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Sovereign credit rating bias: a comparative analysis of developed and developing countries

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Sovereign Credit Rating Bias: A comparative analysis of developed and developing countries

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ABSTRACT

Through the use of an ordered response framework and panel data, this study examines sovereign credit rating bias in Fitch, Moody's, and S&P's ratings assignments. The data sample comprises 118 countries from 1996 to 2019. First, the full sample is estimated; the data sample is then divided according to development levels and estimated separately to determine variations between developed and developing countries. The results provide evidence that developed countries are rated higher despite the performance of economic fundamentals and developing countries are rated according to the theorised relationship between macroeconomic fundamentals and sovereign credit ratings. Moreover, this paper also finds that institutional quality is the source of the bias toward developed countries and against developing countries.

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1. INTRODUCTION

1.1 Background

As financial markets have become more expansive over the last couple of decades, there has been an increase in investment opportunities for debt investors and further access to capital for countries' private and public institutions. Consequently, resulting in the increased importance of sovereign credit ratings, they provide a measure of a sovereign's capacity to meet its debt obligations on time and in full. The Sovereign Credit Rating (SCR) industry is a two-sided market. Investors seek debt securities ratings to inform their portfolio management decisions (Gültekin-Karakaş, Hisarciklilar & Özturk, 2011). Governments seek ratings on their debt stock to decrease their entry barrier to international capital markets (Larraín, Reisen & von Maltzan, 1997).

Critical to this market's success is the intermediary role played by Credit Rating Agencies (CRAs). These agencies condense an exhaustive list of fundamentals that measure economic strength, fiscal strength, event risk, and institutional strength into a single probability risk measure of a sovereign not meeting its debt obligation. Thus, assignments by CRAs are integral to the growth of and access to international capital markets. Firstly, the rationale for this importance is that credit ratings influence a country's borrowing costs because they are critical factors used to determine the interest rate that a country faces in international financial markets. Secondly, CRAs rarely rate domestic corporations and institutions (banks and municipalities) higher than the sovereign rate; thus, sovereign ratings directly impact the ratings assigned to domestic banks or companies, subsequently constraining or facilitating their international markets' growth (Afonso, 2010). Lastly, the mandate of some institutional investors only allows them to invest in investment-grade bonds. Consequently, in their portfolio construction, they consider the credit risk denoted by the rating notation (Afonso, 2010).

Due to the importance of SCRs, CRAs are subject to a significant amount of scrutiny and criticism. Moreover, the lack of competition in the rating's market further exacerbates the level of scrutiny. The ratings market is highly concentrated, with the big three CRAs – Moody's, S&P and Fitch – accounting for roughly 95% of the market (Vernazza, Nielsen & Gkionakis, 2014). Subsequently, there exists many theorised and reported issues relating to CRAs, some of which are a lack of transparency, conflict of interest and reliability (Gültekin-Karakaş *et al*., 2011). The issues relating to conflict of interest and reliability have received

much attention over the years. The belief is that these issues are the underlying cause of bias toward developed countries and bias against developing countries. Firstly, conflict of interest relates to the issuer-pays business model used by the big three CRAs, where the issuer pays the rating agency to have their securities rated (Tennant & Tracey, 2016). The problem with this business model is that it can put rating agencies in the compromising position of issuing higher credit ratings that are not supported by the key fundamentals they use to determine ratings. Secondly, reliability, rating agencies fail to predict the severity a financial crisis might have, and during a financial crisis, they make matters worse by drastically downgrading the most affected sovereigns (Kiff, Holland, Kisser, Nowak, Saab, Schumacher, van der Hoorn & Westin, 2010). These drastic downgrades to the affected sovereigns subsequently lead to capital outflows and increased borrowing costs in international markets (Tennant & Tracey, 2016).

There are two strands of literature that attempt to demystify and provide statistical/econometric evidence relating to these issues. The first area investigates the determinants of sovereign credit ratings (e.g. Cantor & Packer., 1996; Afonso, 2003; Jaramillo, 2010; Erdem & Varli, 2014; Afonso, Gomes & Rother 2010; Bissoondoyal-Bheenick, 2005; Canuto, dos Santos & de Sá Porto, 2012). Cantor & Packer (1996) first determined the common theme in these studies – in that, even though CRAs claim to use an exhaustive list of fundamental factors to determine SCRs, changes in only a handful of these factors are statistically significant in explaining credit rating assignments. The second area investigates the effect of sovereign credit rating changes on international financial markets (e.g. Larraín *et al*., 1997; Schmukler, 1999; Afonso, Gomes & Taamouti, 2014; Jaramillo & Tejada, 2011; Ismailescu & Kazemi, 2010). For the most part, these papers provide econometric evidence on the causality pattern between market reactions and SCR downgrades/upgrades.

The purpose of this study is to investigate the existence of bias in credit rating assignments of the big three CRAs from 1996 to 2019 and answer the question of whether rating assignments are biased toward developed countries and biased against developing countries. This study primarily seeks to contribute to an emerging branch of literature within the aforementioned first strand of credit rating assignment studies. Furthermore, this paper will complement previous papers – in that, Cantor & Packer (1996) were the first to postulate that a small number of variables determine rating assignments. Using an exhaustive list of determinants

Gültekin-Karakaş *et al*. (2011) were the first to provide evidence of bias in rating assignments.

Subsequently, the unique contribution of this paper is twofold. Firstly, this study will synthesise and create a link between the seminal works by Cantor & Packer (1996) and Gültekin-Karakaş *et al*. (2011). Guided by Cantor & Packer (1996) and by other literature, this paper will use a small number of predetermined and theorised variables that are statistically significant in explaining rating assignments and combining them with the ordered response model that Gültekin-Karakaş *et al*. (2011) used to evaluate the existence of bias.

Secondly, this study will also expand on previous work and investigate bias across the big three CRAs. Gültekin-Karakaş *et al*. (2011) and Öztürk (2014) examine the existence of bias using only the ratings from Moody's. Investigating bias across all three agencies is essential for two reasons, the first being that CRAs claim to use different methodologies in determining SCRs, thus, evaluating all three agencies allows us to provide evidence of determinants that differ across agencies. The second reason is that the SCRs market is highly concentrated by the big three, with roughly 95% market share (Vernazza *et al.,* 2014). Subsequently, evaluating the big three will allow for a clear depiction of how the entire industry is biased against poorer nations and create a more transparent cross-country comparison.

1.2 Hypotheses

CRA's foundation is their reputational capital to provide accurate rating assignments; the existence of bias would diminish this capital and force them out of business (Tennant and Tracey, 2016). However, the emerging body of literature suggests bias in credit rating agency assignments, and the rationale behind this is that macroeconomic indicators of developed countries are deteriorating. However, downgrades in these countries are not as severe or frequent as in developing countries.

Subsequently, the testable hypotheses are:
Controlling for macroeconomic, financial and institutional determinants of sovereign credit ratings, credit rating agencies are:

- biased towards developed countries in their assignments
- biased against developing countries in their assignments

The testable null hypothesis is that rating assignments are not subject to any bias.

1.3 Paper Structure

The rest of this study is as follows: the next section is a literature review that evaluates critical studies in understanding the determinants of sovereign credit ratings; studies that evaluate the effect of ratings assignments on bond spreads and studies that cover credit assignments bias. Following that is the data section that provides an overview of the data used in the study. The methodology section details the chosen ordered response model. Subsequently, following the methodology will be the estimation and interpretation of the results and the last section will conclude.

2. LITERATURE REVIEW

2.1 Determinants of Sovereign Credit Ratings

Part of the criticisms that CRAs receive is a lack of transparency in their rating process. To clarify and respond to this criticism, the "big three" CRAs have published an extensive list of macroeconomic, financial and qualitative variables that they use in determining a sovereign's credit rating. However, this increase in transparency has not translated to the clarification of the ratings process. The rationale being, even though the CRAs have provided additional information on the variables they use, they have not provided any information on the weighting of those variables in their final assessment (Jaramillo, 2010). The existing empirical literature on the determinants of SCRs assignments has provided econometric evidence that only a handful of these variables statistically explain SCRs.

Cantor & Packer (1996) wrote the seminal paper on the determinants of SCRs using OLS regressions to determine the variables that significantly influence Moody's and S&P sovereign credit ratings of 49 countries. They concluded that a small number of variables could explain most rating assignments: GDP per capita, GDP growth, inflation, external debt ratios, economic development and default history. In addition to this, Cantor & Packer (1996) also investigated two more interest areas relating to SCRs. Firstly, the cross-sectional relationship between ratings and yields; by regressing the log of a country's bond spreads against their average rating and found that SCRs have significant power in explaining yields. More specifically, "sovereign yields tend to rise as ratings decline" (Cantor & Packer, 1996, p.43). Secondly, using an event study, they investigated the impact of rating announcements on dollar spreads. They concluded that rating's announcements have more impact on dollar spreads for below-investment-grade than for investment-grade sovereigns, particularly for Moody's.

To further establish the determinants of SCRs, Afonso (2003) used the same technique and expanded Cantor & Packer's (1996) work by including 81 developing and developed countries in their analysis of Moody's and S&P's ratings. He found that six factors were significant in explaining ratings assignments. Namely; GDP per Capita, external debt-to-exports ratio, level of economic development, default history, GDP growth rate and the inflation rate. In addition to this, Afonso (2003) also concluded that GDP per capita is the most crucial variable in explaining ratings in developed and developing countries. The

external debt ratio, however, was only critical in explaining developing countries assignments.

Similar to Afonso (2003), Rowland (2004) applied the same econometric method used by Cantor & Packer (1996) to identify the critical determinants of SCRs. Compared to the previous studies, Rowland focused his study purely on developing countries with a B- and higher rating. Consequently, the study investigated 49 developing countries' creditworthiness and concluded that GDP per capita, GDP growth, inflation, debt ratios (e.g. Debt/GDP, Debt/Exports), debt service ratios, international reserves and openness of the economy are critical determinants of SCRs. Based on these results and a direct comparison with the results of Cantor & Packer (1996), Rowland (2004) further postulated that since GDP per capita and debt ratios are significant in both studies, CRAs use the same framework to rate developed and developing countries. However, this view is flawed since Afonso (2003) used the same framework but included both developing and developed countries in his analysis. In his study, Afonso concluded that different macroeconomic factors influence rating assignments for developed and developing countries.

CRAs and other studies criticised these methods for being overly simplistic and inappropriate. The argument centres around the linear transformation of SCRs and cross-sectional OLS models as an inadequate measure of determinants. Linear transformations of qualitative rating assignments assume that a movement from the investment-grade category to the speculative/junk status category is the same as movements within the two categories. Moreover, SCRs are ordinal measures of creditworthiness, linear transformations and traditional cross-sectional OLS models are not sufficient measures of the determinants of SCRs even though these models have strong predictive power (Afonso, 2010). An alternative strand of literature in assessing the determinants of SCRs uses panel data and an ordered response framework to overcome these criticisms.

Bissoondoyal-Bheenick's (2005) paper, in an attempt to better understand SCRs determinants and overcome some of the criticisms of earlier studies, presented an extensive study that spanned over 95 developed and developing countries from December 1995-1999. Moreover, the paper used an ordered response model, complementing the argument that it is a more appropriate measure of SCRs determinants than an ordinary least square model. In his analysis, Bissoondoyal-Bheenick (2005) assess the determinants of high rated countries and low rated countries separately and concludes that GNP per capita and inflation are the most

relevant economic variables in determining SCRs. Moreover, he also finds that different variables affect rating assignments across the different categories; he states that external debt and balance of payments are only relevant for developing countries.

Afonso, Gomes & Rother (2007) assessed the determinants of SCRs using both methods present in the strands of literature from 1995-2005 for the three main CRAs. They used the linear regression methods from previous studies on the linear transformation of the ratings, and they also estimated the same rating's specification under an ordered response framework. For the linear model, the random effects approach was used to account for country-specific error. Furthermore, they also used a limited dependent variable framework using an ordered probit, and random effects ordered probit model. Afonso *et al*. (2007) main findings were that using the panel random effects framework; GDP per capita, GDP real growth, government debt, government effectiveness, external debt and external reserves and sovereign default indicators were the core variables in determining SCRs. Interestingly, the ordered probit models confirmed the results derived from the linear panel regression. Moreover, their results also confirmed previous studies' findings that in lower-rated countries, external debt and external reserves are more relevant in determining their SCRs.

In a later study, Afonso, Gomes & Rother (2010) used the same models, dataset and period as in their previous paper to determine the short-run and long-run determinants of SCRs. Their results showed that GDP per capita, real GDP growth, government debt and government deficit have a short-run impact on a country's SCR. Since government effectiveness, external debt, foreign reserves and sovereign default dummies proxy for cross-country dimensions of SCRs, they consequently have a long-run impact on a country's rating.

Jaramillo (2010) extended on the previous literature of SCRs' determinants by investigating 48 emerging market countries' ratings assignment from 1993-2008. In contrast to previous papers, Jaramillo (2010) did not transform ratings into a linear scale; instead, she uses a binary dependent variable equal to 1 for investment-grade status based on SCRs data from Moody's, S&P and Fitch. Using a random effects binomial model, Jaramillo (2010) concluded that five core variables determine investment-grade status for emerging markets: external public debt a share of GDP, domestic public debt a share of GDP, exports a share of GDP, broad money a share of GDP and political risk. The findings in this paper are in line with previous papers that investigated emerging countries, for example, Afonso (2003) whose

results indicated that for developing countries the level of debt is significant in determining SCRs assignments.

Canuto *et al*. (2012) analysed the determinants of sovereign risk of the main CRAs using three models and a data sample from 1998 to 2002. Firstly, they pooled together all cross-sectional yearly data, subsequently resulting in the first model being a pooled cross section model. The second model is a fixed effects model. The transformation of all the variables in the equation entails subtracting their values for each panel year from their means and then estimated. The third model is a first difference model, where the transformation of all the independent variables involves calculating the difference in one year from the previous year. Post estimation, Canuto *et al*. (2012) indicated that their fixed effects and first difference models are not adequate in explaining rating assignments. The pooled cross section model is a better fit. Their results showed that the determinants for a low sovereign risk rating are: high per capita income; low inflation; high economic growth; low total external debt/current account receipts ratio; low central government gross debt/total fiscal receipts ratio; an absence of defaults and high levels of commercial openness. Furthermore, based on these results, the authors made a policy recommendation for developing countries. If they want to have a higher sovereign risk rating, their policies' underlying mechanisms should be centred around improving this group of identified indicators.

Erdem & Varli (2014) tried to identify the macroeconomic factors and indicators that influence emerging markets' SCR assignments. They used quarterly panel data from 2002-2011 for eight emerging markets rated by S&P, namely, Brazil, China, India, Indonesia, Mexico, Russia, South Africa and Turkey. Like Afonso *et al*. (2007), Erdem & Varli (2014) used the linear regression methods on the ratings' linear transformation. They also estimated the same rating's specification under an ordered response framework. The linear model's estimation results indicated that budget balance/GDP, GDP per capita, governance indicators, and reserves/GDP are significant determinants of SCRs. Like previous studies that evaluated both estimation models, the ordered response framework confirmed the linear model results with the addition of the external debt/export variable as significant in explaining SCRs assignment for the eight countries.

Table 1: Summary of significant determinants

Authors, CRA & estimation method	Significant Determinants
Cantor & Packer (1996) Moody's and S&P OLS	(+)GDP per capita, (+)GDP growth, (-)inflation, (-)external debt ratios,(+)economic development and (-)default history
Afonso (2003) Moody's and S&P OLS	(+)GDP per capita, (-)external debt-to-exports ratio, (+)level of economic development, (-)default history, (+)GDP growth rate, (-)the inflation rate and (-)external debt ratio
Rowland (2004) Moody's and S&P OLS	(+)GDP per capita, (+)GDP growth, (-)inflation, (-)debt ratios (e.g. Debt/GDP, Debt/Exports), (-)debt service ratios, (+)international reserves and (+)openness of the economy
Bissoondoyal-Bheenick's (2005) Moody's and S&P Ordered response	(-)GNP per capita, (+)inflation, (+)external debt and (+)current account and (-) financial balance
Afonso, Gomes & Rother (2007) Moody's S&P and Fitch Linear regression & Ordered Probit	(+)GDP per capita, (+)GDP real growth, (-)government debt, (+)government effectiveness, (-)external debt and (+)external reserves and (-)sovereign default indicators
Afonso, Gomes & Rother (2010) Moody's S&P and Fitch Linear regression & Ordered Probit	Short-run determinants: (+)GDP per capita, (+)real GDP growth, (-)government debt and (-)government deficit. Long-run determinants: (+)government effectiveness, (-)external debt, (+)foreign reserves and (-)sovereign default
Jaramillo (2010) Moody's S&P and Fitch Random Effects Binomial Logit Model	(-)external public debt a share of GDP,(-)domestic public debt a share of GDP,(+)exports a share of GDP, (+)broad money a share of GDP and (-)political risk.
Canuto *et al*. (2012) Moody's S&P and Fitch Pooled Cross Section Fixed Effects First Difference	(+)High per capita income; (-)low inflation; (+)high economic growth; (-)low total external debt/current account receipts ratio; (-)low central government gross debt/total fiscal receipts ratio; (-)an absence of defaults and (+)high commercial openness levels.
Erdem & Varli (2014) S&P OLS Ordered Probit	(+)balance/GDP, (+)GDP per capita, (+)governance indicators, (+)reserves/GDP and (-)external debt/export

Source: Reviewed studies by the author

The reviewed studies may use different methods of estimation and incorporate different variables. However, they all draw the same conclusion postulated by Cantor & Packer (1996) – that only a handful of macroeconomic and indicators explain SCRs assignments as evidenced in the literature review summary table 1.

2.2 The Effect of Credit Rating Changes

The second strand of literature relating to SCR assignments investigates the effect of ratings announcements' on CDS spreads and the broader financial market. The study by Larraín *et al*. (1997) is one of the earlier papers that attempts to provide econometric evidence of the impact of rating announcements on financial markets. Their analysis methods are, first, a Granger causality test on a panel data set from 1988-1995 of 26 countries; and second, an event study on the daily reaction of sovereign yield spreads towards ratings announcements and implemented upgrades/downgrades or outlook changes by S&P and Moody's between 1987-1996. The results of Larraín *et al*. (1997) Granger causality test posit that rating announcements caused changes in yield spreads and vice versa. The event study indicated that during the 29 days before a review for a possible downgrade, spreads rose by approximately 25 percentage points. Similarly, 29 days before putting a country on a positive outlook, spreads fall by approximately eight percentage points. Based on these results, Larraín *et al*. (1997) conclude that CRAs can help dampen excessive private capital inflows into emerging markets with negative rating announcements.

Schmukler (1999) expands on the literature of rating effects by examining the cross-country and cross-security spillover effects of rating changes. His study examines the rating announcement effects of S&P, Moody's and Fitch on 16 emerging markets from 1990-June 2000. To study the effects, Schmukler (1999) firstly estimates a panel regression to determine the contemporaneous effects of announcements. Secondly, he performs an event study to determine the dynamic response of the financial markets around the time of important events. Subsequently, Schmukler (1999) makes several conclusions from his analysis. The first is in line with previous literature, that – changes in ratings and outlook significantly affect bond and stock markets. According to his estimation, yield spreads increase by about two percentage points and the stock market declines by about one percentage point in response to a domestic downgrade. Second, rating changes contribute to spillover effects, SCR changes in one emerging market trigger yield spread and stock market returns in other markets. Third, during a crisis, changes in ratings and outlooks have a more substantial effect on both domestic and foreign financial markets. Fourth, rating changes have a larger impact on more non-transparent emerging economies than on transparent ones. Fifth, in general, domestic country upgrades occur after market rallies and downgrades occur after downturns. Lastly, low rated economies are more severely affected by U.S interest rate changes.

In their analysis of the impact of rating announcements, Micu, Remolona & Wooldridge (2006) follow the existing literature and conduct an event study to examine the impact of various rating announcements from Moody's, S&P and Fitch on credit default swap spreads (CDS). The period of their study is from 1 January 2001 to 31 March 2005. Micu *et al*. (2006) unique contribution to the existing body of literature is that they controlled for events that might foreshadow one agency's announcement by a similar announcement made by another agency. Their results indicate that all ratings announcements have a statistically significant impact on CDS prices, similar to what Schmukler (1999) found. Furthermore, Micu *et al*. (2006) suggest that rating announcements by more than one agency are more informative, "an announcement preceded by a similar announcement by a different agency contains pricing-relevant information" (Micu *et al*. 2006, p.13). Moreover, they further posit that a negative SCR assignment's impact is most significant for issuers at risk of being downgraded to a speculative grade. The impact of a positive assignment has the most significant impact on issuers just below investment grade.

In a complementary study to Schmukler (1999) and Micu *et al*. (2006), Ismailescu & Kazemi (2010) investigates the reaction of CDS spreads to credit rating changes by S&P and the cross-border spillover effects of these announcements. Using a standard event study for the period 2001-2008, Ismailescu & Kazemi (2010) find that there are asymmetric reactions in the CDS market to SCR announcements. Favourable ratings assignments have an immediate effect on CDS spreads, whereas negative assignments have no impact on sovereign CDS spreads. The authors interpret this result as favourable assignments in emerging markets convey more pricing information than negative assignments. Furthermore, they also find that CDS spreads provide important information in estimating the probability of a negative rating event. However, CDS spreads are inadequate at estimating the probability of an upgrade. In terms of spillover effects, Ismailescu & Kazemi (2010) allude that downgrades of low rated emerging economies have more spillover impact than those of middle rated emerging markets.

As indicated above, ratings assignments have adverse effects on bond spreads, Jaramillo and Tejada (2011) attempt to measure these effects' severity. More specifically, they seek to measure the impact of investment grade status on sovereign borrowing costs. Their analysis method is a panel regression based on a sample of 35 emerging market countries and S&P, Moody's and Fitch SCRs from December 1997 to February 2010. Jaramillo and Tejada (2011) prove that investment grade status reduces borrowing costs; in their results,

investment grade status lowers bond spreads by 36 percentage points. Moreover, there is a 5-10 percentage point reduction in bond spreads following an SCR upgrade within investment grade. There is no impact on spreads for upgrades within the speculative grade; Ismailescu & Kazemi (2010) came to a similar conclusion in their analysis.

Afonso *et al*. (2014) expands on this previous literature and uses a panel of daily stock and bond market returns on an EGARCH model to investigate the bond and equity market volatilities to sovereign rating announcements by S&P, Moody's and Fitch. They cover 21 E.U. countries with a dataset from 2 January 1995 – 24 October 2011. Their results indicate that SCR assignments have asymmetric effects on the equity and bond market volatilities. Moreover, they find that upgrades do not significantly affect volatility; however, downgrades increase the equity market volatility contemporaneously and with one lag. Similarly, downgrades increase the bond market's volatility after two lags.

2.3 Bias in Sovereign Credit Ratings

As detailed above, there are two strands of literature investigating sovereign credit ratings - what is of interest to this paper is the emerging branch of literature within the determinants of SCRs strand of studies that examines rating misalignments and their bias against poorer nations. Gültekin-Karakaş *et al*. (2011) are one of the first to examine this bias. They argue that CRAs assign favourable ratings to developed countries regardless of their macroeconomic fundamentals. To do this, Gültekin-Karakaş *et al*. (2011) examine the determinants of Moody's rating assignments by estimating ordered probit models for developed and developing countries from 1999 to 2010. The rationale behind this two-model analysis method is that it allowed for direct comparison and contrast of developed and emerging market economies to determine if CRAs are biased toward developed countries. Furthermore, they investigate the two models' estimation results' performance and compare their predictions with actual ratings. Holding all else constant the results from their estimation provided econometric evidence that CRAs are more likely to give developed countries a higher rating regardless of their macroeconomic fundamentals. Öztürk (2014) advances Gültekin-Karakaş *et al*. (2011) 's work and argues that cross-country differences in institutional quality are the mechanism behind the bias against developing countries. He uses the same ordered probit model used by Gültekin-Karakaş *et al*. (2011) to investigate the differences in institutional quality between developed and emerging countries that are the mechanism behind the bias in the rating assignment of Moody's. His dataset is from 1999-2010 and uses the World Governance Indicator as a proxy for institutional quality. Öztürk

(2014)'s analysis method is twofold; first, using the ordered probit model, he examines whether the institutional quality is a significant determinant of SCRs. Second, he examines the model's predictive power and compares its performance before and after the inclusion of institutional quality indicators. Öztürk (2014) finds that improved quality of institutions would increase the probability of achieving higher sovereign credit ratings. Moreover, his results indicate that government ineffectiveness and poor regulatory quality was the reason for the low sovereign credit ratings in developing nations regardless of their macroeconomic fundamentals.

Fuchs & Gehring (2013) take a different approach compared to Gültekin-Karakaş *et al*. (2011). They argue that ratings are subject to a "home bias" – in that, a rating agency assigns favourable ratings to its home country and countries that display similar economic, political and cultural attributes to the home country. Using monthly dyadic panel dataset on fixed effects OLS regressions, they investigate the existence of home bias of nine rating agency assignments from 1990 to 2013. Their results indicate a home bias amongst the nine credit rating agencies driven by economic interests and cultural proximity, rather than geographic location. On average, the evaluated agencies assigned a rating to its home country that is almost one point higher than what the significant macroeconomic and political variables justify.

Tennant & Tracey (2016) rigorously advance the ordered response framework method of analysis by controlling for fixed effects and model for the qualitative variable of rating stability that credit rating agencies account for in their rating assignments. First, they account for a theorised set of indicators of credit ratings. Second, they combine a first difference approach with a nonlinear ordered response framework to control for fixed effects. The ordered response framework allows the authors to determine a lower threshold below which debt quality changes can lead to a downgrade and an upper threshold where debt quality changes may lead to an upgrade. Third, they model a complicated qualitative part of the assignment process; they model credit rating agencies' behaviour where they try to balance the timeliness of assignments and rating stability. Lastly, they let the data dictate whether the upper threshold systematically varies across different country income levels. Using this approach, Tennant & Tracey (2016) investigate bias towards developed countries over developing countries rating assignments of the big three between 1997 to 2011. Their results prove that the big three find it more challenging to upgrade developing countries relative to developed countries regardless of improved quantitative and qualitative factors. Moreover,

according to their results, S&P and Fitch found it more cumbersome to upgrade African countries relative to other developing countries regardless of improved ability and willingness to repay debts.

In contrast to the method used in Tennant & Tracey (2016), Tennant & Tracey (2020) use a less complicated yet still vigorous heterogenous middle-inflated ordered probit model to examine the existence of bias in sovereign credit rating assignments of Moody's, S&P and Fitch from 1996 to 2011. The empirical approach in Tennant & Tracey (2020) firstly introduces heterogeneity and random shocks. Secondly, they consider the direction of the ratings assignments. Moreover, they also consider its direction as a function of development level, denoted as a hierarchical ordered probit model to achieve coherency. Lastly, they integrate a middle-inflated framework to model an agency's decision-making process. From this approach, their results confirm that there is significant evidence of bias against developing countries that occurs when SCRs assignments systematically diverge from that implied by changes in key economic and institutional determinants.

In terms of this paper, what is relevant from the reviewed literature is the conclusion from the determinants strand of studies – a handful of variables determine sovereign credit rating assignments. From the emerging branch within the determinants strand, the estimation methods used by Öztürk (2014) and Gültekin-Karakaş *et al*. (2011) are relevant to this paper. Though relevant, and informative of bias, Tennant & Tracey (2016, 2020)'s estimation methods are beyond this paper's scope.

3. DATA

This study attempts to examine sovereign credit rating bias toward developed nations and against developing nations. To examine this bias, we divide the data into two sections; the first consists of the dependent variables that comprise of Moody's, S&P and Fitch's sovereign credit ratings. The second section comprises of the theorised and preestablished determinants of sovereign credit ratings. To be able to compare and contrast the existence of bias in country rating assignments of developed and developing nations, the data is divided into subsections according to developed and developing markets as classified by the World Bank country classification for our analysis. We group high-income countries under the developed countries category and the low income, lower middle income and upper-middle-income countries under the developing category. Consequently, we have a panel dataset from 1996-2019 that excludes countries with less than eight years' worth of data and explanatory variables with missing observations were also dropped from the dataset. This paper investigates sovereign credit ratings of 105 countries for Moody's, 110 for S&P and 96 countries for Fitch (see appendix for the list of countries).

3.1 Sovereign Credit Ratings

This paper's sovereign credit ratings data is extracted from Bloomberg and includes the ratings assignments from Moody's S&P and Fitch as at year-end from 1996-2019. We follow the literature and transform the alphanumeric ratings to a 21 point scale shown in table 2 (see Tennant & Tracey (2020) for a similar approach). Credit rating agencies claim to have different methodologies in assessing credit risk. S&P seeks to capture a default occurrence probability and not the default severity (Bhatia, 2002). On the other hand, Moody's focuses on the expected loss in the event of a default which is a function of the probability of a default and the expected recovery rate (Bhatia, 2002). Fitch's methodology is a hybrid, focusing only on the probability of default until the default occurs, once the default occurs, the basis of their ratings is the expected recovery rate (Bhatia, 2002). Each agency assesses a set of variables according to these stated methodologies to determine a sovereign default probability. However, each rating has a significant subjectivity component attached to it. Moody's posit that their final rating of a sovereign is based on the quantitative assessment and their rating committees' judgment (Vernazza *et al*.,2014). S&P says, "rather than providing a strictly formulaic assessment, Standard & Poor's factors into its ratings the perceptions and insights of its analysts" (Vernazza *et al*., 2014, p.6). Fitch states that "the

actual rating determined by the sovereign rating committee can and does differ from that implied by the rating model" (Vernazza *et al*., 2014, p.6).

Table 2: Alphanumeric to 21 Point scale conversion

Investment-grade status	S&P Rating	Fitch Rating	Moody's Rating	21 point scale	Investment-grade characterisation
Investment Grade	AAA	AAA	Aaa	21	Prime
	AA+	AA+	Aa1	20	High Grade
	AA	AA	Aa2	19	
	AA-	AA-	Aa3	18	
	A+	A+	A1	17	Upper Medium Grade
	A	A	A2	16	
	A-	A-	A3	15	
	BBB+	BBB+	Baa1	14	Lower Medium Grade
	BBB	BBB	Baa2	13	
	BBB-	BBB-	Baa3	12	
Speculative/Junk Grade	BB+	BB+	Ba1	11	Non-Investment Grade Speculative
	BB	BB	Ba2	10	
	BB-	BB-	Ba3	9	
	B+	B+	B1	8	Highly Speculative
	B	B	B2	7	
	B-	B-	B3	6	
	CCC+	CCC+	Caa1	5	Substantial Risk of Default
	CCC	CCC	Caa2	4	Extremely Speculative
	CCC-	CCC-	Caa3	3	
	CC	CC	Ca	2	In Default
	D	D	C	1	

Source: Bloomberg
Note*:* Rating SD for S&P and DDD and RD for Fitch are captured in the D rating converted to 1 on the scale.

In a preliminary analysis of bias in SCR assignments, a clear pattern emerges in the percentage distribution of sovereign credit ratings for each agency, segregated according to the development level and shown in table 3. Table 3 clearly shows that countries with a higher development level are deemed more conducive to a more favourable rating. In contrast, countries with lower levels of development are not as conducive for higher ratings. This finding is consistent with previous literature findings, e.g. Öztürk (2014) and Bissoondoyal-Bheenick (2005). Moreover, figures 1-3 show that regardless of differences in methodologies, on average, CRAs assign the same ratings to countries they assess. Across all three agencies, in the Americas, North America has higher ratings. In Europe, Western Europe countries have a higher rating, and Australia and New Zealand have a more favourable rating in Australasia. Developing countries have the least favourable ratings,

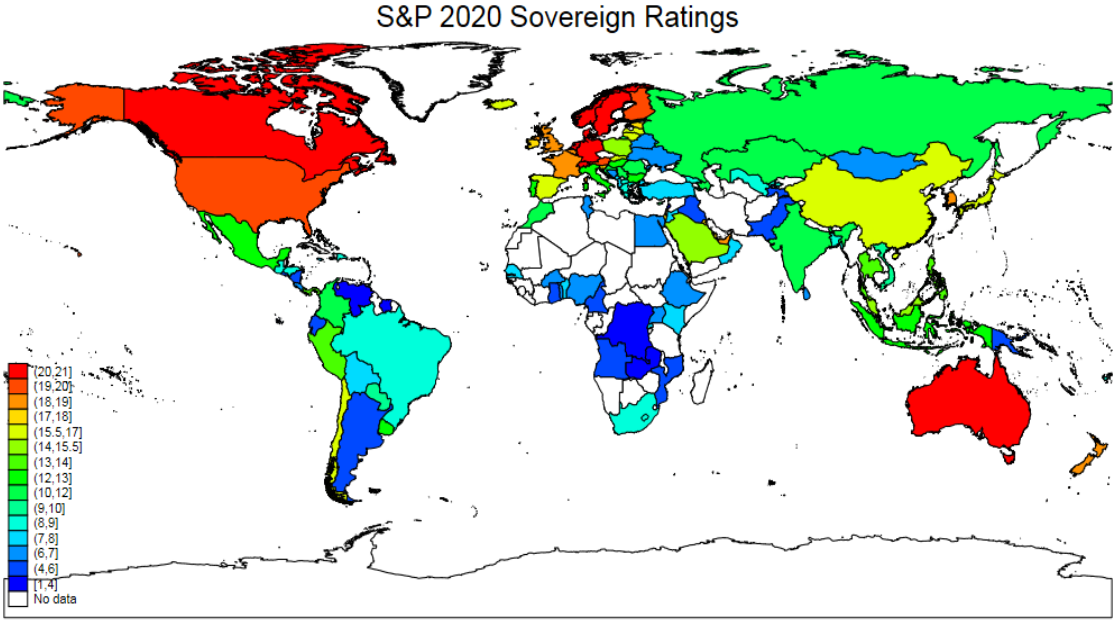
particularly for Africa and parts of South America and Eastern Europe. Consequently, considering that the big three have roughly 95% market share, access to financial markets for developing nations is heavily influenced and constrained by these CRAs views.

Table 3: Percentage distribution of sovereign credit ratings according to development group

			S&P		Fitch		Moody's	
S&P &Fitch Rating	Moody's Rating	21 point scale	Developed (%)	Developing (%)	Developed (%)	Developing (%)	Developed (%)	Developing (%)
AAA	Aaa	21	26.84		29.84		29.95	
AA+	Aa1	20	8.46		7.63		5.2	
AA	Aa2	19	9.06		9.82		7.59	
AA-	Aa3	18	5.98	0.64	6.67		4.27	0.67
A+	A1	17	6.58	0.73	6.67	1.48	8.53	0.67
A	A2	16	9.4	0.37	7.24	0.21	9.3	0.67
A-	A3	15	7.78	1.74	7.72	2.54	5.97	3.08
BBB+	Baa1	14	5.38	5.4	3.43	4.66	6.74	4.81
BBB	Baa2	13	6.24	5.49	6.77	8.37	6.48	5.38
BBB-	Baa3	12	6.58	8.24	6.39	12.18	6.57	10.38
BB+	Ba1	11	3.08	7.88	4.1	9.75	5.63	10.29
BB	Ba2	10	1.88	10.99	0.86	8.69	0.85	9.13
BB-	Ba3	9	0.68	12.36	1.05	13.88	0.85	10
B+	B1	8	0.43	17.12	0.38	13.03	0.43	16.06
B	B2	7	0.51	15.93	0.57	14.83	0.26	10.58
B-	B3	6	0.51	8.88	0.48	5.51	0.43	11.15
CCC+	Caa1	5	0.17	1.83		0.32	0.43	4.33
CCC	Caa2	4	0.34	0.64	0.29	1.69	0.09	0.96
CCC-	Caa3	3		0.46		0.42	0.34	1.25
CC	Ca	2		0.46		0.42		0.29
D	C	1	0.09	0.82	0.1	2.01	0.09	0.29
Total			100	100	100	100	100	100

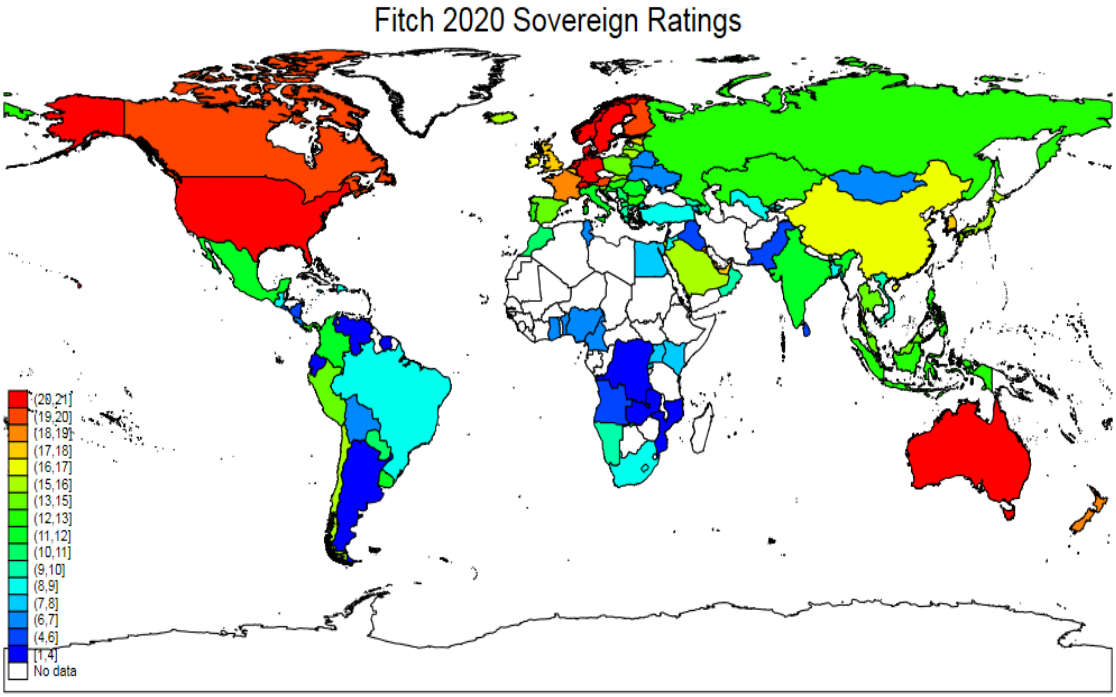
Source: Bloomberg and Author's calculation using STATA

Figure 1: S&P ratings as at year-end 2020



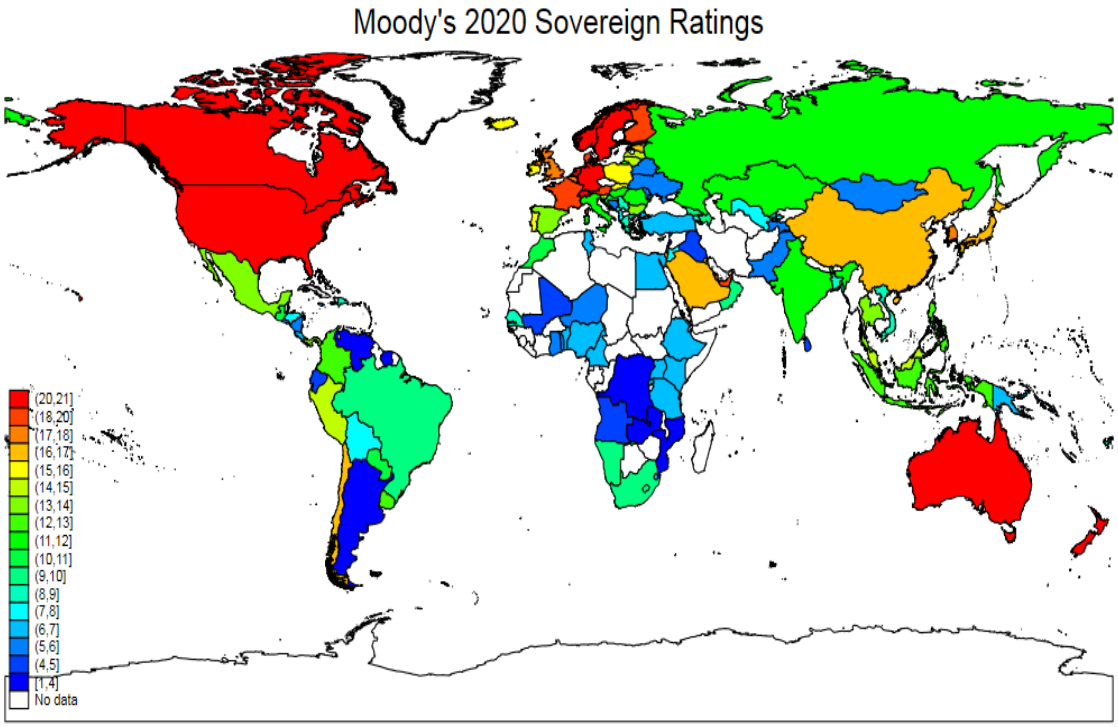
Source: Bloomberg, Ipums International and computed by author

Figure 2: Fitch ratings as at year-end 2020



Source: Bloomberg, Ipums International and computed by author

Figure 3: Moody's ratings as at year-end 2020



Source: Bloomberg, Ipums International and computed by author

3.2 Evaluated Sovereign Credit Ratings Determinants

Rating agencies consider a wide range of factors that determine a country's ability and willingness to pay its debt when they conduct assignments; these factors measure economic strength, institutional quality, fiscal strength and susceptibility to event risk of a sovereign. However, previous literature has provided econometric evidence that, primarily, a handful of variables can explain sovereign credit rating assignments. Researchers conclude that to a great extent, GDP per capita, real GDP growth, debt ratios and the government budget balance explain SCRs (Öztürk, 2014). This paper leverages the previous literature and uses the theorised determinants of SCRs and others to assess a country's ability and willingness to meet its debt obligation. Furthermore, we categorise these explanatory variables according to economic strength, institutional strength, fiscal strength and susceptibility to event risk of a sovereign.

The first category of variables is economic strength, which measures a sovereign's ability to pay its debt. To proxy for economic strength, we use GDP per capita and real GDP growth rate – the rationale behind these proxies is that the greater the potential tax base and growth level of a country, the more likely it will be able to meet its debt obligations. Thus, a positive relationship is expected. Moreover, the level of gross capital formation and FDI will also proxy for economic strength. Lower gross capital formation and net FDI inflow negatively affect the tax base and reduce a country's ability to meet its debt obligations (Tennant & Tracey, 2016). Thus, we anticipate a negative relationship.

The second category of variables is fiscal strength, which also measures a sovereign's ability to pay its debt. To proxy for fiscal strength, we use Government debt to GDP ratio to measure external indebtedness. The domestic credit to GDP ratio measures a country's heightened leverage if borrowed funds are the primary means of funding production (Tennant & Tracey, 2016). Together, these variables indicate a country's debt burden, and we anticipate a negative relationship because a high debt burden signals inadequate debt quality. We also include the current account balance and a country's fiscal balance in the fiscal strength category. A negative relationship is expected for fiscal balance because a higher fiscal deficit indicates that the government cannot increase taxes to service its debt obligation. The expected sign for the current account balance is a bit ambiguous. The theorised interpretation states that a substantial current account balance insinuates that an economy relies heavily on funds from abroad, consequently leading to increased foreign indebtedness that may persist over time and become unstable (Cantor & Packer, 1996), resulting in a negative relationship. However, Afonso *et al*. (2010) postulate a different interpretation; they argue that increasing current account deficits indicate accumulation of investment, resulting in higher growth and improved sustainability. Thus from this perspective, a positive relationship is expected.

The third category of variables is susceptibility to event risk, which also measures a sovereign's ability to pay its debt. This paper uses total foreign reserves, measured in months of imports, and inflation to proxy for event risk. In the event, a country has a large amount of foreign-denominated debt. Access to foreign exchange through foreign reserves indicates that the country can meet short-term debt obligations (Tennant & Tracey, 2016). As such, we expect a positive relationship with SCRs. Increasing levels of inflation insinuate that there are macroeconomic problems in a country. More specifically, when a government is unwilling or

incapable of paying budgetary expenses through taxes or decreased spending, they resort to inflationary measures (Cantor & Packer, 1996). Traditionally, inflation has a negative relationship with credit ratings.

The last category is institutional strength which measures the willingness of a sovereign to pay its debt. To proxy for institutional strength, we use variables in the World Governance Indicators. These variables are Government Effectiveness, Regulatory Quality, Control of Corruption, Rule of Law, Voice and Accountability, and Political Stability. Together, these variables are the theorised measures of institutional quality. Institutional quality affects a government's ability to make adequate governance allocations, and we anticipate a positive relationship because higher levels of institutional quality enhance the willingness to pay.

Table 4 summarises each explanatory variable and its source. Table 5 summarises each variable's summary statistics.

Table 4: Summary of variables and their sources

Variable	Description	Source
Economic Strength		
GDP per capita	GDP per capita, current prices (the U.S. & per capita)	International Monetary Fund WEO
Real GDP growth	Real GDP growth (Annual % change)	International Monetary Fund WEO
Capital Formation	Gross capital formation (% of GDP)	World Bank WDI
FDI	Foreign direct investment, net inflows (% of GDP)	World Bank WDI
Fiscal Strength		
Government debt	General government gross debt (% of GDP)	International Monetary Fund WEO
Domestic Credit	Domestic credit provided by banks (% of GDP)	World Bank WDI
CA balance	Current account balance (% of GDP)	International Monetary Fund WEO
Fiscal Balance	General government net lending/borrowing (% of GDP)	International Monetary Fund WEO
Susceptibility to Event Risk		
Total reserves	Total reserves in months of imports (total reserves/import/12)	World Bank WDI
Inflation	The inflation rate, average consumer prices (Annual % change)	International Monetary Fund WEO
Institutional Strength		World Bank WGI
Control of Corruption	Capturing perceptions of the extent to which public power is exercised for private gain	World Bank WGI
Voice and Accountability	Capturing perceptions of the extent to which a country's citizens can participate in selecting their government, as well as freedom of expression	World Bank WGI
Political Stability	Capturing perceptions of the likelihood of political instability and politically motivated violence, including terrorism.	World Bank WGI
Government effectiveness	Capturing perceptions of the quality of public services, civil service, policy formation and implementation	World Bank WGI
Regulatory Quality	Capturing perceptions of the ability of the government to formulate and implement sound policies and regulations	World Bank WGI
Rule of Law	Capturing perceptions of the extent to which agents have confidence in and abide by the rules of society	World Bank WGI

Notes: Definition of acronyms; WEO: World Economic Outlook, WDI: World Development Indicators, WGI: World Governance Indicators. The WGI variables are measured on an average scale of -2.5 – 2.5.

Table 5: Summary statistics of each determinant variable

Variable	Mean	Std. Dev.	Min	Max
Economic Strength				
GDP per capita (‘000)	15.238	19.399	0.116	120.450
Real GDP growth	3.725	3.602	-15.100	34.500
Capital Formation	24.089	6.946	0.000	58.151
FDI	6.106	19.649	-58.323	451.639
Fiscal Strength				
Government debt	51.468	34.593	0.000	236.600
Domestic Credit	57.921	43.774	0.186	308.978
CA balance	-1.351	8.366	-49.500	45.500
Fiscal Balance	-1.788	5.112	-32.100	43.300
Susceptibility to Event Risk				
Total reserves	4.757	5.087	0.000	83.889
Inflation	5.876	16.870	-8.500	550.000
Institutional Strength				
Control of Corruption	0.176	1.022	-1.520	2.470
Voice and Accountability	0.150	0.907	-1.956	1.801
Political Stability	0.049	0.894	-2.827	1.760
Government Effectiveness	0.180	0.933	-2.810	2.354
Regulatory Quality	0.327	0.869	-2.626	2.261
Rule of Law	0.208	0.969	-1.916	2.100

Source: International Monetary Fund WEO**;** World Bank WDI and World Bank WGI

4. METHODOLOGY

As documented in previous literature and some of the studies reviewed in this paper (e.g. Afonso *et al*. 2010; Öztürk, 2014 and Bissoondoyal-Bheenick's 2005), an ordered probit model is the adequate econometric framework to estimate the relationship between sovereign credit ratings and the explanatory variables. The theorised mechanism behind this is because sovereign credit ratings are categorical variables that measure the probability of a country defaulting on its debt obligations on an ordinal scale. Consequently, the model employed for estimation in this study is:

$$Y_{it} = \beta' X_{it} + u_{it} \quad (1)$$

Let Y_{it} be the continuous evaluation of sovereign credit ratings by Moody's S&P and Fitch of a country *i* at time *t.* Where β is an unknown kx1 parameter vector and X_{it} is a kx1 vector of explanatory variables that measure economic strength, fiscal strength, susceptibility to event risk and institutional strength measured at time *t* for each country *i.* u_{it} is a stochastic disturbance term. This model posits that Y_{it} is unobserved; consequently, the observed criterion for the 21 possible outcomes is given by:

$$S_{it} = s \ \ if \ \mu_{s-1} \leq Y_{it} \leq \mu_s \ \text{ for } \quad s = 1,2,3,\ldots,21 \quad (2)$$

The μ's in equation 2 represents the thresholds where $\mu_0 < \mu_1 < \cdots < \mu_{21}$, μ_0 = -∞ and μ_{21} = +∞.

Where *s* =
- 1, if the rating is D/C
- 2, if the rating is CC/Ca
- 3, if the rating is CCC-/Caa3
- ⋮
- 20, if the rating is AA+/Aa1
- 21, if the rating is AAA/Aaa

Consequently, the probability of observing the sth order for country *i* is given by:

$$Pr(S_{it} = s|X_{it}) = \Pr(\mu_{s-1} \leq \beta' X_{it} + u_{it} \leq \mu_s) \quad (3)$$

Assuming that the error term has a standard normal distribution ($u_{it}: N(0,1)$), rearranging equation two based on this assumption allows for rewriting the conditional probabilities equation is as:

$$Pr(S_{it} = s|X_{it}) = \Phi(\mu_s - \beta' X_{it}) - \Phi(\mu_{s-1} - \beta' X_{it}) \quad (4)$$

Φ represents the normal probability density function with Φ(-∞) = 0 and Φ(+∞) =1. These conditional probabilities are necessary to determine the log-likelihood function and estimate the parameters maximising the above-specified function.

5. EMPIRICAL ESTIMATION AND RESULTS

5.1 Estimation Process

Firstly, we checked the data for multicollinearity by regressing each variable on each other and then determining the variance inflation factor to measure the amount of multicollinearity in the variables (see VIF table 19 in the appendix). We found significant multicollinearity in the governance indicator variables (see correlation matrix figure 4 in the appendix). As such, using the specification above, we estimate the model from 1996-2019 and add the governance indicators one at a time to avoid the multicollinearity problem resulting in six models. The models are estimated for the entire sample for each agency and separately according to country development level. Following the estimations, the goodness of fit of the models is determined.

5.2 Results

Tables 6-8 present our estimation results for the three CRAs for the full sample of data, and tables 9-14 the estimation results segregated by development level. Each table shows the estimation results for each agency. For the full sample, each agency's economic strength indicators are significant with the expected signs except for Real GDP Growth, which is insignificant for Fitch and Moody's and only slightly significant for S&P in model 2. A country with higher GDP per capita and capital formation is most likely to be assigned a higher credit rating. A country with an increase in net FDI inflows as a percentage of GDP is most likely to be assigned a lower credit rating. For fiscal strength indicators, government debt is enormously significant with the expected signs for all three agencies – an increase in government debt is associated with a lower credit rating. Domestic credit is significant for the three agencies but with an unexpected sign, suggesting that, on average, CRAs assign higher SCRs to countries that encourage the use of domestic credit to propel production. However,

this relationship differs across development levels. Contrary to previous studies (Cantor & Packer, 1996 & Tennant & Tracey 2020), who found positive relationships for fiscal balance and SCRs. The estimated results of the full sample for the three agencies find a negative relationship that is strongly significant for Moody's and Fitch and only slightly significant in models 2 and 4 for S&P.

Thus, these two agencies will most likely assign a lower credit rating to a country with a high fiscal deficit.

As aforementioned, the expected relationship between the CA balance and SCRs is ambiguous, but the results show a positive relationship with a high level of significance for all three agencies. Thus, confirming Afonso *et al*. (2010) interpretation; that increasing current account deficits indicate investment accumulation, resulting in higher growth and improved sustainability. Consequently, an increase in the current account deficit might result in a higher SCR across all three agencies.

In the full sample, the indicators for event risk are highly significant, with the expected signs across all three agencies. An increase in a country's reserves is associated with a higher SCR, and an increase in inflation will most likely result in a lower rating. Moreover, for the full sample, the six indicators of institutional strength are strongly significant across all three agencies in all six models with the expected positive sign. An increase in a country's voice and accountability, political stability; government effectiveness; regulatory quality, and the rule of law enhances institutional quality and willingness to pay, resulting in a higher sovereign credit rating assignment.

Table 6: Full sample estimation for Fitch

Credit Rating	Fitch					
Economic Strength	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
GDP per capita	0.0000678***	0.0000733***	0.0000683***	0.0000492***	0.0000461***	0.0000548***
	(0.00000298)	(0.00000293)	(0.00000299)	(0.00000312)	(0.00000324)	(0.00000308)
Real GDP growth	0.00315	0.00321	-0.00150	-0.000274	-0.00301	-0.00580
	(0.0081859)	(0.0082141)	(0.0081768)	(0.0082092)	(0.0081899)	(0.0081926)
Capital Formation	0.0451***	0.0270***	0.0271***	0.0500***	0.0358***	0.0408***
	(0.0050459)	(0.0049081)	(0.0048969)	(0.0050057)	(0.0049124)	(0.0049417)
FDI	-0.00369**	-0.00409***	-0.00434***	-0.00444***	-0.00465***	-0.00361**
	(0.0011728)	(0.0011742)	(0.0011735)	(0.0011756)	(0.0011744)	(0.0011749)
Fiscal Strength						
Government debt	-0.0118***	-0.0107***	-0.0114***	-0.00936***	-0.0114***	-0.0103***
	(0.0008962)	(0.0008918)	(0.0008937)	(0.0008991)	(0.0008938)	(0.0008922)
Domestic Credit	0.00771***	0.00678***	0.00568***	0.00368***	0.00337***	0.00501***
	(0.0008189)	(0.0008184)	(0.0008269)	(0.0008314)	(0.0008376)	(0.0008262)
CA balance	0.0508***	0.0352***	0.0355***	0.0522***	0.0379***	0.0453***
	(0.0045211)	(0.0043118)	(0.0043058)	(0.0044436)	(0.0043292)	(0.0043785)
Fiscal Balance	-0.0177**	-0.0210**	-0.0135*	-0.0151*	-0.00860	0.0186**
	(0.0064963)	(0.0065099)	(0.0064954)	(0.0065036)	(0.0065214)	(0.0065041)
Event Risk						
Total Reserves	0.0276***	0.0171*	0.0200**	0.0434***	0.0393***	0.0224***
	(0.0068685)	(0.0067724)	(0.006709)	(0.0067651)	(0.0067623)	(0.006598)
Inflation	-0.0434***	-0.0405***	-0.0359***	-0.0234***	-0.0321***	-0.0370***
	(0.0050038)	(0.0050441)	(0.0050843)	(0.0051087)	(0.0050547)	(0.005031)
Institutional Strength						
Voice and Accountability	0.536***					
	(0.0449478)					
Political Stability		0.349***				
		(0.0418979)				
Government effectiveness			0.529***			
			(0.04704)			
Regulatory Quality				1.487***		
				(0.0641822)		
Rule of Law					1.247***	
					(0.0596176)	
Control of Corruption						0.863***
						(0.0476769)
Number of obs	1616	1616	1616	1616	1616	1616
LR chi2(16)	2744.06	2211.13	2268.50	2692.41	2586.39	2462.16
Pseudo R2	0.2564	0.2484	0.2549	0.3025	0.2906	0.2766
Countries	96	96	96	96	96	96

*Note: Standard errors are reported in brackets, and *,**,*** indicate 10%, 5% and 1% level of significance, respectively.*

Table 7: Full sample estimation for Moody's

Credit Rating	Moody's					
Economic Strength	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
GDP per capita	0.0000571***	0.0000610***	0.0000542***	0.0000394***	0.0000364***	0.0000410***
	(0.00000257)	(0.00000255)	(0.00000261)	(0.0000027)	(0.00000277)	(0.00000269)
Real GDP growth	0.00318	0.0130	0.00564	-0.00427	-0.00259	-0.00444
	(0.0081753)	(0.0082306)	(0.0081818)	(0.0082085)	(0.0081961)	(0.0082075)
Capital Formation	0.0404***	0.0160***	0.0174***	0.0434***	0.0333***	0.0394***
	(0.0048775)	(0.0047163)	(0.0046995)	(0.0048134)	(0.0047436)	(0.0047981)
FDI	-0.00472***	-0.00521***	-0.00576***	-0.00597***	-0.00557***	-0.00451***
	(0.0011874)	(0.0011875)	(0.0011875)	(0.001191)	(0.0011882)	(0.0011891)
Fiscal Strength						
Government debt	-0.0110***	-0.00924***	-0.0105***	-0.00912***	-0.0115***	-0.00962***
	(0.0008605)	(0.000852)	(0.0008573)	(0.0008596)	(0.0008605)	(0.0008548)
Domestic Credit	0.00845***	0.00831***	0.00651***	0.00364***	0.00278**	0.00509***
	(0.0008133)	(0.000815)	(0.0008254)	(0.0008308)	(0.0008462)	(0.0008282)
CA balance	0.0470***	0.0264***	0.0272***	0.0478***	0.0324***	0.0394***
	(0.0046343)	(0.0043877)	(0.0043778)	(0.0045074)	(0.0043992)	(0.0044679)
Fiscal Balance	-0.0249***	-0.0291***	-0.0220***	-0.0297***	-0.0211**	-0.0281***
	(0.0064796)	(0.006535)	(0.0064562)	(0.0064669)	(0.0064711)	(0.0064853)
Event Risk						
Total Reserves	0.0390***	0.0259***	0.0283***	0.0482***	0.0452***	0.0311***
	(0.0067725)	(0.0067195)	(0.0065686)	(0.0066267)	(0.006619)	(0.0065013)
Inflation	-0.0318***	-0.0289***	-0.0219***	-0.0110*	-0.0186***	-0.0246***
	(0.0045905)	(0.0046192)	(0.0046608)	(0.0046878)	(0.0046443)	(0.0046175)
Institutional Strength						
Voice and Accountability	0.634***					
	(0.0407676)					
Political Stability		0.414***				
		(0.0400862)				
Government effectiveness			0.697***			
			(0.0439141)			
Regulatory Quality				1.616***		
				(0.0603541)		
Rule of Law					1.366***	
					(0.0548631)	
Control of Corruption						1.019***
						(0.0459264)
Number of obs	1755	1755	1755	1755	1755	1755
LR chi2(16)	2252.38	2119.26	2265.54	2751.84	2646.85	2496.20
Pseudo R2	0.2325	0.2188	0.2339	0.2841	0.2733	0.2577
Countries	105	105	105	105	105	105

*Notes: Standard errors are reported in brackets, and *,**,*** indicate 10%, 5% and 1% level of significance, respectively.*

Table 8: Full sample estimation for S&P

Credit Rating	S&P					
Economic Strength	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
GDP per capita	0.0000536***	0.0000575***	0.0000495***	0.0000370***	0.0000338***	0.0000387***
	(0.00000258)	(0.00000258)	(0.00000264)	(0.00000271)	(0.00000276)	(0.00000266)
Real GDP growth	0.00765	0.0167*	0.00915	0.00197	-0.00167	-0.00179
	(0.0084224)	(0.0084767)	(0.0084271)	(0.0084911)	(0.0084563)	(0.0084657)
Capital Formation	0.0478***	0.0201***	0.0204***	0.0530***	0.0391***	0.0421***
	(0.0049762)	(0.0047749)	(0.0047686)	(0.0049707)	(0.0048281)	(0.0048695)
FDI	-0.00496***	-0.00540***	-0.00612***	-0.00597***	-0.00592***	-0.00486***
	(0.0011686)	(0.0011682)	(0.0011689)	(0.0011727)	(0.00117)	(0.001171)
Fiscal Strength						
Government debt	-0.0123***	-0.0100***	-0.0117***	-0.0103***	-0.0127***	-0.0109***
	(0.0008532)	(0.0008411)	(0.0008487)	(0.0008544)	(0.0008516)	(0.0008457)
Domestic Credit	0.0102***	0.00992***	0.00842***	0.00519***	0.00435***	0.00680***
	(0.0008045)	(0.0008045)	(0.0008126)	(0.0008288)	(0.0008368)	(0.0008168)
CA balance	0.0562***	0.0330***	0.0102***	0.0560***	0.0392***	0.0469***
	(0.0042545)	(0.0039986)	(0.0040004)	(0.0041969)	(0.0040304)	(0.0040977)
Fiscal Balance	-0.00880	-0.0128*	-0.00215	-0.0118*	0.0000929	-0.00843
	(0.0056674)	(0.0056806)	(0.0056575)	(0.0056702)	(0.005678)	(0.0056702)
Event Risk						
Total Reserves	0.0429***	0.0222***	0.0256***	0.0452***	0.0435***	0.0301***
	(0.0068701)	(0.006693)	(0.0065731)	(0.0066433)	(0.0066463)	(0.0065266)
Inflation	-0.0428***	-0.0397***	-0.0312***	-0.0223***	-0.0310***	-0.0371***
	(0.0047717)	(0.0047936)	(0.0048423)	(0.0048668)	(0.0048193)	(0.0047898)
Institutional Strength						
Voice and Accountability	1.732***					
	(0.0423536)					
Political Stability		1.481***				
		(0.038315)				
Government effectiveness			1.087***			
			(0.0432917)			
Regulatory Quality				0.735***		
				(0.0616013)		
Rule of Law					0.432***	
					(0.0560593)	
Control of Corruption						0.777***
						(0.0457417)
Number of obs	1748	1748	1748	1748	1748	1748
LR chi2(16)	2499.27	2328.70	2525.54	3031.96	2921.32	2756.90
Pseudo R2	0.2578	0.2402	0.2605	0.3128	0.3014	0.2844
Countries	110	110	110	110	110	110

*Notes: Standard errors are reported in brackets, and *,**,*** indicate 10%, 5% and 1% level of significance, respectively.*

Table 9: Developed Countries Estimation Results for Fitch

Credit Rating	Fitch					
Economic Strength	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
GDP per capita	0.0000560*** (0.00000341)	0.0000587*** (0.00000344)	0.0000555*** (0.00000353)	0.0000448*** (0.00000359)	0.0000326*** (0.00000375)	0.0000458*** (0.00000346)
Real GDP growth	-0.00839 (0.0133953)	-0.00736 (0.0134129)	-0.0126 (0.0134008)	-0.0337* (0.0135873)	-0.0216 (0.0134998)	-0.0229 (0.0135429)
Capital Formation	0.0396*** (0.0089391)	0.0159 (0.0086612)	0.0224** (0.0086522)	0.0376*** (0.0088617)	0.0461*** (0.0088635)	0.0384*** (0.0088442)
FDI	-0.00276* (0.0011952)	-0.00367** (0.001196)	-0.00372** (0.0011957)	-0.00327** (0.0011956)	-0.00393*** (0.0011944)	-0.00293* (0.0011961)
Fiscal Strength						
Government debt	-0.0110*** (0.0011448)	-0.00982*** (0.0011322)	-0.00939*** (0.0011294)	-0.00581*** (0.0011704)	-0.00710*** (0.00114)	-0.00826*** (0.0011339)
Domestic Credit	0.00208* (0.0010253)	0.00181 (0.0010238)	0.00147 (0.0010236)	-0.00201 (0.0010583)	-0.00162 (0.0010474)	0.000343 (0.0010301)
CA balance	0.0696*** (0.0076824)	0.0428*** (0.0070608)	0.0437*** (0.0070345)	0.0387*** (0.0071873)	0.0469*** (0.0071387)	0.0546*** (0.0072129)
Fiscal Balance	-0.0331*** (0.0090146)	-0.0304*** (0.0089801)	-0.0231** (0.008958)	0.00405 (0.0092394)	-0.0125 (0.009066)	-0.0296*** (0.0089905)
Event Risk						
Total Reserves	0.0181 (0.0099436)	-0.00903 (0.0092099)	-0.0120 (0.0091012)	0.0155 (0.0093495)	0.00545 (0.0091531)	-0.00894 (0.0089671)
Inflation	-0.0229 (0.0123421)	-0.0181 (0.0123192)	-0.0160 (0.0123189)	-0.00658 (0.0124132)	-0.0177 (0.0123703)	-0.0160 (0.0123571)
Institutional Strength						
Voice and Accountability	0.690*** (0.0752421)					
Political Stability		0.427*** (0.0714035)				
Government effectiveness			0.449*** (0.0748235)			
Regulatory Quality				1.547*** (0.1077978)		
Rule of Law					1.616*** (0.102906)	
Control of Corruption						0.834*** (0.0621835)
Number of obs	838	838	838	838	838	838
LR chi2(16)	801.27	755.07	755.24	930.17	971.26	893.69
Pseudo R2	0.2049	0.1931	0.1931	0.2379	0.2484	0.2285
Countries	46	46	46	46	46	46

*Notes: Standard errors are reported in brackets, and *,**,*** indicate 10%, 5% and 1% level of significance, respectively.*

Table 10: Developed Countries Estimation Results for Moodys

Credit Rating	Moody's					
Economic Strength	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
GDP per capita	0.0000473*** (0.00000297)	0.0000484*** (0.00000298)	0.0000443*** (0.00000305)	0.0000377*** (0.00000308)	0.0000278*** (0.00000319)	0.0000361*** (0.00000304)
Real GDP growth	-0.00538 (0.0132347)	0.00249 (0.013244)	-0.00552 (0.0132603)	-0.0383** (0.0135017)	-0.0209 (0.013374)	-0.0146 (0.0133744)
Capital Formation	0.0191** (0.0071427)	0.00167 (0.006955)	0.00997 (0.0069981)	0.0176* (0.0070719)	0.0338*** (0.0071974)	0.0283*** (0.0072095)
FDI	-0.00374** (0.0012082)	-0.00464*** (0.0012087)	-0.00487*** (0.0012089)	-0.00435*** (0.00121)	-0.00458*** (0.0012084)	-0.00375** (0.0012096)
Fiscal Strength						
Government debt	-0.0105*** (0.0011137)	-0.00860*** (0.0010891)	-0.00830*** (0.0010878)	-0.00567*** (0.0011114)	-0.00726*** (0.0010956)	-0.00744*** (0.0010918)
Domestic Credit	0.00338*** (0.0010156)	0.00443*** (0.0010153)	0.00388*** (0.0010159)	-0.00131 (0.0010656)	-0.000882 (0.0010573)	0.00225* (0.0010217)
CA balance	0.0449*** (0.0076153)	0.0196** (0.0071258)	0.0234** (0.0071312)	0.0167* (0.0071622)	0.0271*** (0.007177)	0.0347*** (0.0072942)
Fiscal Balance	-0.0258** (0.0088972)	-0.0214* (0.0089067)	-0.0157 (0.008836)	0.00934 0.0089735	-0.00875 (0.0089089)	-0.0244** (0.0089024)
Event Risk						
Total Reserves	0.0209* (0.0095941)	-0.000354 (0.0092061)	-0.000818 (0.0091053)	0.0292** (0.009353)	0.0159 (0.0091677)	0.000396 (0.008986)
Inflation	-0.0191 (0.0119462)	-0.00660 (0.0118771)	-0.00251 (0.0118879)	-0.000975 (0.0119388)	-0.0117 (0.011937)	-0.00314 (0.0119184)
Institutional Strength						
Voice and Accountability	0.598*** (0.0610421)					
Political Stability		0.426*** (0.0697965)				
Government effectiveness			0.580*** (0.0734796)			
Regulatory Quality				1.679*** (0.0991783)		
Rule of Law					1.683*** (0.0947524)	
Control of Corruption						0.885*** (0.0608293)
Number of obs	900	900	900	900	900	900
LR chi2(16)	729.05	671.58	696.61	929.49	960.09	843.09
Pseudo R2	0.1748	0.1611	0.1671	0.2229	0.2303	0.2022
Countries	50	50	50	50	50	50

*Notes: Standard errors are reported in brackets, and *,**,*** indicate 10%, 5% and 1% level of significance, respectively.*

Table 11: Developed Countries Estimation Results for S&P

Credit Rating	S&P					
Economic Strength	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
GDP per capita	0.0000394*** (0.00000304)	0.0000398*** (0.00000307)	0.0000326*** (0.00000313)	0.0000289*** (0.00000314)	0.0000175*** (0.00000308)	0.0000277*** (0.00000306)
Real GDP growth	-0.0120 (0.0129256)	-0.00235 (0.0129031)	-0.0128 (0.0129298)	-0.0468*** (0.0132793)	-0.0298* (0.0130762)	-0.0222 (0.0131038)
Capital Formation	0.0518*** (0.0085703)	0.0230** (0.0081375)	0.0379*** (0.0082633)	0.0501*** (0.0086296)	0.0744*** (0.0086064)	0.0597*** (0.0086863)
FDI	-0.00405*** (0.0011975)	-0.00501*** (0.0011972)	-0.00553*** (0.001198)	-0.00453*** (0.0011992)	-0.00504*** (0.0011958)	-0.00397*** (0.0011982)
Fiscal Strength						
Government debt	-0.0111*** (0.0011259)	-0.00880*** (0.0011028)	-0.00871*** (0.0011025)	-0.00530*** (0.0011408)	-0.00687*** (0.0011031)	-0.00741*** (0.0011103)
Domestic Credit	0.00569*** (0.0010393)	0.00634*** (0.0010411)	0.00628*** (0.0010431)	0.000221 (0.0010851)	0.000593 (0.0010702)	0.00406*** (0.001042)
CA balance	0.0826*** (0.0079329)	0.0505*** (0.007285)	0.0582*** (0.0073227)	0.0495*** (0.0075613)	0.0625*** (0.0074317)	0.0714*** (0.0076831)
Fiscal Balance	-0.0358*** (0.0088943)	-0.0329*** (0.0088905)	-0.0242** (0.0088063)	0.00739 (0.0090451)	-0.0153 (0.0089355)	-0.0355*** (0.0089145)
Event Risk						
Total Reserves	0.0194* (0.0096534)	-0.00902 (0.0091622)	-0.00748 (0.0090782)	0.0214* (0.0093304)	0.00619 (0.0091467)	-0.0101 (0.0089422)
Inflation	-0.0329** (0.0122801)	-0.0213 (0.0122336)	-0.0173 (0.012253)	-0.0168 (0.0123476)	-0.0277* (0.0123412)	-0.0203 (0.0122982)
Institutional Strength						
Voice and Accountability	0.773*** (0.0666232)					
Political Stability		0.534*** (0.0716295)				
Government effectiveness			0.850*** (0.0772433)			
Regulatory Quality				1.979*** (0.1067705)		
Rule of Law					2.009*** (0.1005841)	
Control of Corruption						1.028*** (0.0622989)
Number of obs	872	872	872	872	872	872
LR chi2(16)	796.55	719.69	785.65	1030.38	1080.89	936.43
Pseudo R2	0.1948	0.1760	0.1921	0.2520	0.2643	0.2290
Countries	51	51	51	51	51	51

*Notes: Standard errors are reported in brackets, and *,**,*** indicate 10%, 5% and 1% level of significance, respectively.*

Table 12: Developing Countries Estimation Results for Fitch

Credit Rating	Fitch					
Economic Strength	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
GDP per capita	0.0000956***	0.0000995***	0.0000964***	0.0000656***	0.0000918***	0.0000919***
	(0.0000128)	(0.0639481)	(0.0000127)	(0.0000129)	(0.0000127)	(0.0000127)
Real GDP growth	0.0237*	0.0212*	0.0235*	0.0262*	0.0205	0.0220*
	(0.0106992)	(0.0107289)	(0.010686)	(0.0107302)	(0.0106973)	(0.0106887)
Capital Formation	0.0215***	0.0211***	0.0198**	0.0415***	0.0213***	0.0259***
	(0.0064478)	(0.0063457)	(0.0063523)	(0.0065329)	(0.0063386)	(0.0063989)
FDI	-0.00170	0.000172	-0.00303	-0.00878	-0.00476	-0.00117
	(0.0085136)	(0.0085646)	(0.0085938)	(0.0085574)	(0.0085277)	(0.0085172)
Fiscal Strength						
Government debt	-0.0152***	-0.0156***	-0.0152***	-0.0163***	-0.0168***	-0.0151***
	(0.0015891)	(0.0016051)	(0.0015863)	(0.0016045)	(0.0016062)	(0.0015886)
Domestic Credit	0.0231***	0.0235***	0.0224***	0.0191***	0.0191***	0.0210***
	(0.0016168)	(0.0016296)	(0.0016707)	(0.001648)	(0.0016728)	(0.0016428)
CA balance	0.0300***	0.0292***	0.0290***	0.0508***	0.0292***	0.0348***
	(0.0066937)	(0.0066198)	(0.0066223)	(0.0068398)	(0.0066353)	(0.0066907)
Fiscal Balance	-0.000479	-0.00157	0.000652	-0.00842	0.0140	0.00426
	(0.0114024)	(0.0113712)	(0.0114629)	(0.0114415)	(0.0115272)	(0.0114121)
Event Risk						
Total Reserves	0.0643***	0.0586***	0.0675***	0.0998***	0.0879***	0.0750***
	(0.0105058)	(0.0108833)	(0.0108877)	(0.0108626)	(0.0108643)	(0.0106496)
Inflation	-0.0301***	-0.0318***	-0.0291***	-0.0155**	-0.0241***	-0.0263***
	(0.0057329)	(0.0057682)	(0.0058244)	(0.0058377)	(0.0057798)	(0.0057659)
Institutional Strength						
Voice and Accountability	0.0548					
	(0.0639481)					
Political Stability		-0.0996				
		(0.0571335)				
Government effectiveness			0.0901			
			(0.0698429)			
Regulatory Quality				1.389***		
				(0.0965506)		
Rule of Law					0.810***	
					(0.0949452)	
Control of Corruption						0.546***
						(0.0867682)
Number of obs	823	823	823	823	823	823
LR chi2(16)	630.31	632.61	631.24	839.92	702.65	669.31
Pseudo R2	0.1596	0.1602	0.1599	0.2127	0.1779	0.1695
Countries	50	50	50	50	50	50

*Notes: Standard errors are reported in brackets, and *,**,*** indicate 10%, 5% and 1% level of significance, respectively*

Table 13: Developing Countries Estimation Results for Moody's

Credit Rating	Moody's					
Economic Strength	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
GDP per capita	0.0000820***	0.0000885***	0.0000825***	0.0000584***	0.0000777***	0.0000745***
	(0.0000126)	(0.0000126)	(0.0000126)	(0.0000127)	(0.0000126)	(0.0000127)
Real GDP growth	0.00850	0.00966	0.0113	0.00632	0.00289	0.00150
	(0.0108593)	(0.0109809)	(0.0108842)	(0.0109025)	(0.0108727)	(0.0108799)
Capital Formation	0.0473***	0.0356***	0.0313***	0.0646***	0.0382***	0.0449***
	(0.0071172)	(0.0069323)	(0.0069698)	(0.0071372)	(0.0068965)	(0.0069801)
FDI	-0.0135	-0.0173	-0.0272*	-0.0464***	-0.0270*	-0.0185
	(0.0111029)	(0.0113159)	(0.0113464)	(0.0113114)	(0.0111823)	(0.0111213)
Fiscal Strength						
Government debt	-0.0124***	-0.0113***	-0.0130***	-0.0148***	-0.0153***	-0.0126***
	(0.0015526)	(0.0015446)	(0.0015678)	(0.001572)	(0.001594)	(0.0015528)
Domestic Credit	0.0194***	0.0177***	0.0156***	0.0137***	0.0121***	0.0142***
	(0.0015974)	(0.0016031)	(0.0016418)	(0.0016212)	(0.0016855)	(0.0016501)
CA balance	0.0420***	0.0326***	0.0289***	0.0557***	0.0313***	0.0392***
	(0.0068029)	(0.0066299)	(0.0066677)	(0.006814)	(0.0066421)	(0.00668)
Fiscal Balance	-0.0231	-0.0242*	-0.0201	-0.0480***	-0.00792	-0.0155
	(0.0121854)	(0.0122815)	(0.0121873)	(0.0123587)	(0.0122678)	(0.0122111)
Event Risk						
Total Reserves	0.0723***	0.0696***	0.0775***	0.0933***	0.0891***	0.0799***
	(0.0106864)	(0.0112159)	(0.0108789)	(0.01081)	(0.0108819)	(0.0107886)
Inflation	-0.0217***	-0.0244***	-0.0196***	-0.00708	-0.0168**	-0.0203***
	(0.0053512)	(0.0053506)	(0.0054121)	(0.0054537)	(0.0053912)	(0.005356)
Institutional Strength						
Voice and Accountability	0.394***					
	(0.0641416)					
Political Stability		0.0925				
		(0.0577863)				
Government effectiveness			0.403***			
			(0.0700289)			
Regulatory Quality				1.670***		
				(0.0980369)		
Rule of Law					0.984***	
					(0.0955193)	
Control of Corruption						0.781***
						(0.0932652)
Number of obs	855	855	855	855	855	855
LR chi2(16)	604.05	568.84	599.42	863.24	673.14	636.73
Pseudo R2	0.1423	0.1340	0.1412	0.2033	0.1585	0.1500
Countries	55	55	55	55	55	55

*Notes: Standard errors are reported in brackets, and *,**,*** indicate 10%, 5% and 1% level of significance, respectively*

Table 14: Developing Countries Estimation Results for S&P

Credit Rating	S&P					
Economic Strength	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
GDP per capita	0.0000824*** (0.0000124)	0.0000920*** (0.0000124)	0.0000828*** (0.0000124)	0.0000587*** (0.0000125)	0.0000803*** (0.0000123)	0.0000734*** (0.0000125)
Real GDP growth	0.0378** (0.0115959)	0.0370** (0.0116731)	0.0389*** (0.0116098)	0.0382** (0.0116624)	0.0276* (0.0116408)	0.0298* (0.0116185)
Capital Formation	0.0322*** (0.0065619)	0.0231*** (0.0064386)	0.0194** (0.006462)	0.0497*** (0.0066686)	0.0265*** (0.0064375)	0.0287*** (0.0064576)
FDI	0.0133 (0.0104601)	0.0121 (0.0106556)	-0.00145 (0.010741)	-0.00975 (0.010613)	-0.000423 (0.0105554)	0.00446 (0.010525)
Fiscal Strength						
Government debt	-0.0180*** (0.0015867)	-0.0165*** (0.0015642)	-0.0182*** (0.0015903)	-0.0205*** (0.0016124)	-0.0215*** (0.0016444)	-0.0189*** (0.0015979)
Domestic Credit	0.0227*** (0.0015877)	0.0212*** (0.0015956)	0.0191*** (0.0016208)	0.0169*** (0.0016236)	0.0155*** (0.0016679)	0.0178*** (0.0016325)
CA balance	0.0456*** (0.0068363)	0.0377*** (0.0067528)	0.0335*** (0.0067831)	0.0519*** (0.0068409)	0.0334*** (0.0067691)	0.0406*** (0.0067527)
Fiscal Balance	0.00227 (0.011335)	-0.000423 (0.0113749)	0.00590 (0.0113621)	-0.0115 (0.0114347)	0.0194 (0.0114789)	0.00808 (0.0113741)
Event Risk						
Total Reserves	0.0758*** (0.0108492)	0.0672*** (0.0111901)	0.0785*** (0.010943)	0.0928*** (0.0109165)	0.0944*** (0.0110441)	0.0850*** (0.0109721)
Inflation	-0.0280*** (0.0054954)	-0.0307*** (0.0054985)	-0.0248*** (0.0055664)	-0.0154** (0.0055917)	-0.0234*** (0.0055328)	-0.0265*** (0.0055032)
Institutional Strength						
Voice and Accountability	0.412*** (0.0640381)					
Political Stability		0.0563 (0.05311)				
Government effectiveness			0.422*** (0.0654849)			
Regulatory Quality				1.491*** (0.0936438)		
Rule of Law					1.060*** (0.0933773)	
Control of Corruption						0.805*** (0.0909483)
Number of obs	880	880	880	880	880	880
LR chi2(16)	763.62	723.22	763.77	981.13	852.29	800.95
Pseudo R2	0.1798	0.1703	0.1798	0.2310	0.2007	0.1886
Countries	59	59	59	59	59	59

*Notes: Standard errors are reported in brackets, and *,**,*** indicate 10%, 5% and 1% level of significance, respectively*

The results shown in tables 9-14 are the estimations' outcomes according to the development level. Splitting the sample into developed and developing countries allows for observing any

variation in the explanatory variables across different country groups. Moreover, it will also allow us to observe the ratings' suitability (Gültekin-Karakaş *et al*., 2011). The first variation from the full sample that we observe is in real GDP growth. For developed countries, real GDP growth is significant in model 4 for Fitch and Moody's and for S&P, it is significant in models 4 and 5. However, with a negative sign. Consequently, this goes against the theorised relationship between ratings and GDP growth - this is an interesting finding because it suggests that, holding all else constant, an increase in GDP growth in model 4 for Fitch and Moody's and models 4 and 5 for S&P, for developed countries is associated with a decrease in rating. In reality, however, this has not been the case. Developed countries still have higher and more stable credit ratings despite the growth or deterioration of economic strength. For the developing countries sample, GDP growth is significant for Fitch and S&P, and the relationship is as expected. That is, an increase in real GDP growth will most likely increase the chances of a developing country receiving a higher credit rating.

The second variation is in the explanatory variables for Fiscal Strength. Firstly, Domestic credit, a proxy for a country's level of indebtedness, is not as enormously significant for developed countries. For Fitch, domestic credit is only significant in model 1. For Moody's and S&P, it is only significant for models 1,23, and 6. However, domestic credit has a convincingly significant and positive relationship with ratings across the three CRAs in all six models for developing countries. Suggesting that, holding all else constant, an increase in domestic credit for developing countries will most likely result in a higher credit rating. However, this finding is contradictory because an increase in domestic credit means an increase in the level of indebtedness of a country, which, in reality, hurts credit ratings. This behaviour could potentially be harmful to country ratings in the long run. Secondly, Fiscal Balance is strongly significant in the whole sample for the three agencies. However, for the developing countries sample, it is not as strongly significant. The story is different for developed countries. The fiscal balance is strongly different across all three agencies suggesting that an increase in the fiscal balance will result in a lower credit rating.

The third variation we find is in the indicators of event risk. For both developed and developing countries, inflation has the expected negative relationship with ratings - but the level of significance differs between the country groups – with developing countries having a higher level of significance and only S&P's model 5 finding a significant relationship for developed countries. However, this is explained by the fact that higher inflation levels signal that a government cannot meet its obligations and resorts to inflationary measures to meet

them (Cantor & Packer, 1996). Subsequently, developed countries have more stable government finances than developing countries, thus a lower inflation rate, attributable to the variation in the inflation variable's significance. On the other hand, total reserves for developed countries have a low significance level for Moody's and S&P and no significance for Fitch. However, they are highly significant for developing countries with the expected sign across all three agencies. Suggesting that for developing countries to have higher ratings, they have to have large foreign currency reserves, whereas that expectation is not significant for developed countries.

The last variation is in the institutional strength variables that are very significant with a positive relationship for developed countries for all three agencies across all six models. Theory and previous literature postulate that an increase in these institutional strength variables increases institutional quality and the willingness of a country to meet its debt obligation. However, not all the institutional strength variables are significant in explaining credit ratings assignments for developing countries. For Fitch, only regulatory quality, the rule of law and control of corruption are significant institutional quality indicators. For Moody's and S&P, only Voice and accountability, Government effectiveness, Regulatory Quality, Rule of Law and the Control of Corruption. Subsequently, it suggests that an increase in these variables will likely result in a higher credit rating for developing countries. In contrast, an increase in all the variables for institutional quality will strongly result in a higher credit rating for developed countries.

To further understand the effects of these explanatory variables, we assess the marginal effects that provide detailed information on the effects the parameter estimates have on the probability of observing each rating category (Gültekin-Karakaş *et al*., 2011). For developing countries, the calculated marginal effects are generally higher in the BB, BB+, BBB- and BBB rating category for Fitch and S&P. Similarly, for Moody's, the marginal effects are highest in the Ba1, Baa3 and Baa2 rating category. Suggesting that a percentage point increase in the significant economic strength indicators – GDP per capita, GDP growth and Capital formation – for a developing country increases the probability of that country being in the Ba1, Baa3 and Baa2 or the BB, BB+, BBB- and BBB rating category. Regarding fiscal strength indicators, general government debt, domestic credit and CA balance have the most considerable marginal effects on rating categories. A percentage increase in domestic credit and the CA balance increases a developing country's probability of being in BB, BB+, BBB- and BBB or the Ba1, Baa3 and Baa2 ratings category and a percentage point increase in

government debt decrease that probability. In the case of event risk, total reserves have the highest marginal effects, suggesting a possible increase into BB, BB+, BBB- and BBB or the Ba1, Baa3 and Baa2 categories the CRAs expect developing countries to have significantly large amounts of foreign cash available. The most significant estimates with the most considerable marginal effects for institutional strength indicators are rule of law and regulatory quality. A point increase in regulatory quality increases the probability of a developing country being in BBB-/Baa3 by 23% for Fitch, 25% for Moody's and 19% for S&P. Moreover, A point increase in the rule of law increases the probability of a developing country being in BBB-/Baa3 by 12% for Fitch, 14% for Moody's and 13% for S&P. This marginal effect relationship is a compelling finding. It suggests that in determining a rating, CRAs review a country's quantitative ability to pay factors based on their perspective of the qualitative factors in the particular countries willingness to pay.

For the marginal effects of developed countries, however, the pattern is a bit irregular. The calculated marginal effects for developed countries are generally higher in the AA, AA+ and AAA categories for Fitch and S&P, similar to Moody's with high marginal effects in the Aa2, Aa1 and Aaa categories. In developed country's ratings GDP growth has a negative relationship - in that a point increase in a developed country's GDP will most likely not result in a rating in the AA, AA+ and AAA or Aa2, Aa1 and Aaa category. All the other indicators of economic strengths have a theorised relationship with credit ratings. However, this relationship changes from the AA-/Aa3 category downwards – the marginal effects of GDP growth suddenly become positive as expected, and the marginal effects of GDP per capita and capital formation become negative. The role of institutional strength indicators is even more significant for developed countries. A point increase in the rule of law increases the probability of a developed country being in the AAA/Aaa category by 35% for Fitch, 42% for Moody's, and 38% for S&P. In addition, a point increase in regulatory quality increases the probability of a developed country being in the AAA/Aaa category by 37% for Fitch, 43% for Moody's and 42% for S&P. These results suggest that in rating developed countries, CRAs lack a traditional approach and that based on institutional quality, developed countries achieve favourable ratings regardless of changes in economic conditions.

The existing literature defines bias as when a credit rating agency's sovereign credit rating assignment systematically diverges from the implied changes in a sovereign's critical economic and institutional fundamentals (Tennant & Tracey, 2020). This paper's analysis results align with this premise, suggesting that CRAs are biased towards developed countries

in assessing key economic determinants and against developing countries. Moreover, this bias emanates from how ratings agencies perceive the variations in the qualitative determinants' of institutional strength across country development levels.

5.3 Sovereign Credit Rating Predictions

Following the estimation of the models, we evaluate their goodness of fit in two stages. Firstly, we compute the probabilities of being in each category for countries and years in the data sample using the estimated results. Then we obtain the sample means of the predicted probabilities and compare it to the actual rating distribution in the data (Gültekin-Karakaş *et al*. (2011) for all three agencies, shown in tables 15-17. Secondly, a country's credit rating for that particular year is predicted as the category with the highest probability as determined in the first stage – it follows then that we assess the correct predictions of a few developed and developing countries and allow for one and two notch deviations.

Table 15: Mean predicted probabilities comparison – Fitch

	Fitch					
	Full Sample		**Developed**		**Developing**	
	Actual	Predicted(%)	Actual	Predicted(%)	Actual	Predicted(%)
D	0.8	0.88	0.12	0.14	1.46	1.51
CC	0.12	0.11			0.24	0.21
CCC-	0.25	0.23			0.49	0.44
CCC	0.87	0.79	0.36	0.30	1.34	1.28
CCC+	0.19	0.17			0.36	0.36
B-	2.78	2.51	0.60	0.47	5.10	4.87
B	6.25	5.83	0.72	0.61	12.27	12.05
B+	5.94	6.04	0.24	0.23	12.76	13.55
BB-	7.74	8.28	1.07	1.09	14.09	14.86
BB	5.01	5.32	0.84	0.92	9.48	9.35
BB+	7.12	7.33	3.94	4.23	10.45	10.13
BBB-	9.65	9.54	5.49	5.98	13.61	12.79
BBB	7.55	7.51	5.85	6.21	8.99	8.32
BBB+	4.64	4.84	4.18	4.06	4.86	5.46
A-	5.14	5.40	7.40	6.91	2.79	3.34
A	3.59	3.62	6.68	6.15	0.24	0.30
A+	4.58	4.49	7.64	7.06	1.46	1.19
AA-	3.34	3.16	6.44	6.11		
AA	5.26	5.00	10.62	10.96		
AA+	4.21	3.96	8.23	8.91		
AAA	14.98	15.01	29.59	29.65		

Notes: Obtained from the full sample; developed and developing estimates. The mean predicted probabilities are represented as a percentage.

Table 16: Mean predicted probabilities comparison – Moody's

Moody's						
	Full Sample		Developed		Developing	
	Actual	Predicted(%)	Actual	Predicted(%)	Actual	Predicted(%)
C	0.06	0.12	0.11	0.18	0.23	0.36
Ca	0.11	0.13			1.05	1.05
Caa3	0.63	0.61	0.22	0.24	0.94	0.85
Caa2	0.51	0.44	0.11	0.11	4.91	4.57
Caa1	2.56	2.29	0.33	0.36	11.35	10.99
B3	5.81	5.40	0.56	0.59	9.47	10.19
B2	4.67	4.85	0.11	0.12	12.40	13.22
B1	6.27	6.88	0.44	0.50	8.54	8.45
Ba3	4.67	4.89	1.00	1.07	9.59	9.37
Ba2	5.07	5.23	0.78	0.75	12.05	11.54
Ba1	8.43	8.39	5.00	4.73	12.28	11.84
Baa3	9.57	9.31	7.00	7.02	6.20	6.21
Baa2	6.61	6.66	7.00	7.37	5.50	5.54
Baa1	5.75	5.82	6.00	6.06	3.27	3.54
A3	4.33	4.20	5.33	4.79	0.82	1.06
A2	5.07	4.95	9.11	8.21	0.58	0.63
A1	5.01	5.08	9.22	9.19	0.82	0.60
Aa3	2.74	2.74	4.56	4.67		
Aa2	3.36	3.49	6.56	7.14		
Aa1	2.74	2.75	5.33	5.91		
Aaa	16.01	15.76	31.22	31.00		

Notes: Obtained from the full sample; developed and developing estimates. The mean predicted probabilities are represented as a percentage.

Tables 9-10 compare the actual ratings to the mean predicted probabilities from the full sample and according to development level. For all three agencies and across the data groups, the mean predicted probabilities and the ratio of actual ratings are quite similar – suggesting that the model used in this paper has significant predictive power.

Moreover, the model estimations for Fitch, S&P and Moody's show that compared to developing countries, the model assigns favourable ratings with higher probabilities to developed countries. The model accurately predicts the ratings of Germany, Australia, the United Kingdom and the United States for the three CRAs. For Japan and Canada, the model predicts one notch or two-notch deviation from the actual rating for an average period of 4-5 years followed by an exact match – this captures the procyclical nature of credit ratings. In that, CRAs actively pursue ratings stability by rating through-the-cycle rather than a rating based on the point in time information (Tennant &Tracey, 2016).

Table 17: Mean predicted probabilities comparison – S&P

	S&P					
	Full Sample		**Developed**		**Developing**	
	Actual	Predicted(%)	Actual	Predicted(%)	Actual	Predicted(%)
D	0.29	0.38			0.57	0.70
CC	0.23	0.26			0.45	0.43
CCC-	0.11	0.12			0.23	0.20
CCC	0.46	0.44	0.46	0.56	0.45	0.39
CCC+	1.03	0.88	0.11	0.09	1.93	1.66
B-	4.58	4.29	0.46	0.38	8.64	8.41
B	6.29	6.27	0.69	0.67	12.27	12.83
B+	6.52	6.65	0.23	0.24	12.73	13.60
BB-	7.27	7.58	0.34	0.36	14.09	14.46
BB	7.61	7.53	2.29	2.29	12.84	11.87
BB+	6.52	6.31	3.44	3.27	9.55	8.89
BBB-	7.95	7.92	6.19	6.35	9.66	9.45
BBB	5.89	5.97	5.28	5.64	6.48	6.26
BBB+	5.43	5.96	4.59	4.83	6.25	6.79
A-	4.92	5.24	7.91	7.43	1.93	2.40
A	4.92	4.93	9.40	8.79	0.45	0.50
A+	4.00	3.89	7.34	7.21	0.68	0.64
AA-	3.66	3.38	6.54	6.42	0.80	0.53
AA	3.78	3.59	7.57	8.00		
AA+	3.95	3.75	7.91	8.35		
AAA	14.59	14.64	29.24	29.12		

Notes: Obtained from the full sample; developed and developing estimates. The mean predicted probabilities are represented as a percentage.

For developing countries, however, the prediction pattern is not as clear. Some country ratings estimated as lower than their actual ratings, like China, Brazil, Mexico, Russia and South Africa. For the most part, the estimates for India, Indonesia are in line with their actual ratings, and the estimates for Argentina and Turkey are higher than their actual ratings.

6. CONCLUSION AND RECOMMENDATION

This study attempted to provide unique contributions to the emerging branch of credit rating determinants literature. Firstly we synthesised the work of earlier studies that found that only a handful of variables explain SCRs with the work from the emerging branch that used 27 variables to determine bias. Our results in tables 6-8 find a small number of significant sovereign credit rating determinants, confirming various studies such as Cantor & Packer (1996).

Secondly, this paper expanded on the previous work by Gültekin-Karakaş *et al*. (2011) and Öztürk (2014), who investigated bias only in Moody's assignments. This study used a more extensive dataset that included assignments for the big three agencies, which account for a significant size in the credit ratings industry's market share. Consequently, we provided a more holistic view of bias which implies that S&P, Fitch and Moody's are gatekeepers of access to financial markets for developing countries.

Lastly, the third contribution that this paper attempted to make was to investigate bias in credit rating assignments of the big three credit rating agencies against developing countries and bias toward developed countries. The results from the estimations and predictions suggest that developed countries are assigned higher sovereign credit ratings regardless of their macroeconomic fundamentals. Moreover, we also find that this bias is attributable to how credit rating agencies interpret a country's institutional strength's qualitative judgments.

Fitch, Moody's and S&P use different methodologies in rating countries, but for the most part, their assignments are in agreement with one another. An example of this bias is that of Turkey. Turkey has been documented as having good economic performance in recent years. However, its perceived institutional weakness has resulted in the country being continuously underrated. Moreover, the indebtedness level in the United States is higher than it has ever been. However, this country still has a favourable prime credit rating due to perceptions of institutional quality. Based on our results and the definition of credit rating bias, which defines bias as sovereign credit rating assignments systematically diverging from that implied by changes in critical macroeconomic and institutional indicators. This study concludes that the big three credit rating agencies are biased against developing countries and biased toward developed countries.

We note that a possible explanation for some of the bias against developing countries is attributable to their default history. It is well documented that developing countries have a higher default history, making this an essential variable in explaining the credit rating assignment of developing countries. However, the data for this variable was unavailable for the scope of this paper, hence its exclusion. We recommend that future studies that attempt to study sovereign credit ratings' bias include this prominent variable.

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8. APPENDIX

Table 18: List of countries

Developing			Developed		
S&P	Moody's	Fitch	S&P	Moody's	Fitch
Albania	Albania	Venezuela	Aruba	Australia	Aruba
Angola	Angola	Angola	Australia	Austria	Australia
Argentina	Argentina	Argentina	Austria	Bahamas	Austria
Azerbaijan	Armenia	Armenia	Bahamas	Bahrain	Bahrain
Bangladesh	Azerbaijan	Azerbaijan	Bahrain	Barbados	Belgium
Belarus	Bangladesh	Benin	Barbados	Belgium	Canada
Benin	Belarus	Bolivia	Belgium	Canada	Chile
Bolivia	Bolivia	Brazil	Canada	Chile	Croatia
Bosnia and Herzegovina	Bosnia and Herzegovina	Vietnam	Chile	Croatia	Cyprus
Brazil	Brazil	Bulgaria	Croatia	Cyprus	Denmark
Bulgaria	Bulgaria	Cameroon	Cyprus	Denmark	Estonia
Burkina Faso	China	China	Denmark	Estonia	Finland
Cameroon	Colombia	Colombia	Estonia	Finland	France
China	Costa Rica	Costa Rica	Finland	France	Germany
Colombia	Dominican Republic	Dominican Republic	France	Germany	Greece
Costa Rica	Ecuador	Ecuador	Germany	Greece	Hong Kong
Dominican Republic	Egypt	Egypt	Greece	Hong Kong	Hungary
Ecuador	El Salvador	El Salvador	Hong Kong	Hungary	Iceland
Egypt	Fiji	Zambia	Hungary	Iceland	Ireland
El Salvador	Georgia	Georgia	Iceland	Ireland	Israel
Fiji	Ghana	Ghana	Ireland	Israel	Italy
Georgia	Guatemala	Guatemala	Israel	Italy	Japan
Ghana	Honduras		Italy	Japan	Kuwait
Guatemala	India	India	Japan	Kuwait	Latvia
Honduras	Indonesia	Indonesia	Kuwait	Latvia	Lithuania
India	Jamaica	Jamaica	Latvia	Lithuania	Luxembourg
Indonesia	Jordan	Kazakhstan	Lithuania	Luxembourg	Malta
Jamaica	Kazakhstan	Kenya	Luxembourg	Malta	Netherlands
Jordan	Kenya	Lebanon	Malta	Mauritius	New Zealand
Kazakhstan	Lebanon	Lesotho	Netherlands	Netherlands	Norway
Kenya	Malaysia	Macedonia	New Zealand	New Zealand	Panama
Lebanon	Mexico	Malaysia	Norway	Norway	Poland
Macedonia	Moldova	Mexico	Oman	Oman	Portugal
Malaysia	Montenegro	Mongolia	Panama	Panama	Romania
Mexico	Morocco	Morocco	Poland	Poland	Saudi Arabia
Montenegro	Namibia	Mozambique	Portugal	Portugal	Seychelles
Morocco	Nicaragua	Namibia	Qatar	Qatar	Singapore

Mozambique	Nigeria	Nigeria	Romania	Romania	Slovakia
Nigeria	Pakistan	Peru	Saudi Arabia	Saudi Arabia	Slovenia
Pakistan	Papua New Guinea	Philippines	Singapore	Singapore	South Korea
Papua New Guinea	Paraguay	Russia	Slovakia	Slovakia	Spain
Paraguay	Peru	Rwanda	Slovenia	Slovenia	Sweden
Peru	Philippines	Serbia	South Korea	South Korea	Switzerland
Philippines	Russia	South Africa	Spain	Spain	United Kingdom
Russia	Senegal	Sri Lanka	Sweden	Sweden	United States
Rwanda	South Africa	Suriname	Switzerland	Switzerland	Uruguay
Senegal	Sri Lanka	Thailand	Trinidad and Tobago	Trinidad and Tobago	
Serbia	Suriname	Tunisia	United Arab Emirates	United Arab Emirates	
South Africa	Thailand	Turkey	United Kingdom	United Kingdom	
Sri Lanka	Tunisia	Uganda	United States	United States	
Suriname	Turkey	Ukraine	Uruguay		
Thailand	Ukraine				
Tunisia	Venezuela				
Turkey	Vietnam				
Uganda	Zambia				
Ukraine					
Venezuela					
Vietnam					
Zambia					

Notes: High-income countries are grouped under the developed countries category, and the low income, lower middle income and upper-middle-income countries are grouped under the developing category as classified by the World Bank WDI

Table 19: Variance Inflation Factor

Variable	VIF	1/VIF
Rule of Law	16.50	0.060612
Control of Corruption	10.03	0.099662
Regulatory Quality	8.51	0.117552
Government effectiveness	6.12	0.163440
Political Stability	3.41	0.293012
Voice and Accountability	3.35	0.298127
GDP per capita	2.83	0.352800
CA balance	2.25	0.445011
Domestic Credit	2.09	0.478742
Fiscal Balance	1.95	0.513554
Capital Formation	1.49	0.670602
Total Reserves	1.39	0.721282
Government debt	1.36	0.733578
Inflation	1.32	0.760425
Real GDP growth	1.31	0.764455
FDI	1.09	0.916367
Mean	VIF	4.06

Figure 4: Correlation Matrix

	Credit Rating	GDP per capita	Real GDP growth	Capital Formation	FDI	Government debt	Domestic Credit	CA balance	Fiscal Balance	Total Reserves	Inflation	Voice and Accountability	Political Stability	Government effectiveness	Regulatory Quality	Rule of Law	Control of Corruption
Credit Rating	1																
GDP per capita	0.76***	1															
Real GDP growth	-0.15***	-0.24***	1														
Capital Formation	0.00	-0.13***	0.33***	1													
FDI	0.05*	0.08**	0.01	0.01	1												
Government debt	-0.01	0.14***	-0.25***	-0.18***	0.02	1											
Domestic Credit	0.63***	0.60***	-0.24***	-0.01	0.21***	0.16***	1										
CA balance	0.36***	0.32***	0.01	-0.27***	-0.07**	-0.14***	0.15***	1									
Fiscal Balance	0.25***	0.22***	0.19***	0.00	0.01	-0.35***	0.04	0.55***	1								
Total Reserves	-0.13***	-0.22***	0.08**	0.13***	-0.11***	0.00	-0.10***	0.15***	0.06*	1							
Inflation	-0.43***	-0.32***	0.05	0.02	-0.06*	-0.14***	-0.38***	-0.09***	-0.10***	0.03	1						
Voice and Accountability	0.51***	0.54***	-0.28***	-0.23***	0.09***	0.23***	0.36***	-0.08***	-0.05	-0.45***	-0.25***	1					
Political Stability	0.63***	0.62***	-0.20***	-0.03	0.13***	0.08**	0.49***	0.16***	0.17***	-0.34***	-0.35***	0.61***	1				
Government effectiveness	0.72***	0.69***	-0.21***	-0.04	0.14***	0.18***	0.60***	0.15***	0.07**	-0.31***	-0.41***	0.66***	0.83***	1			
Regulatory Quality	0.83***	0.75***	-0.23***	-0.13***	0.13***	0.12***	0.64***	0.17***	0.11***	-0.32***	-0.44***	0.71***	0.73***	0.84***	1		
Rule of Law	0.84***	0.79***	-0.24***	-0.11***	0.13***	0.17***	0.67***	0.22***	0.12***	-0.31***	-0.41***	0.72***	0.78***	0.88***	0.93***	1	
Control of Corruption	0.79***	0.74***	-0.21***	-0.12***	0.10***	0.14***	0.59***	0.18***	0.14***	-0.31***	-0.37***	0.77***	0.75***	0.84***	0.89***	0.93***	1

* p<0.05; ** p<0.01; *** p<0.001