usually held ratings by Moody's and S&P near (i.e. slightly above or slightly below) the threshold over the period 2003 – 2017. This period is chosen so that potential changes in the relationship pre- and post- the global financial crisis can be determined. 39 fit the above criteria but the number was reduced to 32 because relevant data were not available for some of the sample.

Following the method of Jaramillo and Tejada (2011), the bond yields on the foreign currency (US dollar), long-term debt of the selected nations is compared to the yields on US Treasury Bills, which are used as a proxy for the risk-free rate. The size of the spreads (i.e. the difference in yields) are determined using the J.P. Morgan Emerging Market Bonds Index (EMBI) spread values. This is done for different periods before and after the financial crisis to examine structural changes in bond spreads over the period.

The method of Jaramillo and Tejada (2011), which takes the form of a fixed effects model, is used to assess whether sovereign ratings changes have a significant impact on bond spreads over and above certain key macroeconomic variables. Variables identified from the literature include a real GDP growth, public debt as a percentage of GDP and external debt as a percentage of GDP. In addition, the CBOE Volatility Index (VIX) is used as a proxy for investor risk appetite, as in Jaramillo and Tejada (2011). The required macroeconomic data and bond spreads are obtained from Thompson-Reuters Datastream and J.P. Morgan, respectively. Credit ratings are obtained from Moody's and S&P.

1.4. Thesis plan

The remainder of this thesis is organised as follows. Chapter 2 discusses the relevant literature surrounding sovereign credit ratings. Chapter 3 sets out the data, methods and techniques used to conduct the research. Chapter 4 presents the research results, as well as a discussion surrounding the results. Chapter 5 concludes and provides some indicators of areas for future research.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This chapter discusses the literature surrounding sovereign credit ratings, beginning with a brief history of the origin of sovereign credit ratings and the reason for their existence. Section 2.2 sets out the development of the initial concept of a single signal indicating the creditworthiness of a given organisation, and how this concept spread to being applied to the debt of a sovereign. In addition, it discusses the growth of sovereign ratings, from a limited tool covering only a handful of developed markets to a globally-recognised indicator that now also covers most emerging markets. The theoretical rationale for the use of sovereign credit ratings is discussed. This includes the important differences between global borrowing relationships compared to domestic borrowing relationships and, by implication, the role that sovereign ratings play in modern, globalised capital markets. Section 2.3 examines the methodology surrounding the construction of sovereign credit ratings, including a broad description of the concrete and subjective factors that credit ratings agencies take into account when assigning ratings to sovereigns. Section 2.4 reviews the literature surrounding the relationship between sovereign credit ratings and bond yields. Findings regarding the importance of sovereign credit ratings and macroeconomic factors in determining yields are examined. The effects of ratings changes on financial markets are discussed Section 2.5 summarises the findings from the literature.

2.2. History and motivation for sovereign credit ratings

Before analysing the importance of sovereign credit ratings, it is important to understand first where they came from, their purpose and how their popularity has grown from their origins to the present day. In light of this, a brief account of their history and, in particular, the histories of the Big Three credit rating agencies, namely Moody's Investor Services (Moody's), Standard & Poor's (S&P) and Fitch Ratings (Fitch) is required.[2]

[2] Despite the rise of Fitch in recent years, S&P and Moody's remain the dominant players in the credit ratings sector, according to Kräussl (2003). As such, this thesis will focus mainly on them.

Sovereign credit ratings have existed for over a century, with the oldest of the well-known credit rating agencies, Moody's, being founded in 1900.[3] According to Moody's (2015), it was in 1909 that founder John Moody decided to focus on analysing the credit-worthiness of the stocks and bonds of American railroad companies, taking into account their operations, management and financial position. In so doing, he became the first person to rate the riskiness of public securities. In 1914, he expanded this service to include ratings for US municipal bonds, covering nearly all of the US bond market by 1924.

The concept of sovereign credit ratings is, however, a relatively modern idea. According to Bhatia (2002), as recently as 1975, Moody's rated only three countries (Canada, the USA, Australia), S&P focused only on Canada and the USA, and Fitch had yet to rise to prominence. However, since then there has been rapid growth in the number of rated sovereigns, with Moody's and S&P making ratings available for 33 and 35 sovereigns respectively by 1990, and 108 and 83 respectively by the year 2000. The credit rating agencies began by focusing their sovereign ratings efforts on rating developed countries where bond issues were largest. The concept of a rated sovereign is therefore even newer for emerging markets. Kräussl (2003) notes that while as recently as 1993 only 12 emerging countries carried a rating from Moody's, this number had grown to 64 by the year 2000. The rapid spread of sovereign credit ratings has continued in the 21st century, with 149 sovereigns today carrying an assigned rating from at least one of the three leading ratings agencies (Trading Economics, 2018). Moody's and S&P maintain ratings for 136 and 133 nations, respectively, while Fitch rates 118 sovereigns. Naturally, the expansion of coverage is expected to slow, because the majority of the world's economies are now rated by at least one large ratings agency.

To sum up, the concept of a single piece of information that signals to investors the risks associated with a given investment opportunity is not a new one. Rather, what is relatively new is the expansion of this concept to sovereign bond issues, particularly those of the world's smaller

[3] While Standard and Poor's was officially founded in 1860, the firm in its present guise has existed only since 1941. Fitch Ratings was founded in 1914 as a publishing company, but only became a significant player in the ratings industry in 1989 (Becker and Milbourn, 2010).

economies that are less known to global investors. However, once the concept of sovereign ratings took hold it spread rapidly.

Critical to understanding the role of sovereign credit ratings is the motivation for their existence. The answer to this question lies in the phenomenon of asymmetric information, a situation that occurs when one party in a transaction has more information that the other (Akerlof, 1970). White (2002) notes the impact of asymmetric information on lenders, due to the need to ascertain the continued creditworthiness of borrowers after the granting of a loan. While specialist lenders, such as large banks or pension funds, may be able to gather the necessary information to judge the feasibility of the investment themselves, non-specialist lenders are unlikely to be able to do so (White, 2002). A given investor may possess some information about several different sovereigns and their risk profiles, but there are many sovereigns for which this is not the case. In other words, most investors simply do not possess the required information to take a decision regarding the riskiness of investments with sufficient confidence. As a result, requiring every individual investor to gather and analyse its own information concerning the risk profile (and hence suitability for investment) of every sovereign would be a costly, time-consuming and ultimately futile exercise. In such an environment, many potentially feasible investments would never occur for the simple reason that investors would choose not to invest because they lack sufficient information about the potential risk surrounding the investment.

This effect would be particularly prevalent with regards to smaller, lesser-known nations. Because potential investors would have little information to rely on for guidance, they would probably prefer to focus their attentions on developed nations, which represent apparently safer, more familiar investment opportunities. Developing markets access to global funds would be greatly reduced as a consequence. Therefore, the primary function of credit ratings agencies revolves around eliminating asymmetric information between the parties in a lending relationship (Ligeti and Szőrfi, 2016).

According to Pennartz and Snoeij (2012), credit ratings agencies fulfil the function of specialising in the collection and analysis of a large amount of public and private information and condensing

it down into a single, universally-understood and easy to obtain signal: the credit rating. A ratings agency's forward-looking expectations of the future creditworthiness of the borrower are included in the assigned rating, which represents a useful source of guidance to potential investors (Moody's, 2016). This, in turn, allows lenders to make informed decisions regarding investment options about which they would otherwise have had insufficient information. White (2002: 5) states that credit ratings allow lenders to "pierce the fog of asymmetric information that surrounds lending relationships". Furthermore, White (2002:4)) refers specifically to bonds as an instrument where the "public good" nature of information means that information-gathering efforts are not duplicated, which would be inefficient.[4]

The IMF (2010) argue that even in the aftermath of the global financial crisis, sovereign credit ratings continue to perform several important functions. These include the aggregation of information about the creditworthiness of an array of borrowers (not only sovereigns). This, in turn, allows these borrowers to attract investment, leading to the existence of more liquid markets than would otherwise be possible. Furthermore, credit ratings agencies also perform a "monitoring function" (Ligeti and Szőrfi, 2016). This monitoring function is achieved through providing ratings outlooks and by placing borrowers on "watch lists". Through this function, borrowers receive an early warning to take corrective measures in order to preserve their creditworthiness, if necessary.

In addition, Gupta (2018) notes the important role that credit ratings play in globalised financial markets, with investors eager to achieve international diversification of their portfolios. In particular, in this globalised financial environment, investors emphasise the need for understanding credit risk, which is the possibility of a borrower failing to honour its commitments in terms of debt repayments (Gupta, 2018).

S&P (2014) describe a credit rating as an opinion on an issuer of debt's ability to meet its financial obligations in full and within the expected time period. The ability and the willingness to service

[4] Bonds, such as those issued by a sovereign, represent an instrument that may be taken up by a large number of investors. Hence, access to the required information for all potential lenders can reduce the substantial cost of information-gathering about this instrument.

the debt are two of the key determinants that inform this opinion (S&P, 2014). The ability and willingness of a borrower to meet its debt obligations to a borrower is of particular concern where sovereign credit ratings are concerned, due to the international nature of the lending relationship. Kokkaliaris (2018) defines a lack of "ability" in the above context as a deterioration of a country's fiscal solvency, to the extent that it becomes unable to service its debts.

Moody's (2016) summarizes the uniqueness of international lending relationships (and hence the need for sovereign credit ratings) by highlighting the key differences between sovereign issuers and other debtors. It suggests that, firstly, sovereigns have a unique ability to reduce expenditure or alter the taxation of their populations in response to changing debt situations. Secondly, there is a lack of a higher authority to compel the sovereign to resolve its debt obligations. Finally, defaulting on debt rarely threatens the survival of a sovereign, i.e. continued existence of a country is largely guaranteed, which is not always the case when considering, for example, corporate debtors. Eaton, Gersovitz and Stiglitz (1986) likewise note that, unlike in lending relationships that take place fully within a nation's borders, international lending relationships face a problem of enforcement. This is due to the fact that the lender does not necessarily have the ability to enforce their claim directly in an effective manner, nor to acquire sufficient collateral in order to protect themselves against default risk. In light of this, Eaton, Gersovitz and Stiglitz (1986) find that there may be scenarios in which a borrowing sovereign may choose not to service its debt (i.e. lack the willingness), not due to a lack of ability to do so, but rather due to the inability of the lender to force it to do so directly. Kokkaliaris (2018) agrees with this, noting that certain countries may perform a cost-benefit analysis and deliberately select to default on debt (despite the negative consequences) in spite of having the ability to honour its commitments. As a result, the riskiness of a loan (and hence the expected spreads on government bond yields) would become a function of how likely a given sovereign would be to have the willingness to service the debt in question, rather than a function of its ability to do so.

Cantor and Packer (1996) point out that the demand for sovereign credit ratings has increased dramatically since their introduction because more and more nations with relatively unfavourable risk profiles wish to borrow in the international bond markets and many investors,

particularly those from the USA, prefer to invest only in rated securities rather than unrated ones, regardless of whether or not they have similar credit risks. As noted in section 1.1, Cantor and Packer (1996) point out that it is unusual for credit rating agencies to assign a higher rating to businesses or lower levels of government within a country than to the sovereign itself. This observation is based on the idea that the government of a nation, by definition, can be considered to have a higher creditworthiness than any municipality or business within its borders. In other words, sovereign credit ratings affect not only the ability of a sovereign to borrow, but also affect borrowers of the same nationality. Thus, it may be concluded that sovereign ratings are no longer merely a useful tool to help a sovereign secure credit, but rather a non-negotiable pre-requisite for any sovereign wishing to secure international funds.

2.3. Methodology of sovereign credit ratings and their accuracy

2.3.1. Introduction

This section examines the determinants of sovereign credit ratings, as well as their accuracy in anticipating defaults on the part of indebted sovereigns. Section 2.3.2 begins by setting out the rating scale that covers the credit ratings assigned by the three major ratings agencies, as well as the broad methodology underlying how ratings are determined. Section 2.3.3 attempts to set out more clearly which macroeconomic factors contribute to the economic and political risk factors with which ratings agencies are concerned. Section 2.3.4 discusses the accuracy, stability and timeliness of sovereign credit ratings from the leading ratings agencies and how the quality of these metrics changes as the forecasting period changes.

2.3.2. Broad overview of credit rating categories and determination

Having discussed the history of sovereign credit ratings, the question of how the ratings themselves are determined may now be considered. In particular, it is useful to investigate the factors that are taken into account by rating agencies in order to determine the most appropriate rating for a sovereign at a given point in time.

Kräussl (2003) states that the methodology behind credit ratings can be split up into two broad components, namely political risk and economic risk. Political risk refers to whether or not a sovereign has the political will to repay its debts when they fall due. Simply put, this component is concerned with whether or not the government of a sovereign can be relied upon to meet its future debt obligations. The second component, economic risk, deals with the likelihood of a sovereign having the actual means to service its debts.

Starting with these two broad requirements, credit ratings agencies then consider various economic, social and political factors in order to determine the overall risk of a sovereign defaulting on its debt. According to Katz (2008), S&P takes an array of factors into consideration in order to arrive at its sovereign ratings. These include, amongst others, economic growth prospects, per capita income, fiscal flexibility, general government debt burden, monetary stability and economic development. Moody's (2016) highlights four key factors that determine a sovereign's rating, namely economic strength, fiscal strength, institutional strength and susceptibility to event risk. It notes that each of these factors is further broken down into several components, with each component weighted according to its relative importance to the final rating. For example, the largest determinant of the economic strength factor is the growth rate of real GDP per capita, as well as the volatility of that growth. Fiscal strength is substantially influenced by the sovereign's level of debt, as well as debt affordability. Institutional strength is dependent on the integrity of a nation's institutional framework, including a Rule of Law Index and a Corruption Control Index. Finally, the nation's susceptibility to event risk depends, amongst other determinants, on event risk surrounding the government, the strength of the nation's banking system and risks related to government liquidity.[5]

While both S&P and Fitch use the same credit rating scale, the one used by Moody's differs slightly. However, the two different scales are generally equivalent in their meanings, with each S&P ratings symbol having a counterpart on Moody's scale, and vice-versa. As can be seen in

[5] Moody's (2016) notes that the four factors identified above may not represent an exhaustive list of all factors that affect sovereign credit ratings, but that they provide an understanding of the range of information considered when assigning a rating. In addition, interpretation of some of the components is, by nature, subjective, with past performance used to approximate future events.

Table 1 below, sovereigns rated AAA by S&P and Fitch and Aaa by Moody's have the least credit risk associated with them and thus a minimal risk of default. From there, the ratings decline (indicating a gradual increase in credit risk) until the rating of BBB- (S&P and Fitch) or Baa3 (Moody's) is reached. This rating represents the lowest rating that a sovereign can carry while still being considered "investment-grade", i.e. a sovereign that carries a low to moderate credit risk. The next rating (BB+ or Ba1) is considered "speculative-grade" by the credit rating agencies and implies that the risk of a sovereign defaulting is substantial. This distinction between "investment-grade" and "speculative-grade" is significant because the managers of investment-grade bond portfolios are obligated to invest only in bonds that carry an "investment-grade" rating. By implication, such managers, as well as the managers of investment-grade tracker funds, are obligated to ignore any speculative-grade investments (Kräussl, 2003). For this reason, bonds that carry a "speculative-grade" rating are described as having "junk status", the connotation of this label requiring no further explanation. If a sovereign's rating falls to the "C" level, it is considered to be very near or in actual default, with little chance of recovery from its predicament.

Table 1: Ratings by Agency, Interpretation and Numerical Scale.

Fitch	S&P	Moody's	Ratings grade description (Moody's)	
AAA	AAA	Aaa	Investment Grade	Minimal credit risk
AA+	AA+	Aa1		Very low credit risk
AA	AA	Aa2		
AA-	AA-	Aa3		
A+	A+	A1		Low credit risk
A	A	A2		
A-	A-	A3		
BBB+	BBB+	Baa1		Moderate credit risk
BBB	BBB	Baa2		
BBB-	BBB-	Baa3		
BB+	BB+	Ba1	Speculative Grade	Substantial credit risk
BB	BB	Ba2		
BB-	BB-	Ba3		
B+	B+	B1		High credit risk
B	B	B2		
B-	B-	B3		
CCC+	CCC+	Caa1		Very high credit risk
CCC	CCC	Caa2		
CCC-	CCC-	Caa3		
CC	CC	Ca		In or near default, possibility of recovery
C	C			
DDD	SD	C		In default, little chance of recovery
DD	D			
D				

Source: CNB (2016).

S&P (2016) stress that their ratings are not official recommendations to purchase, sell or hold any security, but rather are carefully formulated opinions that they are under no obligation to update at any point in time after publication.

2.3.3. Macroeconomic determinants of sovereign credit ratings

While the ratings agencies explain the broad methodology they use to produce their ratings there is no official formula or algorithm that can be used to determine accurately how a particular sovereign will actually be rated. A seminal paper by Cantor and Packer (1996) studies a sample

of 49 nations in an attempt to determine the macroeconomic criteria that ratings agencies use in order to assign credit ratings, as well as the relative importance of each of these factors in arriving at the final rating. Cantor and Packer (1996) ultimately select eight macroeconomic factors for their analysis, and carry out regression analysis for both Moody's and S&P individually, as well as a combined regression for both ratings agencies.[6] The different credit ratings categories are assigned numerical values, with the lowest ratings category, B-, given the value of 1. From there, the values assigned to higher ratings categories progress in increments of 1.[7] The highest possible rating category, AAA, is assigned a value of 16. Cantor and Packer (1996) note that even with knowledge of all the criteria that the ratings agencies actually focus on, it is difficult to determine the relationship between the criteria and the actual ratings. This is because some of the criteria are difficult to quantify and it is unclear what weight is assigned to each criterion.

Cantor and Packer (1996) find that three variables, namely a high GDP per capita, low inflation and low external debt are highly significant for nations to secure more favourable credit ratings. Overall GDP growth carries only a moderate level of significance**.** Cantor and Packer (1996) suggest that the reason this is that developing economies tends to grow more rapidly than developed economies, implying that strong GDP growth in and of itself may not be a reliable indicator of creditworthiness. They find that fiscal balance and external balance carry virtually no significance at all. Cantor and Packer (1996) attribute this result to the potential endogeneity of the fiscal balance and external balance variables, concluding that nations that are attempting to improve their credit ratings may undertake more conservative fiscal policies, while international capital flows may be limited for economies that carry a low rating.

[6] The eight macroeconomic factors selected by Cantor and Packer (1996) are: GDP per capita, GDP growth, inflation, fiscal balance, external balance, external debt, overall economic development (i.e. whether or not a nation is considered to be industrialized by the International Monetary Fund) and default history for the period 1970 – 1995.

[7] While it is possible for a given sovereign to carry a rating lower than B-, Cantor and Packer (1996) note that this does not apply to any sovereign within their sample, which explains the decision to assign the rating of B- a value of 1.

Cantor and Packer (1996) find that the indicators for both economic development and default history are also highly significant in determining prospective credit ratings. Sovereigns that are considered industrialized by the IMF are found, on average, to enjoy ratings 2.776 notches higher than their non-industrialized counterparts. By contrast, economies with any history of default in the period between 1970 and 1995 are found, on average, to be rated 2.042 notches lower than those with no history of default.[8] Cantor and Packer (1996) note that, within their sample and time period, no nation with a history of default carries a rating higher than BBB, i.e. the lower end of the investment-grade range.

Overall, it appears that both Moody's and S&P focus on broadly the same criteria, though the weightings they assign to different variables may differ in some cases (Cantor and Packer, 1996). Moody's appears to place more weight than S&P on external debt as a negative factor, while placing less weight on per capita income as a positive factor. Interestingly, the two agencies appear to place similar emphasis on a nation being industrialized, but differ substantially in their focus on default history. As mentioned above, across the sample, industrialized nations, on average, enjoy ratings 2.776 higher than less-developed nations. For both ratings agencies, their individual regressions for industrialization return figures of 2.957 notches (Moody's) and 2.595 notches (S&P), respectively, with both results significant at the 1 percent level. By contrast, while the average "penalty" for any defaults between 1970 and 1995 is found to be 2.042 notches, the results vary significantly, for the individual agencies. Moody's, on average, rates sovereigns that have defaulted over the relevant period 1.463 notches lower than if they had not defaulted, *ceteris paribus*. For S&P, this figure is 2.622 notches lower, implying a difference in weighting of 1.159 notches between the two agencies. Hence, it appears that default history is considered substantially more important by S&P than by Moody's.

A more recent study by Yildiz and Gunsoy (2017) uses ordered logit and probit models to assess the impact of certain macroeconomic factors on ratings in both high income and low/middle income countries. In general, Yildiz and Gunsoy find that GDP per capita is a significant determinant of sovereign across the entire sample but that overall GDP growth is insignificant in

[8] Cantor and Packer (1996) found both of the above-mentioned results to be significant at the 1 percent level.

high income nations. By contrast, unemployment has an insignificant coefficient in low/middle income countries while being significant in high income nations. Similar to Cantor and Packer (1996), the coefficient for inflation is significant across the entire sample. Yildiz and Gunsoy (2017) find the budget deficit and current account balance to be significant factors for low/middle income nations, with an insignificant effect for high income sovereigns, a result which partially supports the conclusions of Cantor and Packer (1996). In addition, Yildiz and Gunsoy (2017) find the ratio of government debt to GDP to be significant across all nations.

2.3.4. Accuracy, timeliness and stability of sovereign credit ratings

Pennartz and Snoeij (2012) tested the quality of sovereign credit ratings from the three major credit ratings agencies in terms of three variables, namely accuracy, timeliness and stability with regards to 13 sovereign defaults on both external and internal debt.[9] Pennartz and Snoeij (2012) measure accuracy by means of cumulative accuracy profiles (CAP-curves), which yield a summary statistic called the accuracy ratio (AR-ratio).[10] Timeliness is measured by investigating how successful the agencies are at identifying changes in credit risk and their record of downgrading sovereigns before they default, as well as how quickly the agencies issue a default rating (a rating of SD or lower). Stability is measured by considering the number of large rating changes (two or more notches) that the agencies perform. According to Pennartz and Snoeij (2012) such large adjustments are undesirable because they signal large fluctuations in creditworthiness. Instead, it is more desirable for rating changes to take place in smaller, more frequent steps. Furthermore, Gu, Jones and Liu (2014) note that while accuracy is simply concerned with predicting whether or not a default will occur, there is a trade-off between timeliness and stability.

[9] These three variables are not universally accepted as a means of rating the quality of credit ratings, but nonetheless provide useful information.

[10] A CAP-curve indicates the cumulative proportion of rated sovereigns vs the cumulative proportion of defaulters. This allows it to illustrate the accuracy of credit rating agencies in ensuring that defaulting sovereigns have an appropriately low credit rating at the time of default and can be tracked for as long as 5 years from the time of default. The AR-ratio is a number between 0 and 1 and indicates the overall accuracy, with a value of 1 representing perfect accuracy. According to Irwin and Irwin (2012: 3) the CAP-curve method is the most common method used by financial experts to perform accuracy tests.

The reasoning behind this observation is two-fold. It is undesirable for ratings to be volatile and unstable, as this may create market uncertainty around the general quality and trustworthiness of credit ratings. Conversely, it is critical that ratings change as quickly as possible when changes in credit risk become apparent, thus allowing investors to remain up-to-date and to react accordingly. The result, according to Pennartz and Snoeij (2012), of these two contrasting objectives is that credit rating agencies are required to balance the need to identify changes in credit risk as quickly as possible (timeliness) and the need to maintain relatively stable ratings that do not fluctuate suddenly or dramatically. Eliasson (2002) concurs with this view, noting that while it is important for ratings to provide an early signal to the market, a downgrade that comes too early may push a nation over the edge and towards a default when in actual fact, given time, it may have been able to recover.

The overall results from investigating the above-mentioned variables indicate that there are some differences in the approach taken by the agencies, in particular between Moody's and S&P (Pennartz and Snoeij, 2012). Pennartz and Snoeij (2012) find that at the time of default, all three agencies return near-perfect accuracy scores, but S&P is the best performer with 99% accuracy compared to Moody's 94% and Fitch's 96%. Such high accuracy ratios may be expected since it is reasonable to expect that the agencies would have downgraded a sovereign to a default rating by the time the default actually occurred. However, Pennartz and Snoeij (2012) express their surprise that none of the three agencies was able to return a perfect accuracy rating at the time of default. This contrasted with their expectation that by the time a sovereign default took place, the agencies would already have performed the appropriate downgrade to a default rating. The explanation offered by Pennartz and Snoeij (2012) for imperfect CAP-curves observed at the time of default is simply that identifying sovereign defaults is an ambiguous practice without fixed criteria.

Six months before the date of actual default, the observed accuracy drops, as one would expect, given the inherent uncertainty involved with forecasting and future predictions. However, all ratings agencies remain highly accurate, with S&P's 91% accuracy the best, followed by Fitch (90%) and Moody's (86%). It appears that increasing the time horizon from six months to one

year takes a significant toll on ratings' accuracy, with the best performer, Moody's, returning an accuracy ratio of 74%, while S&P and Fitch fall to 71% and 68% respectively. The noticeable decline in accuracy as the time period is extended to one year supports the work of Eliasson (2002) which calls into question whether sovereign credit ratings are really forward-looking. It is worth noting that the one-year time horizon is the first time-frame at which Moody's returns the best accuracy ratio, an advantage which it maintains right through to the end of the study, which ends at a five-year time horizon.

In light of the above results, Pennartz and Snoeij (2012) conclude that S&P perform best at anticipating a sovereign default over short time horizons such as six months to a year. Moody's, however, gains the upper hand as the length of time being considered increases. While its advantage over S&P over a one-year time-frame is only 3 percentage points (74% vs. 71%), Moody's extends this lead as the time to default increases, eventually ending up with a 10 percentage point advantage in accuracy (53% vs. 43%) when the time-frame is set at five years before the date of default.[11] Despite the imperfect accuracy of the ratings agencies at the time of default, Le Pallac (2013) points out their generally strong track record in terms of long-term outlook. Since 1975, only 1% of sovereign defaults have come from nations that had held an investment-grade rating at some point in the preceding 15 years, with 30% coming from nations that had been rated as speculative-grade at some point in the preceding 15 years.

With regards to timing, Pennartz and Snoeij (2012) show that S&P is generally the best performer. In 6 of the 13 defaults studied, it was the first to downgrade the sovereign in question to a default rating, and in 8 out of 13 instances they were the first to recognise that a sovereign had, in fact, defaulted. Not only is S&P usually the first to downgrade, it is thus also the most likely to acknowledge that a default has occurred. Moody's is the first to downgrade in only 1 out of the 13 instances, and first to recognise a default in only 2 out of 13 cases. According to Pennartz and Snoeij (2012) S&P's strong performance with regards to timeliness comes as a result of it being

[11] For its part, Fitch's ratings suffer the most noticeable decline in accuracy as the length of time increases with an accuracy rating of 43% being returned for the four-year time-frame and 38% being returned for the five-year time-frame. Pennartz and Snoeij (2012) believe that this may due to do Fitch's smaller dataset when compared to those of Moody's and S&P.

more aggressive in its assessments than Moody's and thus more likely to make rapid ratings adjustments.

As discussed above, there is a trade-off to be made between timeliness and stability. With S&P recognised as having the best timing, the conclusion of Pennartz and Snoeij (2012) that Moody's performs best with regards to stability is to be expected. The explanation offered for Moody's strong performance in the stability part of the study is that they prefer to focus on long-term indicators and ignore natural, short-term fluctuations in the business cycle. While not as timely as S&P, Moody's very seldom reverses their ratings changes, which serves them well from a stability viewpoint.

Overall, both S&P and Moody's perform strongly across all categories, indicating that while their approaches may differ, both are successful at providing investors with an accurate signal of debt defaults in a timely fashion, while also ensuring that this signal does not fluctuate wildly. However, despite the initial intention of Pennartz and Snoeij (2012) to ascertain which of the three major ratings agencies perform best, they fail to reach any clear conclusion. Instead, they conclude that the respective agencies perform best in different areas, which supports the findings of Gu, Jones and Liu (2014) that a trade-off is necessary in certain aspects of ratings agencies. It should be left to user preference to decide to which agency's ratings threshold give greater importance: S&P when short-term accuracy and timeliness are the user's chief concern, Moody's for long-term accuracy and stability and Fitch for a balance between the two.

From this, it may be concluded that despite the lack of transparency of the actual methods used to determine the ratings, the ratings themselves appear to be generally reliable and timely measures of sovereign default risk.

2.4. Do sovereign credit ratings really matter?

2.4.1. Introduction

This section discusses the literature surrounding sovereign credit ratings. A number of studies have examined the question of whether or not differences in credit ratings, in particular between investment-grade and speculative-grade, have any bearing on the market for government bonds, and in particular bond yields. Given that higher government bond yields imply higher debt service costs for governments, a significant inverse relationship between ratings and bond yields would indicate that countries with poor credit ratings should struggle to fund their debt. Section 2.4.2 discusses a seminal paper by Cantor and Packer (1996) which examines the ability of sovereign credit ratings to explain bond yields. Section 2.4.3 covers literature on the role of macroeconomic factors in determining bond yields and discusses the relative importance of a variety of these factors. Section 2.4.4 discusses the claimed forward-looking properties of sovereign credit ratings, i.e. their ability to predict the future creditworthiness of debt-issuing sovereigns. Section 2.5 summarizes the discussion.

2.4.2. Sovereign credit ratings and macroeconomic factors

Cantor and Packer (1996), in a study involving 35 sovereigns rated by both S&P and Moody's, find that sovereign credit ratings have a significant ability to explain average sovereign bond yields, with 92% of the cross-sectional differences in bond spreads being explained by differences in credit ratings. While market yields already incorporate key macroeconomic indicators, Cantor and Packer (1996) argue that rather than simply summarizing the information already offered by the macroeconomic indicators, credit ratings also provide additional information to investors that is not publicly available. Hence, credit ratings are found to have a significant impact on how the market assesses sovereign risk.

However, Cantor and Packer (1996) make an important distinction between speculative- and investment-grade ratings. They find that announcements of changes in credit ratings have a significant impact on the yields of speculative-grade sovereigns, but an insignificant impact on

the yields of sovereigns holding an investment-grade rating. In other words, the impact on bond yields of an announcement of changes in credit ratings is substantially greater if the sovereign in question holds a speculative-grade rating. Cantor and Packer (1996) attribute this difference to the difficulty that international investors have in measuring sovereign risk for speculative-grade nations. This leads to a greater reliance on credit ratings agencies for information on the potential riskiness of such investments.

The *a priori* expectation might be that market anticipation of an announcement of a rating change (i.e. an expectation by the market that a sovereign is about to be upgraded or downgraded) would result in a smaller reaction to the official announcement. The market would respond by taking the anticipated information into account before it is made public, thus blunting the effects of the actual rating change itself. However, Cantor and Packer (1996) find the contrary to be the case. Instead, their findings indicate that the more anticipated a ratings change is, the stronger the market reaction when the official announcement is made. Furthermore, if a ratings announcement confirms or agrees with a rating made by another ratings agency at an earlier point in time, the effect is even more pronounced.

Given the expectations stated above, these results appear highly unusual. However, given the emphasis placed on the opinions of the major credit ratings agencies, it may be that while the market does act on its initial expectations, the official confirmation of the anticipated announcement adds an extra impetus to the market's reaction to the ratings change.

2.4.3. Sovereign bond yields and macroeconomic factors

In a study involving 35 emerging countries from 1995-2010, Jaramillo and Tejada (2011) examine the influence of both changes in credit ratings and changes in macroeconomic fundamentals on bond spreads. Their (Jaramillo and Tejada, 2011) reasoning for this approach is that it is possible that credit ratings simply reflect changes in spreads due to altered macroeconomic fundamentals, rather than having any influence of their own. Furthermore, they place a lesser emphasis on movements within rating classes (i.e. ratings within investment-grade or speculative-grade) and choose instead to focus on changes in bond spread when the investment-

grade threshold is crossed. To this end, each of the 35 emerging markets that form part of the study had been rated as both investment-grade and speculative-grade at various points during the relevant period.

In order to emphasise the effects on bond spreads of crossing the investment-grade threshold, Jaramillo and Tejada (2011) depart slightly from the approach taken by Cantor and Packer (1996). Both sets of authors quantify the different ratings categories by assigning a numerical value to each category. As noted by Eliasson (2002), the numbers chosen for each category do not need to fall within a specific range. Rather, what matters is that the chosen numbers clearly distinguish between the different credit ratings categories, hence reflecting their ordinal nature. Cantor and Packer (1996) make use of a linear transformation in order to quantify the different ratings categories, i.e. the numerical values assigned to the different ratings categories follow a straight line. This approach implies that the significance of a one-notch change in the credit rating is similar across all possible ratings. By contrast, Jaramillo and Tejada (2011) use a non-linear transformation. In this approach, the significance of a one-notch ratings change follows a roughly linear pattern at the respective tail ends of the distribution, i.e. at the highest level of the investment-grade range and the lowest level of the speculative-grade range. The key difference between the two approaches comes in the middle of the distribution. The non-linear transformation approach assumes that a one-notch ratings change that occurs in the middle of the distribution, i.e. towards the lower levels of the investment-grade range and the higher levels of the speculative-grade range, have greater significance than those occurring at the tail ends of the distribution. Eliasson (2002) notes that, visually speaking, a non-linear transformation would follow an "S-shape", with relatively small "steps" between ratings categories at the tail ends of the distribution, coupled with larger "steps" in the middle range.

Jaramillo and Tejada's (2011) results indicate that, for the countries and time period in question, there is a 36 percent difference in bond spreads related to movements between the lowest investment-grade rating (BBB-) and the highest speculative-grade rating (BB+). Hence, compared to a sovereign holding a BB+ rating with a spread of 440 basis points, a sovereign holding a BBB- rating would enjoy spreads of 280 basis points, i.e. 160 basis points lower (Jaramillo and Tejada,

2011). Furthermore, this difference is over and above any changes in spreads that come about as a result of changes in the macroeconomic fundamentals that supported the rating change in the first place. Jaramillo and Tejada (2011) find that a one-notch rating change between two investment-grade ratings results in spread changes of 5-10 percent. Within the investment-grade ratings class, the difference in coefficients between the ratings categories of A+, A and A- is insignificant, though there is a significant difference in the coefficients of all A-rated categories versus the BBB+, BBB and BBB- categories, i.e. higher end of the investment-grade range versus the lower end. Jaramillo and Tejada (2011) also find that a one-notch rating change has no significant effect if the sovereign remains in the speculative-grade range after the rating, apart from the effects of macroeconomic fundamentals. These findings are in contrast to Cantor and Packer (1996), who find that ratings changes have no significant effect on bond yields if the sovereign in question holds (and maintains) an investment-grade rating, but do have an effect on speculative-grade bond yields.

Jaramillo and Tejada (2011) also find that while sovereign credit rating changes display a predictable relationship with spreads, they are not the only factor upon which international markets rely in order to establish the risk profiles for sovereigns which determine bond yields. By assigning different numerical values to different ratings levels (as set out above) and plotting the relationship between ratings and yield spreads from 2002-2009, they (Jaramillo and Tejada, 2011) find that while the exponential trend line fitted to the data remains accurate, international markets are starting to focus more and more on macroeconomic fundamentals. This phenomenon is especially prevalent from 2008 onwards.

These findings suggest that international markets have reduced their reliance on sovereign credit ratings and have chosen increasingly to supplement their knowledge through the study of other economic fundamentals. Jaramillo and Tejada (2011) note that one of the key additional macroeconomic indicators that international investors focus on is the external public debt to GDP ratio. They find that a 7 percentage point increase in external debt to GDP causes a 7 percentage point increase in spreads in investment-grade countries, but a 17 percentage point increase in

speculative-grade bond spreads. However, Jaramillo and Tejada (2011) find that changes in domestic debt have no significant effect on spreads.

For this reason, Jaramillo and Tejada (2011) stress the importance of lower-rated sovereigns pursuing external debt-reduction measures. They find that, evaluated at the median, a one standard deviation increase in the ratio of external debt to GDP raises spreads in BBB-rated sovereigns by 59 basis points, but only raises the spreads of BB-rated sovereigns by 16 basis points. This observation reinforces their findings that although investment-grade countries may receive some additional leeway based on their creditworthiness, they may still be punished by the international market if their external debt does not remain under control. This demonstrates the previous observation that while markets look to credit ratings for a signal, their view of a given sovereign's creditworthiness is also influenced by their own research.

Finally, Jaramillo and Tejada (2011) note the importance of overall GDP growth and the ratio of reserves to GDP in determining spreads, which is contrary to the findings of Cantor and Packer (1996). Nonetheless, in agreement with Cantor and Packer (1996) and Yildiz and Gunsoy (2017) they conclude that external debt is the key macroeconomic determinant of market sentiment.

A study by Sy (2001) which focuses on sovereign bond spreads before, during and after the 1997 East Asian crisis, supports the above findings. It notes that market participants made use of information other than credit ratings during and after the crisis in order to guide their discrimination between different sovereign bonds. González-Rozada and Levy-Yeyati (2010) find that the changes in emerging market bond spreads are due more to changes in exogenous global factors, such as risk appetite of international investors and debt sustainability, rather than changes in credit ratings. They (González-Rozada and Levy-Yeyati, 2010) note the prevalence of fiscal stimulus packages after the 2008 global financial crisis coupled with disappointing global growth as the causes for concern about the ability of even developed nations to service their debt obligations. This, in turn, implies a deteriorating global risk appetite. Thus, global factors continue to be a critical input into bond yields in developing countries worldwide (González-Rozada and Levy-Yeyati, 2010). According to their (González-Rozada and Levy-Yeyati, 2010)

findings, a rating upgrade from BB+ (speculative-grade) to BBB- (investment-grade) results in a reduction in spreads of approximately 35 basis points. However, their (González-Rozada and Levy-Yeyati, 2010) results indicate that the impact on yields of such a reduction in spreads could be undone by a 70 basis point increase in the risk free rate (generally the rate on US Treasury Bills). In other words, the reduction in spreads observed from an upgrade to investment-grade could simply be reversed by a change in exogenous factors that causes increases in risk-free interest rates. Their findings suggest that credit ratings, including the distinction between investment-grade and speculative-grade, are not as significant for sovereign borrowing costs as expected, at least in the case of emerging markets.

2.4.4. Do ratings changes anticipate or lag changes in market news?

González-Rozada and Levy-Yeyati (2010) further find that ratings changes do not anticipate changes in spreads but rather lag them, reacting to significant market news rather than anticipating it. Their (González-Rozada and Levy-Yeyati, 2010) findings indicate that downgrades in emerging markets are preceded by increases in spreads (rather than followed by them) and that apart from a small impact of approximately 50 basis points, have little significant further impact on bond spreads. González-Rozada and Levy-Yeyati (2010) conclude that changes in emerging market bond spreads are largely due to exogenous global factors, with credit ratings lagging behind changes in spreads and exhibiting little influence on them. As a result, they (González-Rozada and Levy-Yeyati, 2010) conclude that credit ratings are largely endogenous. Rather than explaining changes in spreads, they are explained by them.

The findings of an earlier study focusing on the Asian crisis of 1997-1998 by Mora (2006) support the conclusions of González-Rozada and Levy-Yeyati (2010). Sovereign credit ratings were found to be sticky in nature rather than pro-cyclical. According to Mora (2006) actual credit ratings after the Asian crisis were slightly, but not substantially higher than ratings before the crisis, implying that overoptimistic ratings were not to blame for the crisis. Mora (2006) also notes that after the Asian crisis, ratings remained conservative. Mora (2006) supports the view, therefore,

that ratings changes generally come after changes in bond spreads, implying that ratings follow market news rather than predicting it.

Reisen and von Maltzan (1998) provide further insight into the findings above by stating that whether credit ratings lead or lag market expectations has implications beyond academic interest. Reisen and von Maltzan (1998) note that if ratings lagged spreads they would accentuate economic boom-bust cycles by reinforcing market euphoria during the "boom" phase. Conversely, during the "bust" phase, lagging ratings may lead to panic amongst investors and excessive capital outflows. To demonstrate this point, Reisen and von Maltzan (1998) make reference to the Asian crisis, noting that while Moody's, in particular, downgraded both Korea and Thailand ahead of the crisis, the assigned sovereign ratings of Asian countries failed to predict a crisis. Once the crisis erupted, however, the ratings of Asian sovereigns were quickly slashed into the speculative-grade range, which reinforced the effects of the crisis. Since, as noted earlier, sovereign credit ratings act as a "ceiling" of sorts for a given nation's lower tiers of government and private sector debt yields, the rapid downgrades to junk status caused the crisis to spill over also into these sectors of Asian economies. Reisen and von Maltzan (1998) note that, after the downgrades, commercial banks and local business suffered, and institutional investors who had committed to holding only investment-grade securities were forced to sell Asian assets. Furthermore, foreign creditors were sometimes entitled to call in loans because the downgrades breached conditions attached to the original loans. Eliasson (2002) concurs with this assessment, noting that a late downgrade would give late notice to clients of a given ratings agency, which would further deepen the negative sentiment around the sovereign in question.

Reisen and von Maltzan (1998) proceed to study the link between announcements of sovereign ratings changes and bond yield behavior in order to determine whether changes in ratings have a significant impact on the market over and above other yield determinants, i.e. macroeconomic fundamentals that are already publicly available. They also investigate whether the observed effects of ratings announcements are temporary, or whether the impacts are sustained for longer periods after announcements. To this end, they (Reisen and von Maltzan, 1998) perform an event study to gauge the reaction of bond markets in 29 emerging economies before and after a

total of 103 ratings events from the three major ratings agencies.[12] The risk-free benchmark proxy is the 10-year US Treasury bond, while the relative yield spread is expressed as a fraction of the benchmark yield on central government bonds. For each category of the ratings events considered, spreads are examined for a period of 30 days before and after the announcement. Reisen and von Maltzan (1998) find that a change in risk assessment by the three major ratings agencies is generally preceded by a similar adjustment in sentiment and therefore yield spreads by the market. They (Reisen and von Maltzan, 1998) note that this effect is particularly pronounced when the rating event in question is a review for upgrade or downgrade. In the 29-day period preceding a review for downgrade, relative spreads rose by an average of 12 percentage points, while falling by an average of 4 percentage points ahead of a review for upgrade.

Reisen and von Maltzan (1998) further find that downgrades seem to exert a prolonged impact on yield spreads while upgrades do not. In the period following announcements of downgrades, a sustained upward trend in yield spreads is observed. By contrast, the market appears to anticipate planned upgrades; spreads drop in the window preceding the upgrade, but do not continue falling after the announcement is made. Rather, after the confirmation of the planned upgrade, Reisen and von Maltzan (1998) observe substantial market volatility. A similar event study by Afonso (2011) covers a shortened period spanning the two days before a ratings event to the two days after the event in order to limit a possible contamination effect. Regardless, in agreement with Reisen and von Maltzan (1998), Afonso (2011) finds that while negative ratings events have a substantial effect on sovereign yields, the effect of a positive ratings event is minor.

Crucially, Reisen and von Maltzan (1998) note that, in their sample, a rating event from just one of the large ratings agencies does not change yield spreads by a statistically significant margin. However, when considered in aggregate, the effects become significant, implying that the market may value a consensus in sentiment from the prominent ratings agencies, rather than reacting to their individual opinions. These findings are based upon a two-way Granger causality test to

[12] Reisen and von Maltzan (1998) define a ratings event as including both reviews for possible upgrades/downgrades, as well as actual ratings upgrades/downgrades.

determine the extent to which changes in sovereign credit ratings affect changes in bond yield spreads (and vice versa), over and above the effects of other, observable factors, which are included in the analysis.[13] Two-way Granger causality tests are carried out, both for ratings changes carried out by S&P and Moody's individually, as well as for a sample comprised of ratings changes from all three leading agencies.[14] Reisen and von Maltzan (1998) find that there is a unidirectional effect for ratings changes by S&P to changes in yields spreads, but this effect is not observed when individual ratings changes by Moody's are considered in isolation. In addition, changes in bond yield spreads appear to Granger cause changes in ratings by Moody's, but not in those of S&P. Overall, for the panel of average ratings by all three leading agencies, Reisen and von Maltzan (1998) find significant two-way Granger causality, i.e. that sovereign credit ratings influence yield spreads and vice-versa.

Furthermore, for both the individual analysis of S&P ratings and for the panel as a whole, it was found that the first lag of the change in ratings variables carried an unexpected sign, i.e. an upwards rating change in the previous period appears to lead to an increase in yields spreads in the following period. Reisen and von Maltzan (1998) offer the explanation that this observation may be the result of an initial overreaction from the market, or from policy responses that are instituted after the ratings event takes place.

Finally, it is concluded that sovereign ratings have an influence on yield spreads, while also deriving information from yields over and above the usual fundamental yield determinants. Therefore, Reisen and von Maltzan (1998) state that sovereign credit ratings do not lead the market, as may be expected *a priori*, but rather that ratings and bond yields have a relationship of interdependence, which make it difficult to establish a significant market impact. Their (Reisen and von Maltzan, 1998) explanation for this finding is that in determining sovereign ratings, the

[13] Reisen and von Maltzan (1998) note that the observable factors in question agree with those found in work by Cantor and Packer (1996), as well as Edwards (1984). However, these variables are often of an annual nature, while monthly data was required for the Granger causality test. Ultimately, the selected monthly variables are: stock market return, foreign exchange reserves, real exchange rate, terms of trade and industrial production.
[14] Reisen and von Maltzan (1998) state that a lack of observations meant it was not viable to carry out an individual Granger causality test for ratings changes from Fitch. However, these observations are included in the Granger causality test for the combined sample.

sovereign-risk factors considered by ratings agencies are based primarily on publicly available information, such as foreign debt levels and fiscal or political constraints. The financial market also has access to this information, implying that there is a contamination effect – the effects of planned or implemented ratings changes are contaminated as the market responds to the same publicly available information as the ratings agencies and, therefore, has the opportunity to anticipate the announcements.

Despite the conclusion above, Reisen and von Maltzan (1998) note that the manner in which ratings agencies interpret public information may still be an important indicator of creditworthiness. Drawing on the work by Eaton, Gersovitz and Stiglitz (1986), Reisen and von Maltzan (1998) conclude that, in the absence of a credible, external mechanism to sanction sovereign debt (the sovereign credit rating) the size of the default risk premium is determined by the borrower's willingness to repay their debt, rather than their ability. This conclusion was supported by Cantor and Packer's (1996) finding, discussed above, that nations with no history of defaulting on debt obligations over the period 1970 – 1995 enjoyed, on average, a sovereign credit rating two notches higher than nations with a default history, which, *a priori,* should imply a lower cost of sovereign debt. Thus, the ratings assigned by the leading agencies may serve as an added assurance of creditworthiness. This would imply that they have an integral function in the market, namely, to ensure that the cost of sovereign debt is in fact determined by that sovereign's ability to pay (creditworthiness) rather than its willingness. However, Reisen and von Maltzan (1998) warn that it is not easy for ratings agencies to gain an extra "information privilege" to convey this to the market by way of ratings.

Eliasson (2002) focuses on 38 emerging markets over the time period covering 1990 – 1999 in seeking to establish whether the claimed long-term properties of sovereign credit ratings (i.e. that they are forward-looking by nature) are sound. Eliasson's (2002) finding of the negative impact of downgrades occurring during the East Asian crisis was mentioned above. This finding contradicts the theory that downgrades should occur before a crisis in order to dampen investor sentiment and send a signal that there are concerns surrounding an economy. Eliasson (2002) notes, however, that downgrades that occur too early may also prove unnecessarily damaging.

The claimed long-term properties of sovereign credit ratings should imply that ratings agencies focus on long-term trends, rather than on short-term business cycle fluctuations. As a result, Eliasson (2002) states that early downgrades may push a country in to crisis when, in actual fact, it could have recovered, given time.

For the above-mentioned analysis, several random effects econometric models were used and compared with a crisis indicator comprised of high, out-of-the-ordinary interest rate and exchange rate events, with a linear transformation being used to quantify and order the various ratings categories.[15] In addition, Eliasson (2002) makes use of both static and dynamic models. Eliasson (2002) then goes further by estimating a second model that makes use of additional variables that have been deemed significant since the publication of Cantor and Packer's (1996) research, namely debt to exports, export growth, the ratio of short-term debt to reserves and LIBOR interest rate spreads, the inclusion of which have been supported in earlier work by, *inter alia,* Ferri *et al.* (1999) and Chambers (1999). [16] The short-term debt to reserves variable, in particular, was included due to it being an influential factor in the East Asian crisis of 1998/1999. Finally, a third model, which uses all variables that were found to be significant in the previous two models, is estimated, and this is the model that is ultimately used for the presentation and interpretation of results.

The third and final specification of the dynamic model found all included variables to be significant, except for the change in fiscal balance variable and the change in short-term debt to reserves variable. Eliasson (2002) concludes that the models capture the occurrence of the observed downgrades, but underestimate their magnitude. For several nations in the sample, the model suggests lower ratings at the start of the relevant time period than were observed in practice, followed by gradual downgrades as the East Asian crisis approaches. The actual ratings tended to be higher than those suggested by the model, followed by a series of sharp downgrades

[15] Eliasson (2002) notes that, in addition to the macroeconomic factors described previously, qualitative variables such as political uncertainty are also relevant in describing ratings. However, given the difficulty in quantifying such variables, they are omitted from the analysis.

[16] Elliasson (2002) notes that due to high correlation between the variables for external debt and debt to exports, the former was excluded in the second specification of the model, despite being significant in the first specification.

in the midst of the crisis. Eliasson (2002) finds that, overall, actual ratings adjustments in the 38 emerging markets were more severe than suggested by the macroeconomic fundamentals of the time. Furthermore, Eliasson (2002) finds, using the crisis indicator, that credit ratings are largely pro-cyclical rather than counter-cyclical, with downgrades occurring while the crisis was ongoing, rather than warning investors of the pending danger in advance.

Eliasson (2002) notes that ratings are adjusted more frequently in practice than is suggested necessary in the model. This result, according to Eliasson (2002) brings into question the long-term, forward-looking properties of credit ratings. Such properties would lead to fewer ratings adjustments than actually occurred as credit ratings agencies would attempt to avoid reactions based on short-term business cycle fluctuations, focusing instead on the long-term trend of a sovereign's economic circumstances.

A recent study focusing on bonds spreads in the peripheral countries of the Eurozone by de Vries and de Haan (2014) provides further insights.[17] After analysing the relationship between spreads and ratings for the above-mentioned period, de Vries and de Haan (2014) aim to predict bond spreads for the period 2012 – 2014 in the GIIPS countries, before comparing them with actual yield spreads. They (de Vries and de Haan, 2014) find that across the five countries in question, bond spreads were on average 142 basis points lower than predicted by their model over the three years in question.[18] In particular, the model underestimates the magnitude of the spread for Greece and Italy in 2012, while overestimating the spread magnitude in all other observations. Hence, for 13 out of the 15 observations, actual yield spreads were lower than predicted by de Vries and de Haan's (2014) model. As a result, de Vries and de Haan (2014) offer the explanation that there has been a change in the impact of credit ratings on bond spreads since the euro crisis of 2012. The explanation for this observation lies in the unconventional monetary

[17] The peripheral nations of the Eurozone, as defined by de Vries and de Haan (2014) are Greece, Ireland, Italy, Portugal and Spain. They use the acronym "GIIPS" to refer to these countries. The bond spreads of the above countries are their spreads vis-à-vis German bonds.

[18] For detail, the averages of the five countries for each year indicate that in 2012, the predicted bond spreads were 49 basis points higher than expected, while in 2013 and 2014 they were 190 and 286 basis points lower than predicted, respectively. The overall result is then bond spreads that are 142 basis points lower than predicted, on average.

policies implemented by the European Central Bank in order to preserve the Euro after the threat of a break-up in the European Monetary Union in 2012. De Vries and de Haan (2014) suggest that the abundant liquidity created by the European Central Bank's policy of quantitative easing led to a search for yields by markets, leading to bond spreads that no longer reflected the assessment of sovereign credit risk by credit ratings agencies.

A second explanation offered by de Vries and de Haan (2014) is that ratings agencies have changed their approach to assessing sovereign risk, particularly in the GIIPS nations. To examine this, they (de Vries and de Haan, 2014) construct a random effects model to estimate the determinants of sovereign credit ratings. The explanatory variables included in the model are roughly similar to those suggested by Cantor and Packer (1996). However, de Vries and de Haan (2014) omit the two dummy variables that represent industrial development and a history of default. Instead, the ratio of investment to GDP and the unemployment rate are included in the model.[19] The model is estimated for the period 1995-2011 and includes 13 European countries.[20] All coefficients are statistically significant and carry the expected sign, except for the government budget balance coefficient, which was also found to be insignificant in Cantor and Packer (1996), as well as Jaramillo and Tejada (2011) above. De Vries and de Haan (2014) proceed to predict sovereign ratings for the period 2012-2014 and compare them to actual ratings. The results show that the GIIPS nations were rated, on average, 4.58 notches lower than the rating suggested by the estimated model. De Vries and de Haan (2014) note that this result displays a similar trend to work done by Ferri et al (1999), which concludes that ratings agencies adopted a conservative approach in order to regain their credibility in the aftermath of the East Asian crisis.

The overall conclusion reached by de Vries and de Haan (2014) is that the sovereigns in question are somehow rated significantly lower than they should be, yet also display lower yield spreads than anticipated. This is in contrast to the findings of Cantor and Packer (1996), discussed above.

[19] De Vries and de Haan (2014) note that the determinants of sovereign credit ratings used in their model were previously identified in work by Afonso *et al.* (2011) and Hill *et al.* (2010). The decision to make use of a random effects model was also obtained from Afonso *et al.* (2011).

[20] These include the GIIPS nations as well as Austria, Belgium, Estonia, Finland, France, Germany, Latvia and the Netherlands.

While de Vries and de Haan (2014) agree with Cantor and Packer (1996) that ratings changes have a substantial ability to explain changes in bond spreads, they believe that the fundamental relationship between the two indicators has changed since 2012.

2.5. Conclusion

In summary, Cantor and Packer (1996) find that differences in credit ratings have strong explanatory power with regards to differing bond yields across 35 nations, but that the effect on yields of a change in ratings is only significant if the sovereign holds a speculative-grade rating. Cantor and Packer (1996) identify inflation, GDP per capita and a nation's external debt level as being the most crucial determinants of a high credit rating, while also noting the generally higher ratings enjoyed by industrialized sovereigns, as well as those with no history of default. Jaramillo and Tejada (2011) agree in part with these findings, but stress the importance of overall GDP growth (a factor largely dismissed by Cantor and Packer, 1996) as well as the ratio of reserves to GDP. They (Jaramillo and Tejada, 2011) disagree with Cantor and Packer's (1996) finding that the effect of ratings to bond yields is significant only in the case of speculative-grade nations. Instead, Jaramillo and Tejada (2011) conclude that although they may be given some leeway by financial markets, investment-grade nations may still be punished, particularly if their external debt is not carefully-controlled. Yildiz and Gunsoy (2017) partially agree with the research above, finding both GDP per capita and inflation to be a significant determinant of spreads across both high and low/middle income nations, while a given sovereign's budget and current account balances are significant only across low/middle income economies.

González-Rozada and Levy-Yeyati (2010) find that credit ratings are not significant in determining bond spreads in emerging markets. In addition, they (González-Rozada and Levy-Yeyati, 2010) find that ratings changes lag changes in spreads rather than predicting them. In other words, credit ratings are largely endogenous, while changes in spreads are affected by exogenous, global factors. Mora (2006) supports this finding. Reisen and von Maltzan (1998) note that whether ratings lag or lead spreads has implications that go beyond academic interest, since if ratings lag spreads they could accentuate the economic "boom-bust" cycle. During the East Asian crisis of

1998/1999, rapid downgrades by leading ratings agencies during the crisis further deepened the plight of these economies, as well as negatively impacting the creditworthiness of their corporate sectors. Reisen and von Maltzan (1998) find a two-way relationship between ratings and spreads, implying interdependence. Credit ratings changes do not lead changes in bond spreads, because ratings agencies make use of the same publicly available information as financial markets. Nonetheless, Reisen and von Maltzan (1998), drawing on work by Eaton, Gersovitz and Stiglitz (1986), conclude that even if credit ratings do not lead the market, their usefulness lies in the manner in which they interpret the relevant publicly available information. This serves to sanction sovereign debt and ensure that a nation's default premium is determined by its ability to pay, rather than its willingness to do so.

Eliasson (2002) analyses the potential damaging effects of credit ratings that focus only on short-term business cycle movements rather than long-term trends over the time period 1990-1999, i.e. the time period surround the East Asian crisis. Eliasson's (2002) models (based on macroeconomic fundamentals) suggest that, in general, the ratings of East Asian sovereigns should have been lowered as the signs of impending danger came to light. In practice, sovereign ratings were later adjusted more severely than the econometric models suggested they should be. In light of this, Eliasson (2002) questions the long-term, forward-looking properties of sovereign credit ratings, and concludes that ratings appear to be pro-cyclical, rather than bringing early concerns hidden in macroeconomic fundamentals to the attention of investors.

Finally, in a study involving the GIIPS nations of the Eurozone over the period 1995-2011, de Vries and de Haan (2014) find that ratings have a significant ability to predict bond spreads. However, for the period 2012-2014, de Vries and de Haan (2014) find that bond spreads in the GIIPS nations are generally lower than predicted, but that these economies also, in general, carried lower sovereign ratings than predicted. As a result, de Vries and de Haan (2014) conclude that the relationship between bond spreads and bond yields has changed since 2012, primarily as a result of unconventional policies put in the place by the European Central Bank in the aftermath of the European debt crisis, as well as a generally more conservative approach by the large ratings agencies, who had suffered damage to their credibility in light of the global financial crisis, and

thus opted to remain cautious in assigning higher ratings, even as investor sentiment largely recovered.

The survey of the literature therefore reveals mixed evidence of the relative importance of sovereign credit ratings and macroeconomic variables in determining bond spreads and yields and yields in emerging economies. For this reason, both sets of factors are included in the models that follow. This is done in order to isolate the effects of changes in ratings while making provision for the influence of key macroeconomic variables on the cost of sovereign debt. In addition, previous research done on the relationship between sovereign credit ratings and sovereign bond yields in the aftermath of the global financial crisis has covered relatively short time periods. This research fills that gap by investigating a longer time period, allowing for the relationship to be studied comprehensively before, during and after the crisis, utilising appropriate techniques identified in the literature. This allows for relevant conclusions to be drawn regarding the nature of the sovereign ratings/spreads relationship, as well as identifying where the current base of knowledge requires expansion.

CHAPTER 3: DATA, METHODS AND TECHNIQUES

3.1. Introduction

This chapter sets out the techniques used to conduct the research. Section 3.2 reiterates the overarching objectives of the research and explains how the required data was identified, collected and manipulated in order to meet those aims. It includes the reasoning behind sample size and selection, the time period considered and the sources of the data. Section 3.3 sets out the regression analysis employed, including the specified model and its dependent and explanatory variable(s). The *a priori* expectations associated with each explanatory variable are briefly discussed, as well as how the impact of individual coefficients is measured.

3.2. Mean spread vs average ratings analysis

The overarching aim of this research is to analyse the influence of sovereign credit ratings on the relative cost of sovereign debt and whether there is any noteworthy difference in yield spreads when the threshold between investment-grade and "junk" status is crossed. In other words, is the impact on debt yields of a one-notch movement between the two asset classes (investment-grade and "junk") different to a one-notch movement within the individual asset classes? Given the conclusions of de Vries and de Haan (2014) the research also investigates changes in the relationship between sovereign credit ratings and bond yields over time, in particular in the aftermath of the global financial crisis of 2007/2008 and the Eurozone debt crisis of 2012. This is important as the impact of ratings changes and crossing the "threshold" is likely to be different in periods where the appetite for risk is high, compared with periods when it is low.

To investigate these questions, the relationship between sovereign ratings and bond spreads is examined over time. In order to achieve this, a sample of 39 largely emerging-market economies was selected.[21] The nations in question were selected on the basis of their sovereign rating

[21] The full, initial list of selected sovereigns was as follows: Argentina, Bahrain, Barbados, Belize, Bolivia, Brazil, Bulgaria, Chile, China, Colombia, Croatia, Cyprus, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Hungary, Iceland, Indonesia, Kazakhstan, Lebanon, Lithuania, Malaysia, Mexico, Morocco, Panama, Peru,

history. The selected sovereigns all (i) displayed a ratings history that included substantial changes in their rating over time; and (ii) held ratings that generally fluctuated a few notches above, or a few notches below, the investment grade/junk status threshold. For each nation, the history of its sovereign ratings (specifically for long-term, foreign currency-denominated debt) was obtained from both S&P and Moody's for the period 2000-2017. Each ratings category is assigned a numerical value, with the highest ratings class, AAA, assigned a value of 1. Each subsequent one-notch movement down the rating scale sees the numerical value increase by 1. The lowest investment-grade rating, BBB-, carries a value of 10, while at the bottom of the scale, all ratings lower than C are assigned a value of 22.

Each sovereign's average monthly rating from both S&P and Moody's was recorded for each month of the period under consideration. The average across the two ratings agencies was calculated for every month, after which the values were averaged for each year in order to obtain average ratings levels for each year. In the interest of simplicity, in the months during which ratings adjustments took place, the numerical value assigned for that month was chosen based on which rating the sovereign held for the majority of the month. Hence, if the ratings change was made in the second half of the month, the selected average rating was the "old" rating. If, by contrast, the change took place in the opening half of the month, the selected average rating was the updated rating.

The average annual ratings for each nation in the sample was then plotted against that nation's corresponding Emerging Markets Bond Index (EMBI) spread, in order to provide a visual comparison of the relationship between ratings and spreads, as well as how the relationship has changed over time.[22] The EMBI spreads in question were obtained from J.P. Morgan. Limitations

Philippines, Portugal, Romania, Russia, Slovakia, South Africa, Spain, Thailand, Turkey, Uruguay. As noted above, one of the criteria for selecting sovereigns was a history of substantial ratings changes over the time period considered. For this reason, certain emerging markets, such as India, for example, were excluded. While Portugal and Spain are developed economies, they fell with the ratings range examined and were therefore included.

[22] The EMBI was constructed by J.P. Morgan in 1992 and incorporates Brady bonds, dollar-denominated loans and Eurobonds, i.e. debt that is repaid in US dollars. The index value (i.e. spread) is calculated by taking into account the total size of the above-mentioned debt instruments held by a given nation, as well the relative proportion that each instrument contributes to the total. The yields on these debt instruments are then weighted accordingly, and compared to the yields on comparable U.S. debt instruments.

in data gathering meant that EMBI spreads were only available for 32 of the 39 nations originally identified, and only from 2006 onwards, which necessitated changes to both sample size (32 nations) and the length of the time period under consideration (2006 – 2017). The time period under consideration was divided into four three-year periods, i.e. 2006 – 2008, 2009 – 2011, 2012 – 2014 and 2015 – 2017. The rationale for this was to examine the relationship between average ratings and average spreads in each of these individual time periods and identify changes therein. Hence, the first time period (2006 – 2008) studies the relationship in a largely pre-financial crisis setting. 2009 – 2011 roughly covers the immediate aftermath of the global financial crisis, while 2012 – 2014 sees the emergence of the Eurozone debt crisis. 2015 – 2017 covers the sovereign debt market most recently. In order to identify differences between the relationship in the individual periods and the overall period, average ratings and average spreads were also calculated for the entire 2006-2017 period.[23]

To add numerical context to the established visual relationships, a variety of calculations were performed on the data. For each time period, the average spread across all 32 nations was calculated, as well as the range of the spreads, i.e. the difference between the average maximum and average minimum spread for the period. However, in order to account for possible distortions arising from an unusually high or unusually low average spread, the range for each period was also calculated after excluding the highest and lowest average spreads in the sample. This was done to avoid undue influence on the calculated range coming from single outliers in the data.

In addition, for all four time periods, as well as for the overall period, the above analysis was performed for just those nations with average credit ratings in the six-notch range between A-

[23] EMBI spreads were not available for all nations from the beginning of 2006 onwards. As a result, the 2006-2008 period compares the average ratings and average spreads of the 25 sovereigns for which data was available. For the 2007-2009 period, 27 nations are considered, while 2012-2014 analyses the relationship for 29 nations. The final time period (2015-2017) includes all 32 nations. For the overall (2006-2017) time period, only the 25 nations for which data was available for the entire period were included.

and BB-. The motivation for this is to study behaviour only in the area just above and below the investment-grade threshold, BBB-.[24]

3.3 Regression analysis

The above analysis was necessary to determine the overall investment climate in which individual countries' credit spreads might be changing. The logic is that in a period of strong credit appetite, overall spreads are likely to be relatively small. In a period of lower credit appetite they are likely to widen. Thus the impact on credit spreads of a one-notch credit upgrade or downgrade, or a switch between investment-grade and "junk" status is likely to be quantitatively different depending on the market's appetite for risk at a point in time.

In order to analyse the effects of sovereign ratings changes on mean monthly bond spreads, regression analysis was performed on the sample of 25 nations falling within the narrow ratings range 3 notches above and 6 below the investment-grade threshold and for which EMBI spreads were available for the period January 2006 – December 2017. Based on the panel nature of the sample in question, a fixed effects model with a monthly frequency of the following specification was constructed, similar to that used by Jaramillo and Tejada (2011):

$$\log(Spreads)_{it} = \beta_0 + \beta_1 GDPGR_{it} + \beta_2 EXDBTGDP_{it} + \beta_3 PUBDBTGDP_{it} + \beta_4 Ratings_{it} + \beta_5 VIX_{it} + \delta_i + \varepsilon_{it}$$

The dependent variable is the natural logarithm of sovereign bond spreads, based on each sovereign's EMBI spread. The natural logarithm of the spreads was used in order to express changes in spreads in terms of percentage changes. As mentioned earlier, spreads were sourced from J.P. Morgan. The model includes a constant (β_0), as well as making provision for fixed effects differences across nations, given by δ_i. In order to isolate the effects of ratings changes on spreads, certain macroeconomic variables found to be significant in the literature were included as explanatory variables. Early work by Cantor and Packer (1996) includes a plethora of macroeconomic variables, but only six (GDP per capita, inflation, external debt as a proportion

[24] The A- and BB- ratings grades carry numerical values of 7 and 13, respectively. The BBB- ratings grade, which represents the investment-grade threshold, carries a value of 10, and hence falls in the middle of the above-mentioned range.

of GDP, GDP growth rate, level of economic development and default history) were found to be significant. This thesis follows the findings of Jaramillo and Tejada (2011) and uses only variables which they found to have the most notable effects on spreads. The selected macroeconomic variables were real GDP growth (given by $GDPGR_{it}$), external debt as a percentage of GDP ($EXDBTGDP_{it}$) and public debt as a percentage of GDP ($PUBDBTGDP_{it}$). It is expected, *a priori,* that real GDP growth would have a negative relationship with spread size, given that a higher level of growth makes it easier for a nation to service its debts (Jaramillo and Tejada, 2011). By contrast, the public debt to GDP ratio is expected to have a positive relationship with spreads, since a higher level of public debt increases the debt burden that a nation has to service, implying a higher potential for default. Jaramillo and Tejada (2011) use external government debt as one of their macroeconomic variables, but due to difficulties in obtaining data of just government's external debt for all 32 countries modelled, external debt for the nations as a whole was used instead. Data for all three variables were obtained from Thomson Reuters Eikon Datastream. The data in question was available only in an annual frequency. As a result, the data was interpolated using Eviews 10 in order to match the monthly frequency of the other variables in the model, following the methodology of Aziakpono (2005).

$Ratings_{it}$ is a vector containing dummy variables for each ratings category under observation. In total, the vector includes 9 dummies, representing the range of ratings between BBB+ and B- , with each dummy variable becoming active, i.e. being set equal to 1, for the period during which a given sovereign held the rating in question. Hence, if a sovereign holds a given rating in a certain month, the dummy associated with that rating is set equal to one. Since a sovereign can hold only one rating at a time, the other ratings dummies are set equal to 0 during that month. The appropriate ratings dummy remains active until the sovereign has its rating changed, at which point the old dummy is set equal to zero, and the ratings dummy becomes active. This is done in order to isolate the effect on spreads of holding a particular ratings versus the average spreads for the remaining group of ratings, while holding the other variables constant. In order to account for possible endogeneity in the relationship between spreads and ratings, the dummies are lagged by one period, i.e. the average spread in a given month is compared to the credit rating held in the previous month (Jaramillo and Tejada, 2011). For this purpose, monthly ratings data

(specifically for foreign currency denominated debt) were obtained from both S&P and Moody's. The ratings assigned by both agencies for a given month were averaged, with this average determining which dummy variable in the $Ratings_{it}$ vector is active for the month in question. The expectation is that a more favourable credit rating should lead to lower bond spreads, though the magnitude of this effect, and whether it is constant across the entire range of ratings classes will be indicated by the results.

While Jaramillo and Tejada (2011) make use of a fixed effects model of the above specification, a random effects model is also utilised in the present study and the results compared to those obtained from the fixed effects model. All models use robust standard errors, in order to correct for heteroscedasticity.

Interpreting the influence of each of the ratings dummies in isolation implies comparing the average spread when a given ratings dummy is active versus the average spreads obtained when the omitted dummies are active. As noted by Jaramillo and Tejada (2011) the percentage effect of each ratings dummy variable's coefficient is isolated by use of the formula:[25]

$$Impact = (e^{coefficient} - 1) * 100$$

It was decided to include a proxy for global risk appetite, with the *a priori* expectation that a greater appetite for risk would lead to a greater willingness to hold riskier assets, implying a lower spread on emerging market debt. The converse holds in periods of higher expectations of future volatility, which would likely require riskier markets to offer a more attractive return (i.e. a higher risk premium), which would imply higher bond spreads. As in Jaramillo and Tejada (2011), the selected proxy for global risk appetite was the Chicago Board Options Exchange (CBOE) Volatility Index (VIX), represented by the variable VIX_{it}.[26] Daily data on the VIX were obtained from the

[25] So, for example, a significant coefficient with a value of 0.1 would imply spreads that were 10.51% higher for the ratings dummy in question than for the rest of the sample, *ceteris paribus*. Similarly, a coefficient value of -0.12 would imply spreads that were 11.31% lower than for the rest of the sample, *ceteris paribus.*

[26] The VIX is an index of the market's expectations of future volatility, based on options on the S&P 500 Index. CBOE.com (2018) considers the VIX to be the world's leading measure of U.S equity market volatility.

CBOE. The data were averaged on a month-by-month basis in order to conform to the remainder of the model.

In light of the previously identified differences (Jaramillo and Tejada, 2011) between the relationship before and after the financial crisis, it was decided to perform the same regression analysis, but to vary the periods under observation. Hence, the regression analysis was initially performed on the period spanning 2006 – 2017, before being repeated on just the 2010 – 2017 period, in order to focus specifically on the relationship between ratings and spreads after the financial crisis.

3.4. Conclusion

This chapter has set out the methods, data and techniques used in order to conduct the research. The overarching goals of the research were set out, along with the criteria for constructing the panel of sovereigns that comprise the sample, including details such as sample size and the time period under consideration. In addition, the required data, as well as their sources were identified. The chapter explained how the gathered data was manipulated in order to meet the goals of the research. Furthermore, the structure of the regression analysis employed to meet the research aims was set out, including the functional form of the estimation expression used. The *a priori* expectations associated with the coefficients of each of the selected variables were set out, as well as how the impact of the variable coefficients would be interpreted.

CHAPTER 4: FINDINGS AND INTERPRETATION OF RESULTS

4.1. Introduction

In this section, the relationship between average spreads and ratings are analyzed in detail. Section 4.2 presents the statistical findings associated with the ratings/average spreads relationship. The initial discussion covers the entire period under consideration, 2006 – 2017. Each of the four individual periods (2006 – 2008, 2009 – 2011, 2012 – 2014, 2015 – 2017) is subsequently analysed. The discussion of each individual period includes a comparison between the period in question and the previous period, as well as against the overall time period. These comparisons allow for a greater emphasis on the differences between the findings across individual time periods. This is followed by a concluding section that summarizes the findings and identified trends from the analysis.

Section 4.3 shows the results of the regression analysis performed to isolate the effects of sovereign ratings on sovereign spreads, holding certain macroeconomic factors constant. The regression analysis was performed for two time periods, 2006 – 2017 and 2010 – 2017. For each of these time periods, the results for both fixed effects and random effects models are shown. The results of the Hausman test employed to determine whether the fixed or random effects model is more appropriate for each time period are discussed.

4.2. Descriptive findings: mean spreads versus average ratings

The results of the calculations for the four separate 3-year time periods are summarized in Table 2 below. The findings for each time period are discussed, with each discussion supported by two graphs. In each case, the first graph illustrates the relationship between average ratings and average spreads for the entire sample of 32 countries, while the second graph shows the relationship only for nations with average ratings between A- and BB-. In the interest of conciseness, the above-mentioned graphs are shown below in the text for the overall (2006 – 2017) period. The graphs relating to the four individual time periods may be found in Annexure

A. In each graph, the vertical line represents the investment-grade threshold. Ratings to the left of the vertical line represent investment-grade ratings, while those to the right of the vertical line represent speculative-grade ratings. In Table 2 below, all figures are in basis points. The figures in brackets represent the difference (in basis points) from the previous 3-year period.

Table 2: Spread Mean, Range and Median: 2006 - 2017

Spread Mean, Range and Median: 2006 - 2017				
Entire Sample				
Time Period/Calculation	**Mean Spread**	**Spread Range**	**Spread Range (excl. outliers)**	**Median**
2006 - 2017	277	868	572	230
2006 - 2008	244	850	430	203
2009 - 2011	348 (+104)	1211 (+361)	1010 (+580)	247 (+44)
2012 - 2014	306 (-42)	1163 (-48)	844 (-166)	198 (-49)
2015 - 2017	283 (-23)	969 (-194)	808 (-38)	234 (+36)
A- to BB-				
Time Period/Calculation	**Mean Spread**	**Spread Range**	**Spread Range (excl. outliers)**	**Median**
2006 - 2017	205	228	132	212
2006 - 2008	180	227	182	187
2009 - 2011	252 (+72)	440 (+213)	333 (+151)	234 (+47)
2012 - 2014	206 (-46)	307 (-133)	237 (-106)	187 (-47)
2015 - 2017	210 (+4)	285 (-22)	258 (+21)	213 (+36)

Source: Author's own calculations in Microsoft Excel based on data from J.P. Morgan (2018), Moody's Investor Services (2018) and Standard and Poor's (2018). Note: Bracketed figures are changes (in basis points) from the previous period.

4.2.1. Overall period (2006 – 2017)

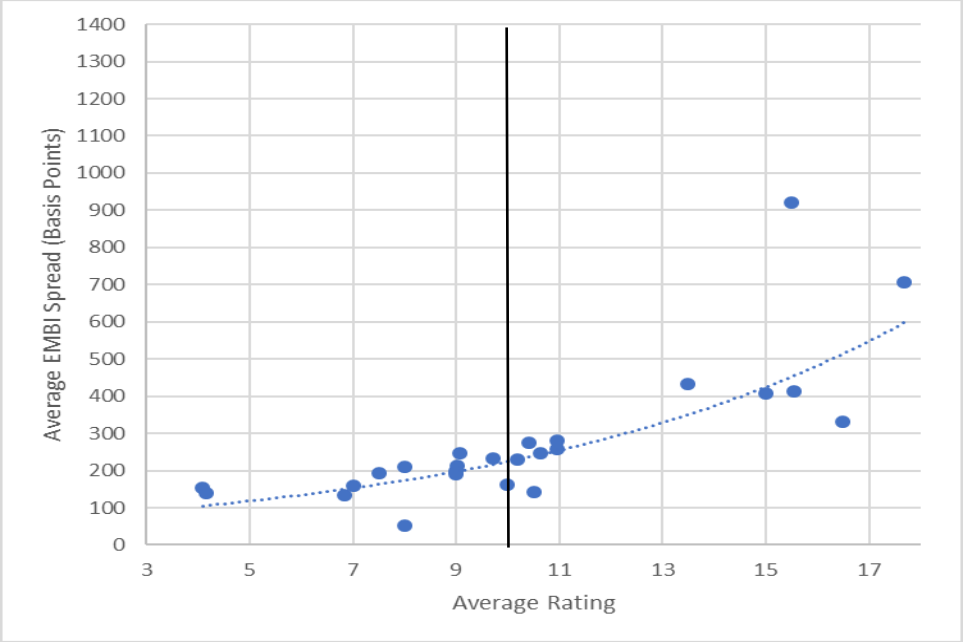

Figure 1: EMBI Spreads vs Average Ratings, 2006 – 2017 (entire sample).
Source: Author's own calculations in Microsoft Excel based on data from J.P. Morgan (2018), Moody's Investor Services (2018) and Standard and Poor's (2018).
Note: Spread data is in basis points.

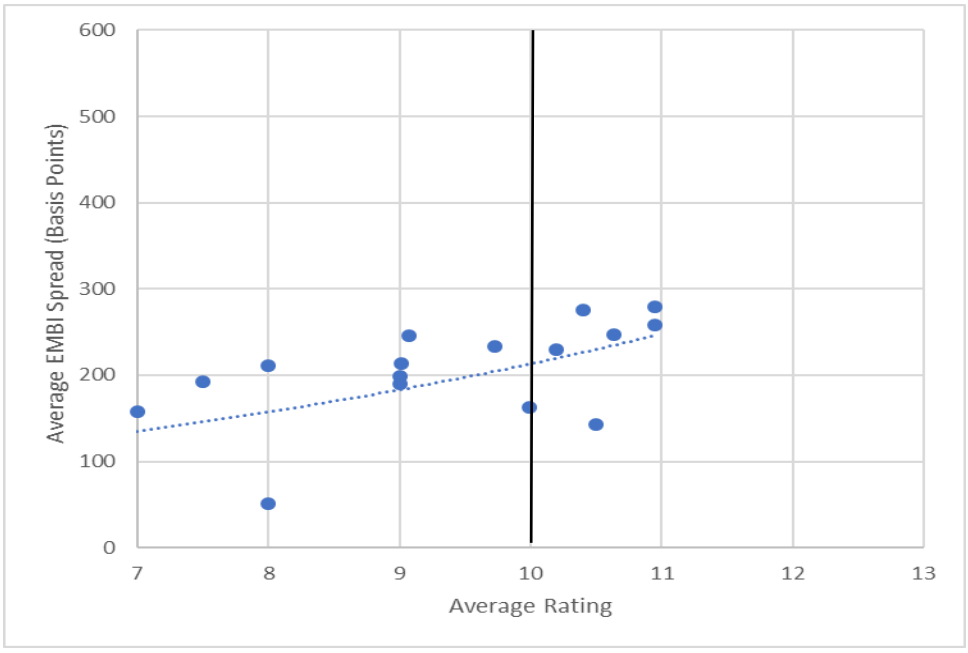

Figure 2: EMBI Spreads vs Average Ratings: 2006-2017 (only countries rated A- to BB-).
Source: Author's own calculations in Microsoft Excel based on data from J.P. Morgan (2018), Moody's Investor Services (2018) and Standard and Poor's (2018).
Note: Spread data is in basis points.

The mean spread for the sample over the period as a whole is 277 basis points. The range on spreads is 868 basis points, but once the top and bottom values are excluded, this figure drops to 572 basis points. This large difference is due to the high spreads associated with those nations rated far below the investment-grade threshold. For only those nations rated in the A- to BB- range, the mean spread is lower, at 205 basis points, and the spread range is more compressed, at 228 basis points. Once the highest and lowest values are discarded for these countries, the spread range is reduced to 132 basis points. These findings demonstrate the enormous discrepancy in spreads at the lower and higher ends of the ratings distribution, with ratings classes in the middle returning much tighter spread differences. This observation is supported by the finding that the median for the sample is 230 basis points, while the median of the A- to BB- ratings distribution is 212 basis points.

4.2.2. Period 1 (2006 – 2008)

For the first period under consideration, the mean spread over the entire sample is 244 basis points, while for the A- to BB- ratings range, it is only 180 basis points. Both of the above spreads are lower than the comparable figures for the entire 2006 – 2017 period (277 and 205 basis points, respectively). At 850 basis points the sample spread range is also slightly lower than for the overall time period (868 basis points) and falls to 430 basis points when the top and bottom values are removed. For nations in the middle of the ratings distribution, the spread range is virtually identical to the value for the entire time period (227 basis points vs. 228 basis points), with a value of 182 basis points once outliers are removed. The median between 2006 and 2008 is 203 basis points for the entire sample, and 187 basis points for the A- to BB- range. Overall, for this time period 2006 - 2008, all calculated figures are lower than their corresponding values over the entire time period, with the spread range for nations rated between A- and BB- the only exception, and only once the top and bottom values are discarded.

These results point to a more compressed spread vs. rating relationship in the period leading up to the global financial crisis than in subsequent time periods, with lower mean spreads, a tighter range and lower median reported over both the sample as a whole, as well as the sub-sample

covering sovereigns rated between A- and BB-. This suggests that investors applied lower premia for risk in this period than subsequently. However, given that the mean spread is higher than the median spread for this period, some skewness is present in the data, with spreads growing quickly after the median is crossed.

4.2.3. Period 2 (2009 – 2011)

The second period, which covers the aftermath of the global financial crisis, sees a substantial increase in mean spreads from 244 to 348 basis points, an increase of 42.62% compared with the sample as a whole. This effect of higher spreads is also observed for the A- to BB- ratings range, for which mean spreads climb 40% from 180 to 252 basis points. The spread range for the sample rises dramatically to 1 211 basis points (up from 850 basis points). Even after the highest and lowest values are removed, the spread of 1 010 basis points is far higher than in the previous period. The median spread increased, but not by as much as the mean, implying that the data is more skewed in the 2009 – 2011 period than previously, though this may be due to outliers towards the tail end of the data.

The middle of the ratings distribution displays a similar outcome, with the spread range climbing to 440 basis points (up from 227 basis points), with a value of 333 basis points once the outlying values are discarded. Both the entire sample and sovereigns rated between A- and BB- record similar increases in their median spreads, with the former increasing by 44 basis points, and the latter 47 basis points.

For the 2009 – 2011 time period, all measures of the spreads increase. Given the post-financial crisis circumstances surrounding the 2009 – 2011 time period, the finding that movements were larger (in both directions) than the changes observed over any of the other three time periods under consideration is unsurprising.

4.2.4. Period 3 (2012 – 2014)

The period 2012 – 2014 sees a reduction in mean spreads across the board compared with 2009 – 2011, with a 12.07% reduction of 42 basis points for the sample as a whole, and a 18.25%

decrease of 46 basis points for nations rated between A- and BB-. The spread range for the entire sample falls slightly, by 48 basis points, but once the highest and lowest spreads are removed, the reduction is 166 basis points. The middle of the ratings range experiences a decrease in spread range of 133 basis points, which becomes a 106 basis point fall once the outermost values are removed. In addition, median spreads fall compared to the previous period for both the overall sample (49 basis points) and sovereigns in the A- to BB- range (47 basis points).

Overall, the 2012 – 2014 period returns lower spreads across all considered metrics compared to the 2009 – 2011 period. However, despite these decreases, all measures remained higher than for the 2006 – 2008 period, with mean spreads for the sample as a whole 25.40% (62 basis points) higher across the sample than in 2006 – 2008. This shows that while risk appetite had improved, investor optimism had not returned to the levels experienced prior to the financial crisis. For the middle of the ratings range, this effect was less pronounced, with mean spreads only 14.44% (26 basis points) higher than in the first period. Furthermore, the gap between the mean and median rose to the largest margin yet during the 2012 – 2014 period, implying that nations in the first 50 percent of the ratings range saw spreads fall more rapidly than those in the second 50 percent of the ratings range.

Even with extreme values omitted, both the entire sample and the A- to BB- group of sovereigns experience a larger spread range compared to the 2006 - 2008 period. This result is especially pronounced for the overall sample, which returns a spread range 414 basis point higher than in 2006-2008, while the A- to BB- group sees the range increase by a smaller margin of 55 basis points. The only measure of spreads that is not higher than in 2006 – 2008 is the median, which is 5 basis points lower for the entire sample, and equal to its Period 1 value for the middle group of sovereigns.

4.2.5. Period 4 (2015 – 2017)

The results for the final period under consideration are less clear-cut than previous periods. Mean spreads compared with 2012 – 2014 fall by 7.51% (23 basis points) across the sample as a whole, but increase by 1.9% (4 basis points) for the A- to BB- range. The spread range for the

sample as a whole falls by 194 basis points, and by 38 basis points when the highest and lowest spread values are removed. But, for the overall sample, the spread range remains higher than the average for the entire (2006 – 2017) period, both before and after the two most extreme values are removed. . By contrast, nations between A- and BB- experience a spread range reduction of 22 basis points compared with 2012 – 2014. However, once highest and lowest values are removed, the spread range is 21 basis points higher. Both the sample as a whole and the subset of A- to BB- sovereigns see median spreads rise by 36 basis points compared to the previous period, closing the gap to the smallest margin since the 2006 – 2008 period. All measures of spreads are higher than during the 2006 -2008 period.

4.2.6. Summary of statistical findings

The above results demonstrate noticeable changes in spreads across the different time periods. Initially, for the 2006 – 2008 period, all spread metrics were substantially lower than those for the overall time period. The only exception is the sample range for nations rated in the A- to BB- sub-sample, and only once the two outermost values are removed. The second period saw an increase in all calculated metrics, in particular in mean spreads. The most dramatic change, however, took place in the spread range. Even after removing the highest and lowest values for both the overall sample and the A- to BB- range, the calculated spread range for 2009 – 2011 remained higher than the spread range from the previous period, even with extreme values included. Clearly, for the second period, there was not only a noticeable increase in average spreads when compared to the 2006 – 2008 period, but also a greater variability in spreads. It is especially notable that even amongst nations with similar average ratings, substantial differences in spreads were observed, as can be observed from the graphs included in Appendix A. While this phenomenon was not wholly absent in the first period, it was far more obvious in the second period.

Period 3, 2012 – 2014, saw the calculated metrics return to lower levels across the board compared to the second period. However, all metrics remained noticeably higher than in the first period, and also higher than the values for the overall period, median spreads being the only

exception. The final period, covering 2015 – 2017, witnessed a slowing, and in some cases, even a reversal of the tendency towards lower spread metrics during the previous period. While some measures, specifically mean spreads, spread range for the sample (including and excluding extreme values) and spread range for the A- to BB- group (including extreme values) still fell, the rate of decline slowed. By contrast, the remaining measures increased slightly. The overall results for the 2015 – 2017 period appear similar to the average results for the entire period in some respects, but with values noticeably higher than for the 2006 – 2008 period, which preceded the global financial crisis.

The substantial movements in the calculated statistics discussed demonstrates that the relationship between average ratings and average spreads fluctuated considerably over the sample period. While there generally appears to be a clear link between a lower sovereign credit rating and higher spreads (as expected), it does not appear that the extent of this relationship can be predicted with certainty over a given period of time. The above results suggest that while the *a priori* expectations surrounding the negative relationship between ratings and yield spreads are confirmed, the amount by which a lower credit rating coincides with higher average spreads changes over time. It is particularly striking how each post-crisis period of analysis witnessed the gradual return of the average spread versus average rating relationship to almost pre-crisis levels. However, this return was incomplete, as at the end of the sample period (2015 – 2017) most measures were still higher than for both the pre-crisis period (2006 – 2008) and the overall sample period. While such an outcome was to be expected in the immediate aftermath of the financial crisis, the above-mentioned incomplete return to pre-crisis levels nearly a decade after the worst of the crisis is possibly unexpected. The incomplete return to pre-crisis levels in the average spread versus average rating relationship nearly a decade after the worst of the crisis raises the question of whether a return to 2006 – 2008 levels is likely to occur before the global economy enters its next recession, or whether the relationship has altered fundamentally.

The finding that while there is a clear negative relationship between sovereign credit ratings and the cost of sovereign debt the absolute value of this relationship changes over time may be due to investors relying on signals other than credit ratings to determine the desirability of investing

in specific sovereign debt. Such an outcome has been suggested in the literature discussed earlier. In the aftermath of the financial crisis, increased emphasis on other measures, such as macroeconomic fundamentals, rather than a pure reliance on sovereign ratings was to be expected.

It is unclear from the above statistical findings how much the changed relationships between ratings and spreads is affected by an altered appetite for risky investments or by the influence of macroeconomic factors. In order to isolate the effects of sovereign ratings changes on the cost of sovereign debt more precisely, it is necessary to control for the influence of these macroeconomic factors, as well as the global appetite for risk. It is also clear that these relationships must be examined for different time periods because of the changed outcomes in terms of credit spreads. This is examined in the next section using appropriate regression analysis.

4.3. Regression analysis

In this section, the regression results for the fixed and random effects models for both the 2006 – 2017 and 2010 – 2017 time periods are discussed. Each summarized set of regression results is followed by a discussion on the significance and size of the individual coefficients and whether or not they conform to *a priori* expectations.[27] In all regressions, the cross section is comprised of 25 nations.

4.3.1. Regression analysis: 2006 – 2017

The regression results for both the fixed effects (Model 1) and random effects (Model 2) models for the period 2006 – 2017 are summarized in Table 3 below.

[27] As mentioned earlier, dummy variables are used to isolate the influence of ratings on bond spreads, holding all else constant. The impact of each rating is represents the difference between the spreads for nations holding that rating at a point in time versus the average spreads for nations holding the remaining group of nations. This impact is then expressed as a percentage.

Table 3: Fixed and Random Effects Models Regression Results (2006 – 2017).

2006 – 2017		
Dependent Variable: Log (Spreads)		
Variable	**Model 1 (Fixed Effects)**	**Model 2 (Random Effects)**
C	4.4824***	4.5331***
	(0.0679)	(0.1605)
GDPGR	-0.0464***	-0.0468***
	(0.0037)	(0.0036)
PUBDBTGDP	0.0095***	0.0089***
	(0.0013)	(0.0014)
EXDBTGDP	0.0036***	0.0035***
	(0.0006)	(0.0004)
VIX	0.0231***	0.0230***
	(0.0009)	(0.0009)
BBB+(-1)	-0.1368***	-0.1493***
	(0.0278)	(0.0278)
BBB(-1)	0.0022	0.0012
	(0.0768)	(0.0286)
BBB-(-1)	-0.0050	-0.0024
	(0.0300)	(0.0316)
BB+(-1)	-0.0893**	-0.0897**
	(0.0348)	(0.0350)
BB(-1)	0.0557	0.0627
	(0.0424)	(0.0426)
BB-(-1)	0.1275***	0.1393***
	(0.0377)	(0.0373)
B+(-1)	0.2355***	0.2429***
	(0.0373)	(0.0373)
B(-1)	0.2421***	0.2536***
	(0.0381)	(0.0377)
B-(-1)	0.3070***	0.3255***
	(0.0436)	(0.0425)
Adjusted R-squared	0.7864	0.4344
F-Statistic	356.5427***	212.0937***

Source: Author's own estimation using Eviews 10.
Note: The significance of individual coefficients is indicated by *** for significance at the 1% level, ** for significance at the 5% level and * for significance at the 10% level.
Robust standard errors are reported in brackets below each individual coefficient.
Table B.1. in Annexure B depicts the cross-sectional fixed and random effects for each model.

4.3.1.1. Model 1 (fixed effects)

For the whole time period 2006 – 2017 the coefficient of real GDP growth is significant at the 1% level, and in line with *a priori* expectations, carries the anticipated negative sign, implying that stronger economic growth is correlated with lower spreads, holding all else constant. Similarly, the coefficients of both external debt as a percentage of GDP and public debt as a percentage of GDP are significant at the 1% level, with a positive sign, as expected. The coefficient of VIX is significant at the 1% level and carries a positive sign, implying that expectations of higher volatility in the future are, as expected, correlated to higher spreads in emerging markets, holding all else constant. In summary, all four of the included macroeconomic control variables were found to be highly significant, and all carried the expected sign.

The results further indicate that sovereigns with a credit rating of BBB+ (the highest considered for the sample) enjoy spreads that are 12.79% lower than those holding the remaining ratings, on average, *ceteris paribus*.[28] The coefficient is significant at the 1% level. The coefficients of the BBB and BBB- dummy variables are insignificant. The coefficient for the BB+ rating class is significant at the 5% level and implies spreads 8.54% lower than for the other ratings under consideration, on average, *ceteris paribus*. The coefficient for the BB dummy variable is insignificant. The BB- ratings class has a highly significant coefficient, implying spreads that are 13.60% higher than for the remaining group, on average, *ceteris paribus*. The coefficient for the B+ dummy variables is highly significant and implies spreads that are 26.56% higher than for the remaining group, on average, *ceteris paribus*. The observed effect of higher spreads is carried on through the final two ratings classes under consideration, i.e B and B-, both of which are found to be significant at the 1% level. Sovereigns holding the rating of B return spreads that are 27.39% higher than for the remaining group, on average, *ceteris paribus*. Sovereigns in the B- ratings class return spreads that are, on average, 35.93% higher than for the remaining group, c*eteris paribus*.

[28] As mentioned earlier, this is calculated as: $-12.79\% = (e^{-0.1368} - 1) * 100$. This means in practice that nations holding a BBB+ rating in the sample enjoyed spreads 12.79% lower than the average spread enjoyed by the remaining group of nations, holding all else constant.

Overall, the results display the expected result that higher-rated nations enjoy lower average sovereign spreads, with a gradual decline in the positive effect as the ratings decline towards the investment/speculative-grade threshold. When the BB- rating is reached, nations begin to see higher average spreads, an effect which is carried through to the bottom of the ratings range under consideration. Interestingly, the most substantial difference in spread size appears to occur between the BB- and B+ ratings classes (13.60% higher versus 26.57% higher, a difference of 13.27 percentage points). This is despite the afore-mentioned ratings classes both being below the investment-grade/speculative-grade threshold. Below B+ the higher average spreads observed appear to increase at a more gradual rate, from 26.56% higher to 27.39% higher between the B+ and B ratings classes, an increase of just 0.83 percentage points. This is followed by a larger increase between the B and B- ratings classes (from 27.39% higher to 35.93% higher), an increase of 8.54 percentage points.

The regression has reasonably strong explanatory power, with an adjusted R-squared of 0.786.[29] The p-value of the F-statistic indicates that the regression as a whole is significant at the 1% level, implying that overall, the independent variables are jointly successful in explaining changes in the values of the dependent variable.

4.3.1.2. Model 2 (random effects)

In the second model, the individual macroeconomic variables included in the model remain highly significant and maintain similar influences, as well as keeping the anticipated signs. There is no change in the levels of significance (or lack thereof) of the individual ratings dummy coefficients, but there are differences in the impact of some of the significant ratings on spreads.

The coefficient of the BBB+ dummy implies spreads 13.86% lower than for the remaining group, compared to 12.78% lower for the fixed effects model, a difference of 1.08 percentage points. The impact of the BB+ ratings dummy is marginally larger (spreads 8.58% lower, compared to 8.54% in the first model), but as the lower end of the ratings range is reached, the differences

[29] The adjusted R-squared value, which can range between 0 and 1, indicates that 78.6% of the variation in the dependent variable can be explained by changes in the independent variables.

become more pronounced. Model 2 suggests that average spreads for nations with a BB- rating are 14.94% higher than those holding other ratings, *ceteris paribus*. This is 1.34 percentage points higher than the impact suggested by Model 1. For the B+ ratings dummy, Model 2 suggests a difference in impact of 0.93 percentage points, with spreads 27.49% higher for these sovereigns than for the remaining group, compared to 26.56% higher in Model 1. Similarly, the coefficient of the B ratings variable suggests spreads 28.87% higher than for the remaining group, *ceteris paribus*, which is 1.48% higher than the impact of the same variable in Model 1. The largest difference occurs when the final ratings dummy, B-, is considered. The coefficient obtained in Model 2 suggests average spreads 38.47% higher for the relevant nations when compared to the remaining group, *ceteris paribus*. This is a noticeably higher than the impact suggested by Model 1 (35.93%).

The second model remains highly significant overall, as indicated by the F-statistic. However, the adjusted R-squared is substantially lower for the random effects model than for the fixed effects model (0.4344 vs 0.7864). The results of the Hausman test for which model is more reliable are discussed in Section 4.3.3 below.

4.3.2. Regression analysis: 2010 – 2017

In Models 3 and 4 the time period analysed is reduced to 2010 – 2017. This is done to remove the impact of the overall very low spreads for the 2006-2008 period discussed in Section 4.2.2 and the very high spreads during the global financial crisis discussed in Section 4.2.3. Results for Model 3 and Model 4, which represent the fixed effects and random effects models, respectively, but for just the 2010 – 2017 period, are summarized in Table 4 below. As before, robust standard errors are reported in parentheses under the coefficient value.

Table 4: Fixed and Random Effects Models Regression Results (2010 – 2017).

2010 – 2017		
Dependent Variable: Log (Spreads)		
Variable	**Model 3 (Fixed Effects)**	**Model 4 (Random Effects)**
C	4.3031***	4.4492***
	(0.0796)	(0.1388)
GDPGR	-0.0345***	-0.0381***
	(0.0025)	(0.0028)
PUBDBTGDP	0.0061***	0.0059***
	(0.0015)	(0.0012)
EXDBTGDP	0.0131***	0.0106***
	(0.0008)	(0.0008)
VIX	0.0217***	0.0215***
	(0.0021)	(0.0021)
BBB+(-1)	-0.0916***	-0.1114***
	(0.0245)	(0.0239)
BBB(-1)	-0.1049***	0.1014***
	(0.0217)	(0.0210)
BBB-(-1)	-0.1337***	-0.1389***
	(0.0188)	(0.0211)
BB+(-1)	-0.1638***	-0.1754***
	(0.0329)	(0.0317)
BB(-1)	-0.1182***	-0.1209***
	(0.0327)	(0.0292)
BB-(-1)	0.0462	0.0655**
	(0.0342)	(0.0334)
B+(-1)	0.0939***	0.1159***
	(0.0345)	(0.0324)
B(-1)	0.1304***	0.1568***
	(0.0331)	(0.0317)
B-(-1)	0.0656	0.1003**
	(0.0467)	(0.0485)
Adjusted R-squared	0.8403	0.2933
F-statistic	338.3799***	76.7458***

Source: Author's own estimation using Eviews 10.

Note: The significance of individual coefficients is indicated by *** for significance at the 1% level, ** for significance at the 5% level and * for significance at the 10% level.

Robust standard errors are reported in brackets below each individual coefficient.

Table B.2. in Annexure B depicts the cross-sectional fixed and random effects for each model.

4.3.2.1. Model 3 (fixed effects)

The coefficients of the macroeconomic variables specified earlier (real GDP growth, external debt as a percentage of GDP, public debt as a percentage of GDP and the VIX) remain highly significant, with all coefficients significant at the 1% level. Furthermore, all four coefficients still carry the expected sign. The coefficients demonstrate minor differences in magnitude compared with the models of the 2006 - 2017 time period. The influence of real GDP growth and public debt as a percentage of GDP on spreads is slightly diminished in the shorter period. By contrast, external debt as a percentage of GDP now appears to have a larger influence on changes in average spreads. The impact of changes in the VIX appears largely unchanged, with only a marginally smaller value of the coefficient for the 2010 – 2017 period compared to the larger 2006 – 2017 time period.

The most noticeable differences between the results of the two fixed effects models (Model 1 and Model 3, respectively) for the two time periods under consideration are found in the coefficient and significance values of the ratings dummy variables. The BBB+ variable has retained its negative coefficient. However, the coefficient now implies that, between 2010 and 2017, sovereigns with a rating of BBB+ enjoyed average spreads 8.75% lower than the remaining group, *ceteris paribus* (compared with 12.78% lower for the 2006 - 2017 period). The coefficient remains significant at the 1% level.

In contrast to the 2006 – 2017 period, the coefficients for both the BBB and BBB- ratings dummies are now significant, and at the 1% level. Furthermore, both coefficients now carry the expected (negative) sign. The coefficient of the BBB variable implies that over the 2010 – 2017 time period sovereigns with a BBB rating enjoyed spreads 9.96% lower than those with ratings from the remaining group, on average, *ceteris paribus*. The coefficient of the BBB- rating suggests that average spreads were 12.51% lower for nations holding this rating between 2010 and 2017, on average, *ceteris paribus*.

Crossing the investment-grade threshold, the coefficient of the BB+ dummy variable retains both its significance at the 1% level, as well as its negative sign. The influence of the coefficient is

greater, however, and implies average spreads 15.11% lower than for the remaining group, *ceteris paribus*. In the shortened time period under consideration, this is the largest influence from any single rating dummy variable.

In contrast to the 2006 – 2017 time period, the coefficient of the BB ratings dummy is significant over the 2010 – 2017 period, at the 1% level, with spreads, on average, 11.15% lower for nations with a BB rating than for the rest of the sample, *ceteris paribus*. The coefficient of the BB- variable is no longer significant at conventional levels.

Towards the lower end of the ratings range, the coefficients of the B+ and B ratings remain significant, while the B- rating coefficient becomes insignificant at conventional levels. In addition, the impact of the two significant coefficients is smaller than in the former specification. The B+ coefficient implies average spreads that are 9.85% higher than for the remaining group, compared to 26.56% higher in the former model, ceteris paribus. Similarly, the impact of the B coefficient implies spreads 13.93% higher than previously, compared to 27.39% higher, *ceteris paribus.*

The adjusted R-squared of the fixed effects regression for 2010 – 2017 is noticeably higher than that of the longer time period, at 0.849267 vs. 0.786407. The p-value of the F-statistic indicates that the regression remains highly significant overall, i.e. at the 1% level.

4.3.2.2. Model 4 (random effects)

As in the three previous models, the four macroeconomic variables are significant at the 1% level and carry the expected sign. The coefficient of the BBB+ ratings dummy is again highly significant, and suggests average spreads 10.54% lower than for the remaining group, *ceteris paribus*. This is 1.79 percentage points higher than the impact obtained in the corresponding fixed effects model for 2010 – 2017 (Model 3) but 3.32 percentage points lower than the value obtained in Model 2, the random effects model for 2006 – 2017. The coefficients of the BBB and BBB- ratings dummies remain significant and retain a similar impact to that suggested in Model 3, with suggested average spreads 9.64% and 12.96% lower than for the remaining group, *ceteris*

paribus. This is in contrast to Model 1 and Model 2, neither of which found coefficients for these ratings to be significant at any conventional level.

Similar to the above, the BB+ and BB coefficients remain significant at the 1% level, with average spreads 16.09% and 11.39% lower than for the remaining group of nations*, ceteris paribus*. In contrast to Model 3, the BB- coefficient is found to be significant at the 5% level, but with average spreads that are only 6.76% higher than for the remaining group, which is the smallest impact observed by any of the significant ratings dummy variables across all four models.

As in Model 3, the coefficients of both the B+ and B ratings variables are significant and suggest higher average spreads than for the remaining group, *ceteris paribus*. For the B+ variable, this figure is 12.29% (compared to 9.85% in Model 3) and for the B variable, it is 16.98%, versus 13.93% in Model 3. In contrast to the previous model, the B- coefficient is significant, albeit at the 5% level, with average spreads implied to be 10.55% higher than for the remaining group of nations, ceteris paribus.

As for the previous models, the F-statistic indicates that the regression is significant for the 2010 – 2017 period at the 1% level overall, though the adjusted R-squared appears low at 0.293265.

4.3.3. Hausman tests for fixed versus random effects models

In order to determine which of the above models are most reliable, the Hausman test was applied to both the 2006 – 2017 and 2010 – 2017 time periods. According to Gujarati and Porter (2009) the null hypothesis of the Hausman test is that the fixed effects estimators and random effects estimators do not differ substantially. The alternative hypothesis is that that there is a substantial difference between the estimators. Gujarati and Porter (2009) note that if the null hypothesis is rejected, the fixed effects model is preferred due to possible correlation between the random effects and the regressors. The results of the Hausman tests for both time periods are reported below.

Table 5: Hausman Test, 2006 2017.

Test Summary	Chi-Squared Statistic	Chi-Squared d.f.		Prob.
Cross-Section Random	44.536607	13		0.0000
Cross-Section Random Effects Test Comparisons				
Variable	Fixed	Random	Var (Diff.)	Prob.
GDPGR	-0.046362	-0.046763	0.000000	0.0050
PUBDBTGDP	0.009539	0.008586	0.000000	0.0013
EXDBTGDP	0.003641	0.003538	0.000000	0.2764
VIX	0.023130	0.022958	0.000000	0.0025
BBB+	-0.136756	-0.149301	0.000018	0.0031
BBB	0.002208	0.001202	0.000015	0.7931
BBB-	-0.004972	-0.002426	0.000016	0.5195
BB+	-0.089260	-0.089712	0.000013	0.9017
BB	0.055704	0.062675	0.000017	0.0896
BB-	0.127497	0.139252	0.000021	0.0111
B+	0.235533	0.242864	0.000019	0.0905
B	0.242071	0.253623	0.000011	0.0005
B-	0.306951	0.325462	0.000012	0.0000

Source: Author's own estimations using Eviews 10.

Given that the chi-squared statistic is significant at the 1% level, the null hypothesis is rejected. Following Gujarati and Porter (2009) this implies that the fixed effects model is preferred for the above time period.

Table 6: Hausman Test, 2010 - 2017.

Test Summary	Chi-Squared Statistic	Chi-Squared d.f.		Prob.
Cross-Section Random	121.934997	13		0.0000
Cross-Section Random Effects Test Comparisons				
Variable	Fixed	Random	Var (Diff.)	Prob.
GDPGR	-0.034450	-0.038102	0.000000	0.0000
PUBDBTGDP	0.006065	0.005918	0.000000	0.8277
EXDBTGDP	0.013172	0.010551	0.000000	0.0000
VIX	0.021665	0.021495	0.000000	0.2875
BBB+	-0.091607	-0.111407	0.000025	0.0001
BBB	-0.104898	-0.101364	0.000035	0.5513
BBB-	-0.133707	-0.138850	0.000035	0.3853
BB+	-0.163754	-0.175401	0.000033	0.0430
BB	-0.118163	-0.120937	0.000037	0.6477
BB-	0.046159	0.065455	0.000031	0.0005
B+	0.093918	0.115884	0.000061	0.0048
B	0.130371	0.156836	0.000020	0.0000
B-	0.065602	0.100302	0.000024	0.0000

Source: Author's own estimations using Eviews 10.

As for the 2006 – 2017 period above, the chi-squared statistic is highly significant, implying a rejection of the null hypothesis. Once again, the fixed effects model is also preferred for 2010 – 2017.

4.4. Conclusion

Overall, the findings from the above regression analysis conform to *a priori* expectations. Lower credit ratings appear to imply higher spreads, with the majority of coefficients across all models significant at conventional levels, similar to the results of Jaramillo and Tejada (2011) and Cantor and Packer (1996). Varying the time periods under consideration did not materially alter the general findings of the analysis, although changes in the size of individual coefficient impacts was observed. Interestingly, it appears that the point at which spreads begin to rise lies below the investment-grade/speculative-grade threshold, once differences in the included macroeconomic factors have been controlled for. In addition, given the differences in the magnitude of the impact from each ratings dummy variable coefficient, the influence of holding individual ratings on spreads differs at different points of the ratings scale. This is observed in Model 3 and Model 4, where the (negative) coefficient of the BB+ ratings variable is larger than the (also negative) coefficient of the higher ratings that precede it. In other words, the ratings themselves have a smaller impact on spreads at say BBB+ than at BB+. This may indicate investors' greater reliance on macroeconomic factors and global risk appetite as ratings worsen and sovereigns cross the investment-grade threshold. Given that Model 3 and Model 4 cover the period following the global financial crisis, this result is consistent with the notion that investors are basing their investment decisions on wider information than previously, particularly as ratings worsen.

Hence, the above regression results suggest that for the sample and time period under consideration, crossing the threshold does not necessarily imply an increase in spreads. This phenomenon might be the result of investors relying on other information over and above sovereign ratings in order to assess the feasibility of a given investment, a possibility which was also raised in certain sections of the literature (González-Rozada and Levy-Yeyati, 2010, Sy, 2001). In effect, investors appear willing to tolerate the speculative-grade status of certain investments,

provided that they remain confident of receiving the anticipated return on their investments.[30] However, below the BB rating, investors demand higher yields.

[30] This excludes those investors that are constrained by a mandate that compels them to invest exclusively in investment-grade debt.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

The overarching aim of this thesis was to study the influence of sovereign credit ratings changes on the cost of sovereign debt, in particular in emerging markets. Furthermore, given that sovereign credit ratings scales are split into investment-grade and speculative-grade ranges, the thesis sought also to determine whether the perceived distinction between these two asset classes is reflected in reality by differences in yield spreads. In other words, does the cost of sovereign debt increase substantially once the investment-grade threshold is crossed?

As mentioned earlier, the initial concept of an indicator of creditworthiness came into existence in the early period of the 20th century. The eventual development of this concept to include the debt of sovereign borrowers now appears to be a natural and necessary extension of that initial concept. In practice, however, it was not until the final quarter of the 20th century that sovereign credit ratings in their current form were first established and implemented. In addition, it was only during the period spanning the end of the 20th and beginning of the 21st centuries that sovereign credit ratings began to cover a substantial quantity of emerging markets, which were the focus of this research. The accepted existence of sovereign credit ratings, and the role they play in modern capital markets is largely a consequence of their rapid spread, particularly across the developing world. In short, while sovereign ratings are now considered a well-established part of a globalised financial environment, they represent a comparatively modern idea that proceeded to spread quickly across the world once the motivation for their existence became clear. It was this comparatively modern nature of sovereign credit ratings that motivated this thesis, due to the need for a greater understanding of the intended role that sovereign credit ratings should play in financial markets, as well as a greater understanding of their efficacy in performing that role.

5.1. Literature review and method

In order to study the determinants of sovereign credit ratings and the role that ratings play in financial markets, a literature review was conducted in Chapter 2. The empirical discussion

surrounding sovereign credit ratings is vast, with a variety of sources debating both the determinants of sovereign ratings and the impact of changes in ratings.

Chapter 2 began by discussing the history of sovereign credit ratings, coupled with the economic theory surrounding them, concluding that the fundamental functioned performed by sovereign ratings is a necessary part of the relationship between borrowers and lenders in globalised financial markets. The factors taken into account by both S&P and Moody's when assigning ratings were examined. These include a variety of measures, each of which carry different weight in arriving at the final decision. While the array of factors that the major ratings agencies consider is impressive, interpretation of some of the factors and their importance is subjective by nature, relying on past observations in order to make future predictions, possibly creating room for miscalculation on the part of the ratings agencies. Cantor and Packer (1996) confirm this view, noting that while the factors taken into account by both S&P and Moody's are largely similar, the emphasis placed on certain factors is different, which points to a level of subjective interpretation when it comes to assigning weight to specific factors. In short, while the ratings agencies appear largely to share a framework for assigning ratings, there is not, at this time, a universal approach to assigning ratings that can be used to predict ratings consistently.

Pennartz and Snoeij (2012) study the accuracy, stability and timeliness of ratings, concluding that even at the time of default, none of the major ratings agencies are able to predict the default with 100% accuracy. As expected, as the time horizon to the date of default lengthens, they (Pennartz and Snoeij, 2012) find a corresponding decrease in the accuracy of ratings. The results for the stability and timeliness of ratings differ across agencies, suggesting that the approaches of each have their merits, but that a given approach is not necessarily inherently superior to that of another agency.

Cantor and Packer (1996), studying the macroeconomic determinants that are needed to secure a favourable rating, conclude that GDP growth per capita, low inflation and low external debt are the most critical factors. Focussing on borrowing costs (i.e. sovereign bond spreads) rather than simply predicted ratings, Jaramillo and Tejada (2011) broadly agree with the importance of the

macroeconomic factors identified by Cantor and Packer (1996), but stress the importance of overall, rather than per capita, GDP growth, as well as a favourable reserves to GDP ratio. They (Jaramillo and Tejada, 2011) find also that external debt as a proportion of GDP has the largest impact on the cost of borrowing for sovereigns.

González-Rozada and Levy-Yeyati (2010) call the claimed forward-looking properties of sovereign credit ratings into doubt by concluding that sovereign ratings are largely explained by changes in spreads, rather than the other way around. Mora (2006) corroborates this view, finding ratings to be sticky rather than pro-cyclical. Reisen and von Maltzan (1998) find that the relationship between sovereign ratings and bond spreads is one of interdependence, due to the risk-factors considered by ratings agencies being based largely on publicly available information. They (Reisen and von Maltzan, 1998) note the fundamental importance of sovereign credit ratings, but call into question whether it is really possible for the ratings agencies to gain an extra level of "informational privilege" that exceeds that already enjoyed by financial markets. As financial markets become more globalised, this becomes a more valid point. Elliason (2002) contributes to this view, noting that if credit ratings agencies are really focused on providing ratings that are long-term and forward-looking in nature, there would be relatively few ratings adjustments. This is because credit ratings agencies would, in such a scenario, largely ignore short-term business cycle fluctuations, choosing instead to focus on nations' long-term trajectories. This observation plays into the criterion of "stability" identified by Pennartz and Snoeij (2012), which emphasises the need for ratings agencies to avoid large adjustments in credit ratings. While Pennartz and Snoeij (2012) do find some differences in the stability of ratings from the three leading agencies, they concluded that the three agencies all perform at an acceptable level in this regard. Given this conclusion, questions surrounding the approach of the ratings agencies when it comes to the long term view appear merited. This may point to the necessity of a change to the fundamental approach employed by the ratings agencies. Alternatively, these questions may simply reflect the realities of a more globalised financial world, in which ratings agencies do not enjoy any substantial informational advantage compared to the rest of the markets, in which case long-term predictions may prove to be unreliable by nature.

Chapter 3 outlined the process followed in conducting the thesis research, which included determining appropriate methods to answer the research questions, as well as selecting an appropriate sample of sovereigns that met the criteria related to the research questions. The chapter described how the required data surrounding the sovereigns were identified, collected and manipulated in order to be useful for the selected research methods. During this process, it was noted that despite the large number of available developing economies that exist, constructing the necessary sample was not without challenges. Not all developing economies have a sufficiently long, or sufficiently varied, history of sovereign credit ratings that allows for their inclusion in the final sample. In addition, amongst the preliminary group that did have suitable sovereign credit rating histories, there were some for which the required macroeconomic data were not readily available. As a result, the final selection of a panel of sovereigns, and the construction of the dataset needed to conduct the research, did not allow for arbitrary selection of nations. Given that sovereign credit ratings only gained a notable foothold in developing economies at the start of the current century, the passage of time may allow for a larger proportion of these emerging economies to be included in similar research in the future.

5.2. Findings

Chapter 4 focussed on analysing the relationship between average spreads and ratings in a more detailed fashion. This was achieved by, firstly, analysing the behaviour of average spreads relative to ratings over the 2006 – 2017 period, and the four three-year subperiods into which this time period was divided. Following that, regression analysis was implemented, with fixed and random effects models used to isolate the effects of ratings changes on spreads while controlling for certain macroeconomic factors.

The statistical analysis found that the observed metrics surrounding spreads (mean spread, spread range, spread range excluding outliers and median spread) were lower in the 2006 – 2008 period compared to the overall time period. In general, spreads during this period were low and within a tight range (once outliers were removed). The fact that the mean for this time period

was higher than the median points to some skewness in the data, with the spread values after the median (generally representing sovereigns with poor ratings) increasing quickly compared to those before the median. In other words, there is evidence of non-linear growth in spreads across the sample for the observations that fall in the second 50 percent. Overall, the statistical findings from the 2006 – 2008 time period suggested a low risk premium for riskier sovereign bonds, an observation corroborated by the relatively low spreads enjoyed even by nations that were well below the investment-grade threshold.

In the 2009 – 2011 period immediately following the global financial crisis, mean spreads rose to the highest observed value in the sample, with the range also growing substantially, signifying a much higher risk premium than in the previous period. The median spread increased, but not as quickly as the mean spread. This implies that the dataset was markedly more skewed than in the 2006 – 2008 period, although this is likely largely due to the presence of outliers at the tail-end of the ratings scale, which saw their spread values rise rapidly. Overall, the immediate post-crisis period saw the greatest period-on-period adjustments for both mean spread and spread range (with and without outliers), which is unsurprising.

The following period, 2012 – 2014, saw a general reduction in spreads as the post-crisis recovery became more noticeable. Mean spreads fell, although they remained higher than in the pre-crisis period. The range, however, even with outliers excluded, remained stubbornly high. Interestingly, the median fell to the lowest observed value of all the periods under consideration. During the 2012 – 2014 period, the gap between mean and median spreads was at its largest, with the mean higher than the median. This implies that spreads in the first 50 percent of observations (i.e. before the median) fell by a substantially larger amount than in the second 50 percent of observations. In effect, the first 50 percent of observations (largely investment-grade nations) saw their spreads return to similar levels as before the crisis, but those in the second 50 percent did not benefit to the same extent. Hence, while the risk premium for nations above and around the investment-grade threshold mostly returned to pre-crisis levels, this did not occur for the group of nations deeper into the speculative-grade range.

The final period under consideration, 2015 – 2017, saw mean spreads fall slightly across the sample, but remain noticeably above original, pre-crisis level. The range, even without outliers, was only reduced slightly. Median spreads rose compared to the previous period, closing the gap to the mean value to the closest margin since the 2006 – 2008 period. This coincided with some nations in the second half of the ratings range benefiting from reduced spreads. On the whole, however, none of the observed metrics recovered fully to pre-crisis levels, with the range metric (excluding outliers) proving particularly stubborn.

Following the statistical analysis, regression analysis was used to isolate the effects of sovereign ratings changes on sovereign bond spreads, controlling for key macroeconomic variables identified from the literature. Given the differences identified by the statistical analysis in the relationship between sovereign spreads and sovereign ratings before and after the financial crisis, the regressions were run over two periods. The first, covering 2006 – 2017, included the pre-crisis period, while the second, covering 2010 – 2017, did not. For each of these time periods, both fixed effects and random effects models were utilised, leading to a total of four regressions being run.

For the 2006 – 2017 period, the fixed effects and random effects models gave generally similar results, returning coefficients with similar levels of significance. In addition, for both models, the coefficients of all macroeconomic variables were significant and conformed to *a priori* expectations.

The regressions run for the 2010 – 2017 period retained significant coefficients for the macroeconomic variables, although the magnitude of the coefficients differed from the 2006 – 2017 period. However, in the second time period, for both regressions, the coefficients of the BBB and BBB- dummies became significant and implied lower spreads than for the remaining group. The same effect was observed for the coefficient of the BB dummy variable. Interestingly, in the 2010 – 2017 period, the coefficient of the BB- dummy variable was only significant in the random effects model (Model 4), and the impact of the coefficient was

noticeably smaller than in the 2006 – 2017 time period. The Hausman test, however, suggested that the fixed effects models were to be preferred in this context.

Overall, the conclusion from the regression analysis as concerns *a priori* expectations was not entirely clear. The results showed that, across the sample, sovereigns that held investment-grade ratings generally enjoyed spreads that were lower than for the omitted group, on average. This was particularly noticeable in the two regressions that were run for the 2010 – 2017 period, which saw the coefficients of the BBB and BBB- dummy variables become significant. This result may be linked to a requirement for an assurance of quality from investors in the period following the financial crisis, whereas, by contrast, before the crisis, general euphoria may have dampened the need for such a requirement. It was interesting to note that the models did not suggest a sudden rise in average spreads when the investment-grade threshold was crossed. While the results suggest that holding an investment-grade rating benefits a sovereign in terms of its cost of debt, the point at which ratings cause average spreads to rise independent of macroeconomic factors relative to the remaining group only occurred several notches into the speculative-grade ratings class. While investment-grade status did coincide with lower sovereign borrowing costs, it does not appear to be the only factor considered by investors. The regression results are less clear-cut than those of Jaramillo and Tejada (2011), whose results emphasised the strong influence of holding an investment-grade rating on the cost of sovereign debt. However, the regression results are in contrast to those of González-Rozada and Levy-Yeyati (2010) and Mora (2006), who argued that credit ratings have no direct impact on spreads, and that spreads are instead determined by exogenous factors in the global economy.

Given the events of the global financial crisis, the finding that investors prioritised additional metrics in order to make their investment decisions is unsurprising. As a result, the cost of sovereign debt does not appear to swing between two binary options. While investment-grade status largely seems to confer lower sovereign spreads, a speculative-grade rating does not necessarily appear to imply that the cost of sovereign debt will rise dramatically. This points to further nuances in market decision-making as concerns the pricing of sovereign debt that extend beyond simply looking at sovereign credit ratings.

5.3. Policy recommendations and further research

The key objectives of this thesis involved an analysis of sovereign credit ratings and their impact on capital markets. However, given the interconnected and interdependent nature of financial markets and the role of sovereign credit ratings within them, it would be naïve to suggest that the analysis performed in this thesis is comprehensive. While the main goals in terms of the research questions have been met, it became clear during the research process that certain other questions surrounding sovereign credit ratings are of importance. While these questions fall outside the scope of this thesis, they could serve as valid areas of further investigation in the future.

The sample used to conduct the research in this thesis was constructed with data from developing economies. As mentioned earlier, while the number of developing economies in the world is large, the lack of certain data significantly reduces the potential sample size possible for conducting similar research. Given that sovereign credit ratings are a relatively modern idea, especially for developing economies, it may be that only the passage of time will allow for a wider, more representative sample of developing economies to be constructed. When this becomes possible, however, the subsequent research may shed new light on the importance of sovereign credit ratings in developing markets.

The relationship between sovereign credit ratings and market behaviour is another area of interest that came to light during the research process. The *a priori* expectation that ratings would change, followed by a reaction from the markets, seems reasonable. However, the literature appears to show varying views on whether this is the case, with some research arguing that in sharp contrast to expectations, sovereign ratings change in reaction to changes in borrowing costs. Therefore, the question of whether sovereign credit ratings lead or lag the market is another avenue for further exploration. In addition, the question of whether this lead-lag relationship remains constant or undergoes changes over time, possibly due to the global business cycle, is of interest.

A substantial part of the statistical analysis in the thesis discusses the behaviour of sovereign bond spreads before and after the global financial crisis. As expected, the results indicate that, across the sample, the time period surrounding the financial crisis was one of turmoil as far as sovereign bond spreads is concerned. The periods that followed the crisis involved a gradual return to lower spreads. However, even after the general recovery of the world economy nearly a decade after the worst of the crisis, borrowing costs remain higher across the sample than in the pre-crisis period. Perhaps the gradual decline in spreads will continue towards the end of the current decade, with an eventual return to pre-crisis levels. On the other hand, perhaps pre-crisis spread levels represented an unsustainable euphoric limit, implying that the current relationship between spreads and ratings are the new normal as far as developing economies are concerned. It will be worth investigating whether sovereign bond spreads return to pre-crisis levels in a sustainable way, or whether the global financial crisis has led to a fundamental shift in the assessment of risk in developing markets. If the latter, developing economies may need to adapt to the reality of a higher cost of debt, which may lead to questions about the sustainability of their current models of obtaining financing from the market.

This thesis included certain macroeconomic factors that were relevant in explaining changes in sovereign bond spreads. In the interest of simplicity, four of the more prominent macroeconomic factors identified in the literature were selected for inclusion. In the regression analysis, all the selected macroeconomic factors returned highly significant coefficients, making clear their role in influencing the cost of sovereign debt. However, it may be that there are other factors that would further aid in explaining sovereign spread behaviour. These factors may either differ from those used in the literature, or alternatively, factors that were initially deemed insignificant in earlier literature may become more relevant in the post-crisis market for government debt.

The frameworks used by credit ratings agencies to assign sovereign credit ratings are based on both objective and subjective measures. Understandably, the approach that the ratings agencies employ changes over time in order to incorporate new, relevant factors as they emerge. The impact of the objective factors and the emphasis placed on them is reasonably well understood. By contrast, there exists substantial scope for miscalculation on the part of ratings agencies when

it comes to the interpretation of subjective factors, such as those surrounding a nation's political and social climate, or challenges with the fairness and impartiality of its legal system. It may not be possible to quantify these subjective factors fully. Credit ratings agencies generally point out that assigned ratings are their opinions. Opinions are not infallible. However, given the turmoil caused by the financial crisis, and the role that credit ratings agencies in general played in that turmoil, they have a responsibility to continue to refine and improve their ratings methodologies in order to serve modern financial markets better. Further research on the foundations of sovereign ratings methodology and how ratings are assigned would be welcome.

Finally, while this thesis has focussed on developing economies, there may be differences in the spread versus rating relationships between these economies and those of the developed world. It would be worth investigating whether there exists a disconnect between the way in which credit ratings agencies assign ratings to developing economies compared to their developed counterparts, and whether this subsequently drives market perceptions of emerging economies. In other words, the question of a potentially inherent bias in ratings methodologies and how this filters through into market behaviour is worth examining.

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ANNEXURES

Annexure A: average ratings versus average spreads

A.1. Period 1 (2006 – 2008)

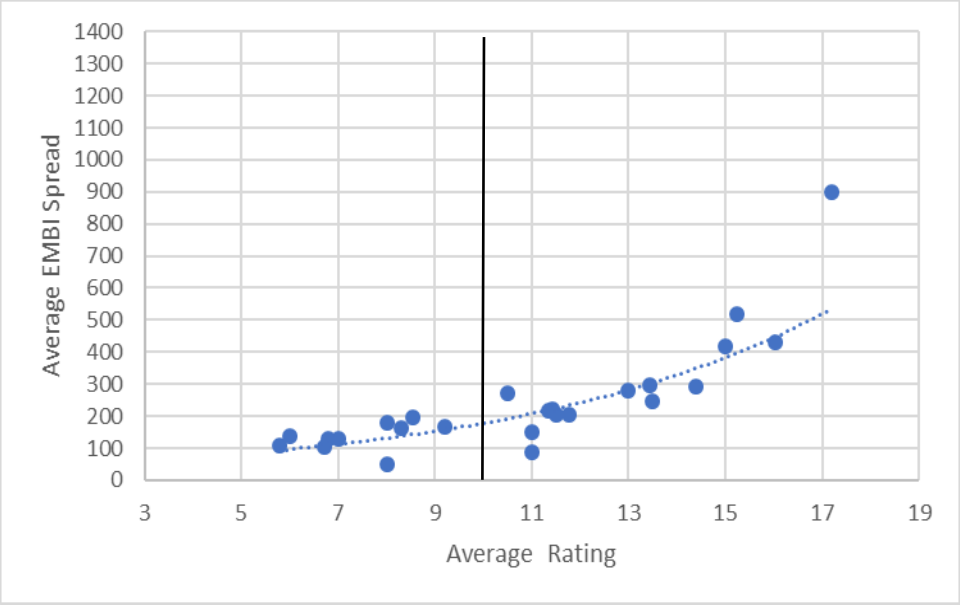

Figure A.1: EMBI Spreads vs Average Ratings, 2006 – 2008 (entire sample).
Source: Author's own calculations in Microsoft Excel.
Spread data obtained from J.P. Morgan (2018).
Ratings data obtained from Standard and Poor's (2018) and Moody's Investor Services (2018).

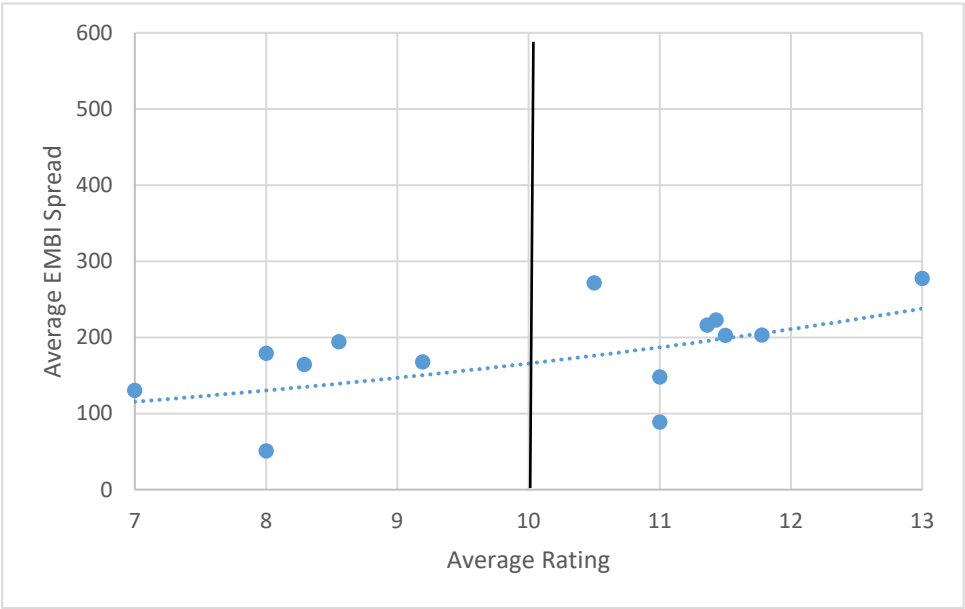

Figure A.2: EMBI Spreads vs Average Ratings, 2006 – 2008 (only countries rated A- to BB-).
Source: Author's own calculations in Microsoft Excel.
Spread data obtained from J.P. Morgan (2018).
Ratings data obtained from Standard and Poor's (2018) and Moody's Investor Services (2018).

A.2.Period 2 (2009 – 2011)

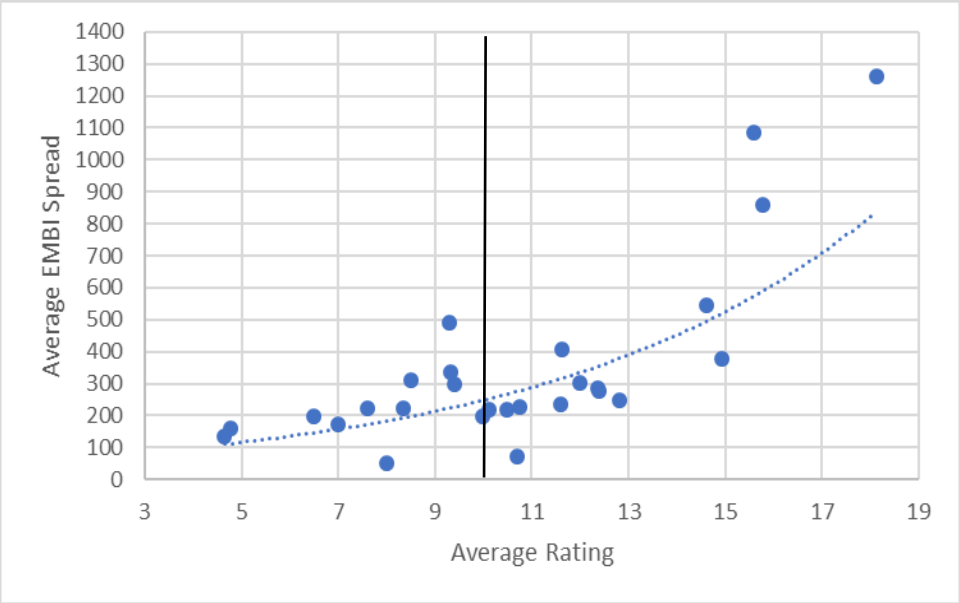

Figure A.3: EMBI Spreads vs Average Ratings, 2009 – 2011 (entire sample).
Source: Author's own calculations in Microsoft Excel.
Spread data obtained from J.P. Morgan (2018).
Ratings data obtained from Standard and Poor's (2018) and Moody's Investor Services (2018.

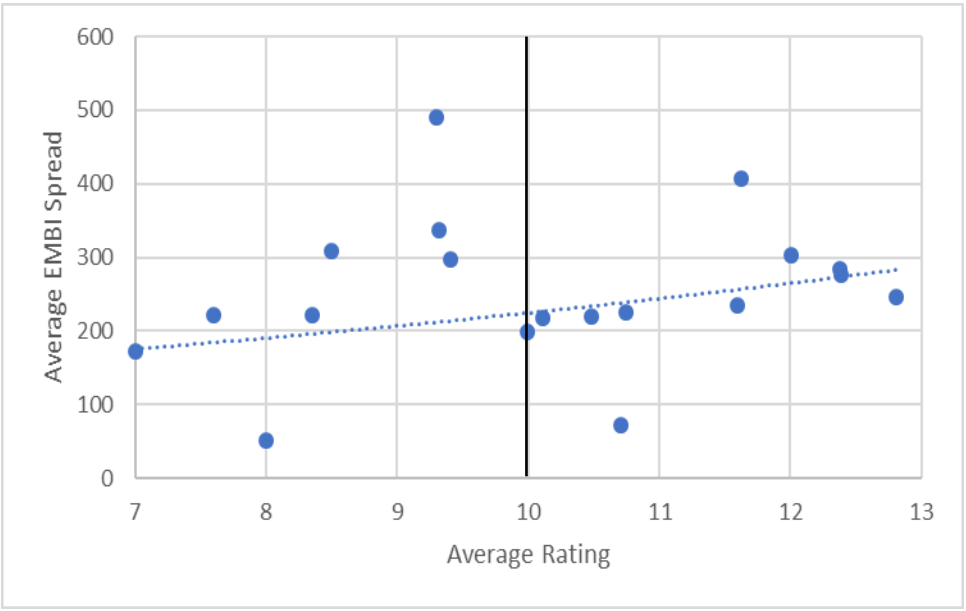

Figure A.4: EMBI Spreads vs Average Ratings, 2009 – 2011 (only countries rated A- to BB-).
Source: Author's own calculations in Microsoft Excel.
Spread data obtained from J.P. Morgan (2018).
Ratings data obtained from Standard and Poor's (2018) and Moody's Investor Services (2018).

A.3. Period 3 (2012 – 2014)

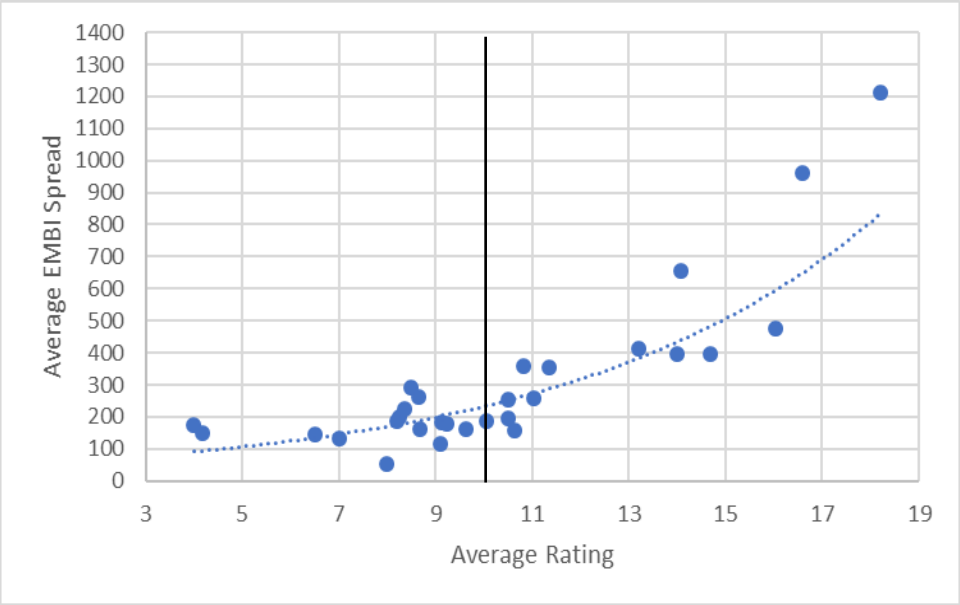

Figure A.5: EMBI Spreads vs Average Ratings, 2012 – 2014 (entire sample).
Source: Author's own calculations in Microsoft Excel.
Spread data obtained from J.P. Morgan (2018).
Ratings data obtained from Standard and Poor's (2018) and Moody's Investor Services (2018).

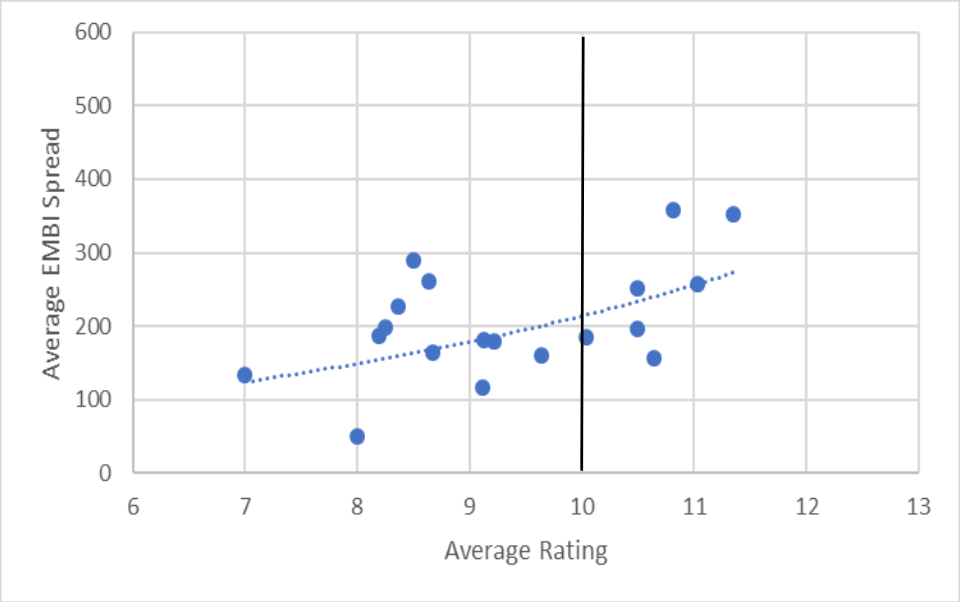

Figure A.6: EMBI Spreads vs Average Ratings, 2012 – 2014 (only countries rated A- to BB-).
Source: Author's own calculations in Microsoft Excel.
Spread data obtained from J.P. Morgan (2018).
Ratings data obtained from Standard and Poor's (2018) and Moody's Investor Services (2018).

A.4. Period 4 (2015 – 2017)

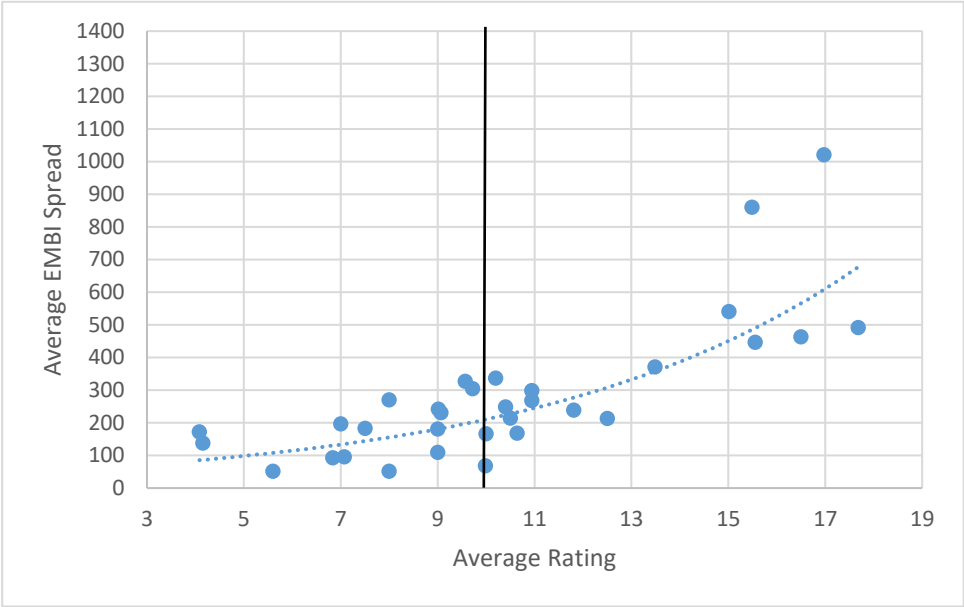

Figure A.7: EMBI Spreads vs Average Ratings, 2015 – 2017 (entire sample).
Source: Author's own calculations in Microsoft Excel.
Spread data obtained from J.P. Morgan (2018).
Ratings data obtained from Standard and Poor's (2018) and Moody's Investor Services (2018).

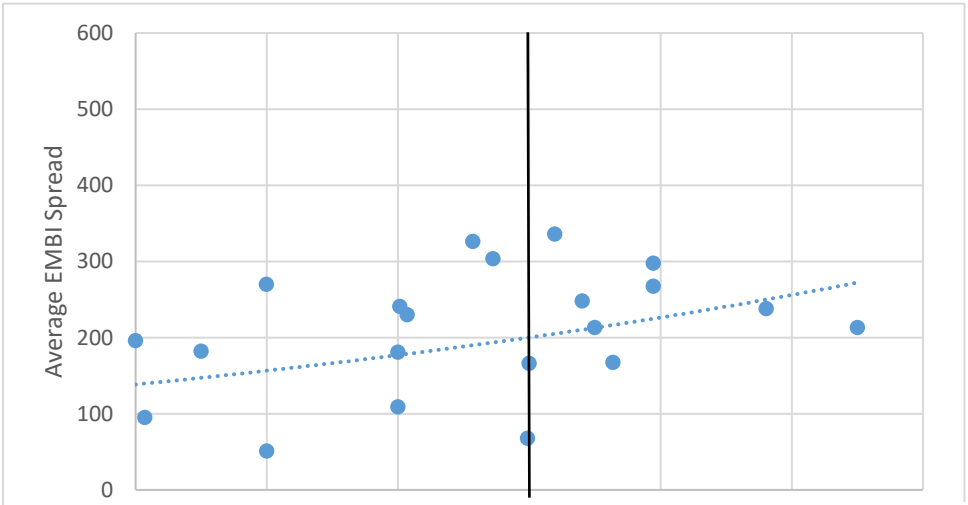

Figure A.8: EMBI Spreads vs Average Ratings, 2015 – 2017 (only countries rated A- to BB-).
Source: Author's own calculations in Microsoft Excel.
Spread data obtained from J.P. Morgan (2018).
Ratings data obtained from Standard and Poor's (2018) and Moody's Investor Services (2018).

Annexure B: cross section fixed and random effects

B.1. 2006 – 2017

Table B.1: Country Specific Coefficient Difference from Model Average (2006 – 2017).

Country	Cross-Section Fixed Effects (Var.)	Cross-Section Random Effects (Var.)
Argentina	0.872618	0.854838
Brazil	-0.075678	-0.066262
Bulgaria	-0.484224	-0.500105
Chile	-0.071019	-0.100205
China	0.153629	0.125505
Colombia	0.129188	0.123255
Dominican Republic	0.710648	0.681843
Ecuador	1.450723	1.413361
Egypt	-0.159857	-0.125642
El Salvador	0.350594	0.349789
Hungary	-0.619223	-0.580423
Indonesia	0.463999	0.440103
Lebanon	-0.672455	-0.578230
Malaysia	-0.372957	-0.364583
Mexico	0.127267	0.125654
Morocco	-0.686015	-0.660921
Panama	-0.235380	-0.224372
Peru	0.181701	0.162696
Philippines	-0.147970	-0.147148
Poland	-0.695203	-0.681024
Russia	0.545461	0.515660
South Africa	0.101555	0.101271
Thailand	-1.076486	-1.074519
Turkey	0.397297	0.381430
Uruguay	-0.189332	-0.171970

Source: Author's own estimations using Eviews 10.

B.2. 2010 – 2017

Table B.2: Country Specific Coefficient Difference from Model Average (2010 – 2017).

Country	Cross-Section Fixed Effects (Var.)	Cross-Section Random Effects (Var.)
Argentina	1.212887	1.129070
Brazil	0.324857	0.231317
Bulgaria	-1.017978	-0.928320
Chile	-0.323873	-0.309466
China	0.329425	0.246393
Colombia	0.171877	0.127237
Dominican Republic	0.725443	0.675752
Ecuador	1.527432	1.434850
Egypt	0.641637	0.545532
El Salvador	0.416503	0.422183
Hungary	-0.879421	-0.693010
Indonesia	0.553299	0.516469
Lebanon	-0.417335	-0.384413
Malaysia	-0.582391	-0.531402
Mexico	0.162373	0.129841
Morocco	-0.349066	-0.359555
Panama	-1.482805	-1.165442
Peru	0.155392	0.115727
Philippines	-0.014617	-0.060666
Poland	-0.962982	-0.899526
Russia	0.574027	0.527686
South Africa	0.147926	0.123682
Thailand	-1.117376	-1.131869
Turkey	0.545634	0.540172
Uruguay	-0.356476	-0.302242

Source: Author's own estimations using Eviews 10.