



Impact of Sovereign Ratings Changes on Interest Rates in Emerging Markets

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Abstract

The array of existing studies have focused on the effect of changes to sovereign ratings on bond prices, equity prices, spreads, default swaps, economic growth, investments, etc. This paper seeks to fill the gap in literature; it aims to quantify the effects that changes to sovereign credit ratings have on interest rates in emerging market economies. With the use of a system GMM model, we find that an upgrade of one notch in foreign currency sovereign credit ratings leads to a 0.35% decrease in interest rates. A one notch upgrade therefore, has minimal impact on interest rates. Whereas a one notch downgrade in ratings leads to a 0.51% increase in interest rates. The results are robust after accounting for endogeneity, use of alternate specification, macroeconomic factors that affect interest rates and sovereign ratings revisions. We conclude that changes in long term foreign currency sovereign credit ratings impact on interest rate through the risk premium which decreases (increases) after an upgrade (downgrade). The effects are larger for a downgrade than that experienced following an upgrade. Future studies can consider the use of additional control variables for: financial liberalization, financial crisis, investor protection and quality of institutions.

DECLARATION

I declare this research report is my unaided work. It is submitted in partial fulfilment of the requirements of the degree of Masters of Management in the field of Finance and Investments at the University of the Witwatersrand, Johannesburg. This research report has never been submitted before for any degree or examination in any other University.

.....
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.....day of 2018

DEDICATION

For my late father, Maj. Celestino Kapolyo Chibamba (Rtd), I know that my success in attaining this Master's Degree would have made you very proud. You are sorely missed and abundantly loved.

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1 Introduction

1.1 Background

The reliance on sovereign credit ratings to provide indicators for country credit worthiness in international financial markets has become of significant importance. Several emerging market economies like South Africa, Brazil, Russia, China, Greece, and Argentina to mention a few, have seen downgrades to their sovereign ratings in recent years. Previous studies (Pukthuanthong-Le *et al.*, 2007; and Chen *et al.* 2013) assert that changes to sovereign ratings affect financial markets through the cost of capital. This paper focuses on emerging markets and developing countries because they are usually characterised with high budget deficits and information asymmetry. Therefore, sovereign credit ratings are of heightened importance, due to the fact that they provide lenders with material information that determines the cost and terms of financing arrangements.

The recent spate of sovereign credit rating downgrades shows how important it is to examine the effects that changes to ratings have on a country's ability and cost of raising funds. Merton (1974) explains that a higher risk premium is associated with lower credit ratings, thereby raising interest rates. This increases debt servicing costs, and negatively affects economic performance, thus putting strain on national budgets leading to reduced spending and higher deficits. Emerging market and developing economies seldom have the capacity to withstand these adverse increased costs of accessing funds in international markets. The citizens in negatively rated countries are forced to bear the brunt through increased cost of debt financed consumption.

Previous studies (Kaminsky and Schumkler, 2002; Chen *et al.*, 2016) show that downgrading (or upgrading) a sovereign may have a drastic impact on stock prices and bond yields via cost of capital. This study goes beyond previous studies by quantifying the impact on interest rates brought about by changes of sovereign credit ratings and providing key information for policy makers. The study will sample an array of emerging markets, by analysing what the impact of changes instituted by ratings agencies have on interest rates.

Reinhart (2002) details the importance of sovereign credit ratings in determining a countries' access to international capital markets and the terms of such finance obligations. In his study that surveys determinants of sovereign ratings; Afonso (2003) states that the relevance of rating the creditworthiness of sovereign borrowers stems from the fact that governments are

the largest issuers of debt instruments in capital markets. Therefore, sovereign ratings are seen as indicators of public and private sector financial wellness.

Afonso (2003) further argues that classification of sovereign public debt goes beyond a measure of the solvency and capacity of interest payment and return of loans; to an assessment of the economic, financial, and political situation of an economy and a measure of a country's development. In addition, Kaminsky and Schmukler (2002) explain that when a country's credit rating is downgraded, all debt instruments in that country will likely get downgraded in light of the sovereign ceiling doctrine. This makes it extremely costly and difficult for commercial banks and corporations that have been downgraded to sub-investment grade in line with the host country to participate in international markets.

This study seeks to quantify the impact of sovereign ratings changes, be it positive or negative, on interest rates. This in turn informs how such changes impact on returns and prices of equities and bond prices, etc. By running regressions on factors that inform ratings changes, the results obtained will provide a set of quantified indicators. These indicators will provide a degree of measure for which policy makers in emerging economies will be able to rely upon, so as to improve that country's macroeconomic management in lieu of improved sovereign risk levels, marked economic growth and favourable credit ratings. Furthermore, the study hopes to aid asset managers with policy formulation and regulation and indeed individual investors.

The study will sample nine emerging market economies, covering the major regions in the world over a period of 20 years from 1996 to 2006.

1.2 Problem Statement

The problem exists in that there is a lack of research that specifically deals with the impact of sovereign ratings changes on interest rates. Previous studies (Kaminsky and Shumkler, 2002; Rowland, 2004; Cantor and Parker, 1996; Chen *et al.*, 2016) have focused on the effect of changes of sovereign credit ratings on bond prices, equity prices, spreads, default swaps, economic growth, investments, etc. Yet the problem remains in that limited studies have been conducted to quantify the effect on interest rates that arise as a result of changes to a sovereign's credit rating.

Sovereign credit ratings convey views of ratings analysts (Amadou, 2002; Erdem and Varli, 2014) about a country's economic and political condition. Investors use this information as an indication of a country's willingness and ability to meet debt obligations. Sovereign credit ratings are of particular importance in emerging markets because they attract (Chen *et al.*

2013; and Chen *et al.*, 2016) investments and capital flow. Negative ratings; increase the cost of capital, which burdens government budgets and private investment, putting a strain on economic activity.

This paper attempts to quantify the effect that changes to sovereign credit ratings pose on interest rates in emerging markets. The paper will assess how changes to sovereign ratings affect the risk premium, which in turn affects interest rates. The study will take into consideration various variables that determine sovereign ratings revisions, when analysing the impact on risk premium and interest rates.

1.3 Objectives of the Study

The main objective of this study is to quantify the impact that Sovereign Ratings Changes (upgrade or downgrade) have on Interest rates and fill the gap in research. This study will adopt a system Generalised Methods of Moments (GMM) on panel data, to run estimation regressions on an extended version of the Taylor rule. According to (Chen *et al.* 2013; and Chen *et al.*, 2016) the GMM system helps to alleviate endogeneity in the estimation model hence results are more robust than other models obtained such as a simple OLS. The equation details functions of interest rates in an open market economy with a focus on emerging markets. The equation will also include determinates of sovereign credit ratings.

1.4 Research Questions

1. What is the effect of changes to sovereign credit ratings and to what extent do these changes affect interest rates in emerging market economies?
2. Are these effects of sovereign credit rating changes on interest rates asymmetric?

1.5 Hypothesis

- i. Sovereign credit ratings have an impact on interest rates in emerging market economies.
- ii. Sovereign credit ratings are asymmetric.

2 Literature Review

2.1 Introduction

Chapter 2 deals with the definition of sovereign credit ratings as a measure of a country's credit risk from a theoretical view point. The chapter reviews the interplay between ratings changes and interest rates on financial assets. In addition, the chapter covers determinates of sovereign credit ratings in emerging markets, with results obtained from empirical studies. Determinates of sovereign credit ratings are used later on, as variables in chapter 3. Criticism levelled against rating agencies and the corresponding link between ratings changes and financial crisis are covered in 2.3.

2.2 Understanding Sovereign Credit Ratings

Pukthuanthong-Le *et al.* (2007) explains that the objective of a sovereign credit rating is to determine a country's overall risk or creditworthiness. This is drawn from a government's willingness and ability to meet its obligations in accordance with the debt issue terms. Sovereign credit ratings are issued by Credit Ratings Agencies (CRA's), which are for-profit organisations providing specialized credit assessments for debt issued by corporates and countries alike. According to Ponce (2012) CRA's perform a dual role of certification through ratings of security issues and dissemination of asymmetric information between investors and borrowers.

Bismondoyal-Bheenick (2005) describes sovereign credit ratings as a mechanism of assessing each government's ability and willingness to service its debts in full and on time. Edem and Varli (2014) suggest that ratings are particularly important in that they provide investors with signals which help to attract capital inflow and investments, especially for emerging markets. The importance of sovereign credit ratings extends beyond a governments ability to raise capital, Christopher *et al.* (2012) to financial intermediaries, corporations, etc. Due to the fact that changes to credit ratings impact on all debt assets such as bonds and equities through increased cost of capital. While bond holders may suffer a decrease or increase in returns depending on the nature of the change to the rating. Enterprises are affected via changes in cost of capital that impacts investments and profitability.

Cantor and Parker (1996) explains that credit rating agencies seldom assign higher ratings to borrowers of the same nationality such as a local municipality, provincial government, or private corporates than those assigned to the home country. As a result when a country's sovereign debt rating is amended all debt instruments in the affected country may have to be

revised especially in the case of a down grade, which can be explained by the sovereign ceiling doctrine.

With the ever growing globalisation of financial markets, credit ratings have become prominent features in financial arrangements. According to Becker and Milbourn (2011) such agreements may have special clauses entrenched in them that require that investments be recalled in an event that the borrower gets downgraded below a given level. In addition, state-run pension funds or mutual funds for instance may impose restrictions on fund managers to invest in certain assets based on their credit rating; such restrictions will normally preclude investments in assets rated as junk.

While a large number of ratings agencies exists globally, the lead assigners of sovereign credit ratings used for purposes of this study are Fitch, Moody's and Standard and Poor's (S&P). Moody's, and S&P dominate the credit ratings market, accounting for nearly 80% of global credit ratings market. Ratings are indicators for relative risk and may vary from time to time based on economic cycles, political factors, etc. Table 1 illustrates the various symbols employed by leading ratings agencies, with a brief classification for each category. It is important to note here that Fitch and S&P utilise the same ratings codes.

Table 1, Credit Rating Symbols

Rating Symbols For Long-Term Debt			
Interpretation	Moody's	Standard & Poor's	Fitch
<u>INVESTMENT GRADE RATINGS</u>			
Highest Quality	Aaa	AAA	AAA
High Quality	Aa1	AA+	AA+
	Aa2	AA	AA
	Aa3	AA-	AA-
Strong payment capacity	A1	A+	A+
	A2	A	A
	A3	A-	A-
Adequate payment capacity	Baa1	BBB+	BBB+
	Baa2	BBB	BBB
	Baa3	BBB-	BBB-
<u>SPECULATIVE-GRADE RATINGS</u>			
Likely to fulfil obligations, ongoing uncertainty	Ba1	BB+	BB+
	Ba2	BB	BB
	Ba3	BB-	BB-
High-risk obligations	B1	B+	B+
	B2	B	B
	B3	B-	B-
Subject to very high credit risk	Caa1	CCC+	CCC+
	Caa2	CCC	CCC
	Caa3	CCC-	CCC-
Near default, with little prospect of recovery of principal and interest	Ca	CC	CC
	C	C	C
Typically in default with little prospect of recovery of principal and interest		D	D

Source: www.globalratings.net

Table 2 illustrates the current long term foreign currency sovereign credit ratings. In addition the table provides the comprehensive number of revisions in the year that the country gets rerated over the sample period. In a year that a country gets rerated, the study records only the first revision to ratings in that year.

Table 2, Country Ratings and Ratings Revision History

Sovereign Ratings

Country Ratings as at end of 2017				Ratings Revisions		
Country	Moody's	S&P	Fitch	Upgrades since 1996	Downgrades since 1996	Total Changes
Brazil	Ba2	BB-	BB	7	3	10
Chile	Aa3	A+	A	4	1	5
China	A1	A+	A+	3	1	4
India	Baa2	BBB-	BBB-	3	1	4
Malaysia	A3	A-	A-	3	2	5
Mexico	A3	BBB+	BBB+	4	0	4
Russia	Ba1	BB+	BBB-	6	4	10
South Africa	Baa3	BB	B	3	3	6
South Korea	Aa2	AA	AA-	6	1	7
Total				39	16	55

Source: www.countryeconomy.com.

2.3 Criticism levelled against Credit Rating Agencies

With a growing importance of credit ratings in the global economy; CRA's have seen a boom in their business owing to the fact that lenders require critical signals of likelihood of defaults by borrowers. Ratings agencies are purported to provide such information to lenders and investors. However, rating agencies have come under immense scrutiny following their role in the recent global financial crisis that started in 2008. The crisis was triggered by a collapse of the subprime mortgage market in the USA and developed into a colossal banking crisis with a collapse of heavyweight Investment Bankers Lehman Brothers and costly bail-outs for several other financial institutions.

According to Hirth (2014) investors investing in corporate and government bonds in the USA at that time were misled by ratings agencies that issued inflated ratings to what was otherwise bad debt. The unfolding events that lead to the subprime mortgage crisis proved otherwise. This led to questions over the legitimacy of ratings, issued by ratings agencies.

Manso (2013) acknowledged the criticism levelled against the ratings business which is seen to be infested with conflicts of interest. He explains that this results from the payment structure in which agencies are paid for their service by the bond issuers, rather than investors. The conflict arises from the fact that credit rating agencies may harbour interests in securing long term business from the issuers of debt that seek favourable ratings. This may result in the loss of integrity of ratings issued by CRA's.

Haspolt (2015) classifies the criticisms levelled against ratings agencies as being; a lack of transparency in their grading methodology, a lack of competition in a market dominated by the three leading agencies, an income model that raises a conflict of interest for ratings agencies, failure of ratings agencies to anticipate a crisis and a propensity to deepen existing crisis.

2.4 Determinants of Sovereign Credit Ratings in Emerging Markets

In a seminal study by Cantor and Parker (1996) in which they analysed eight determinants of sovereign ratings namely; Per Capita Income, GDP Growth, Inflation, Fiscal Balance, External Balance, External Debt, Economic Development and Default History for a sample comprising of 49 both developed and developing countries. They found six factors to be statistically significant namely; per capita income, GDP growth, inflation, external debt, the indicator variables for economic development and default history. However, fiscal policy and external balances were statistically insignificant and the reason for this stems from the fact that; countries seeking favourable credit standing may tend to favour conservative fiscal policies, and the supply of international capital may be limited for countries with low credit ratings.

Canuto (2004) provides similar findings for factors that determine sovereign risk to those presented by Cantor and Parker (1996) vis-à-vis; high per capita income; high economic growth; low total external debt/current account receipts ratio; low central government gross debt/ total fiscal receipts ratio; low inflation rate; a lack of default events in the past 30 years. In addition, Canuto (2004) found a prominent level of commercial openness as provided by trade flows to be significant. Rowland (2004) argues that ratings agencies use similar factors when rating both developed and developing countries. In his study, he found that the following factors were significant in determining credit ratings; GDP per capita and the debt ratio, growth rate, inflation rate.

In a more recent study conducted by Haspolat (2015) in which an analysis of Moody's methodology of grading countries was conducted, the study found that; GDP per capita, governance quality, current account balance, growth performance and growth expectations, being a developed country and having a reserve currency impacted sovereign credit rating positively. While exchange rate volatility, interest payments, debt stock and default occurrences were the factors affecting credit ratings negatively.

The study therefore adopts an intersection set of factors from the various studies above, which include; GDP per Capita, GDP growth rate, Inflation, Debt ratio, Level of Economic Development and Default history.

2.5 Transmission effects of sovereign ratings changes

Pukthuanthong-Le *et al.* (2007) found that the rating agencies provide financial markets with new and tradable information. In addition, changes to bond ratings also impact stocks although the reaction has different signs. After an upgrade, bond market returns are positive while a downgrade has a discernible impact on equity and bond returns and the effects of rating announcement are significantly asymmetric. The impact on equity returns is more visible in the presence of low foreign currency debt, rising inflation and low fiscal balance. While the impact on bond returns following a downgrade is more noticeable when the economy is in contraction as evidenced in emerging market economies which are characterised with high inflation, and low current account.

The above phenomenon can be explained with theoretical background in economics, whereby a change in sovereign ratings alarms investors of a possible default. In the case of a downgrade, investors will seek a higher compensation for the new risk level. This is based on the premise that investors arrive at estimates for compensation to assume risk greater than the risk-free rate. Therefore, in a bond valuation an increase to risk premium increases investor's expected required rate of return. Higher rate of return increases the value of the bond, because the numerator becomes larger in value than the denominator yield to maturity. This will increase the bond value for bond holders but renders new purchases of bonds expensive. In the case of equities, the impact on the value of stocks has an inverse relationship to that on bonds. Almeida *et al.* (2017) explains that an increase in interest rates will lead to increased cost of capital, which in turn leads to reduced expenditure by firms and less returns as a result of increased financing costs. This will lead to a drop in the equity value. Furthermore, Chen *et al.* (2016) assert that unregulated outflow of capital, following a ratings downgrade will lead to increased cost of capital which will hamper credit. This in turn will slow down economic activity and possibly lead into a recession. The opposite is true for positive credit rating revisions.

Changes to sovereign credit ratings affect other debt instruments domiciled in the related country. Research has shown that credit rating changes to foreign denominated currency bonds also affect stock markets in that country. Kaminsky and Schmukler (2002) explain this as emanating from government's decision to amend policy in order to neutralise the effects of

a downgrade which leads to increased cost of capital. Governments may seek to raise additional tax which affects the future profitability of corporations leading to a loss of value of their stocks.

Furthermore, Kaminsky and Schmukler (2002) found that for emerging markets changes to credit ratings cause cross-country contagion in that the effects of changes to one country are felt in its neighbouring countries. In addition, the authors found that upgrades tend to happen in rallies and downgrades happen in economic contractions, leading to the contentions that credit rating agencies contribute to instabilities in emerging markets. Emerging markets are mentioned here because they tend to have problems of information asymmetry. Therefore, when ratings provide new information about a country, the effects tend to be magnified.

2.6 Impact of sovereign ratings changes on interest rates

Changes to sovereign ratings upgrades or downgrades affect interest rates via the risk premium that investors seek as compensation for taking on risk. If a country gets downgraded for instance, lenders or fund managers may seek to relocate their investments to safer investment countries. The downgraded country looking to access foreign funds will pay a higher interest rate as a result of heightened default risk.

Chen *et al.* (2013) provide an explanation as to how sovereign credit rating changes can affect the cost of capital and impede investment through the risk premium. They explain that if a country's risk cannot be entirely diversified away, then a risk premium is necessary to cover for associated country risk. In addition, capital flows resulting from changes to sovereign credit ratings may limit the liquidity of financial markets in the case of a downgrade and therefore a risk premium is required. In both instances real private investment will see a reduction or increase for a downgrade or upgrade respectively.

According to Brooks *et al.* (2004) in the formation of international portfolios a range of fundamental inputs are analysed which may affect the top-down choice of the basic allocation of funds to different regions and national markets. Paramount is the change of sovereign ratings which is a fundamental event that may trigger substantial re-weighting of international portfolios which may subsequently lead to capital flight.

Finnerty *et al.* (2013) assert that markets anticipate ratings changes, and this is more prevalent for downgrades than it is for upgrades. The reasoning behind their assertions is that severe credit monitoring by credit ratings agencies enables the agencies to issue warnings ahead of rating change announcements. These warnings are significant enough to cause a ratings change. As a result, when the actual announcement is delivered the impact on bond

prices is insignificant. The impact of the announcement is magnified for lower rated countries in sub-investment categories than their counterparts in investment categories.

Most literature has focused on the impact that changes to sovereign credit ratings have on; credit default swaps (Ismailescu and Kazemi, 2010; Finnerty *et al.*, 2013), financial intermediaries, bonds and stock returns (Kaminsky and Schumkler, 2002; Brooks *et al.* 2004) private investment (Chen *et al.* 2013) and economic growth (Chen *et al.* 2016).

This study seeks to add to the existing body of knowledge by going beyond previous research and quantifying the effect that changes to sovereign credit ratings (upgrades or downgrades) have on interest rates in emerging market economies. The study employs a panel data of nine emerging market economies over from 1996 to 2016. The countries included in the sample are Brazil, Chile, China, India, Malaysia, Mexico, Russia Federation, South Africa and South Korea. These countries have been selected as a representation of the world's emerging market economies. The countries are picked from all major global regions and include the BRICS nations. According to Marten *et al.* (2014), BRICS nations account for approximately 25% of the world's land mass, with nearly half of the world's population. The results from this study will therefore provide results that can be reliable upon when analysing all emerging markets.

3 Chapter Methodology

3.1 Introduction

Chapter 3 defines the model and specifications used to derive an approximate measure of the impact that changes to sovereign credit ratings have on risk premium and interest rates. Two landmark equations are used to derive estimating tools for both risk premium and interest rate; these are Uncovered Interest Rate-Parity and Taylor Rule respectively. The chapter further provides detailed explanations of determinates of sovereign credit ratings used to augment the two landmark equations.

3.2 Impact of sovereign ratings changes on risk premium

Ratings agencies assign a particular score depending on the country's credit default risk. Therefore, the starting point of this study is to define a method to measure the effects of revisions to sovereign credit ratings on risk premium. This paper will use the uncovered interest rate parity to extract the risk premium. The uncovered interest rate parity can be stated as follows;

$$e_t = E_t e_{t+1} + r_t^f + \rho_t - r_t \quad (1)$$

Where e_t is the current exchange rate, $E_t e_{t+1}$ is the expected future exchange rate, r_t^f is the foreign risk free rate, ρ_t is the risk premium and r_t is the required rate of return.

Mohanty and Klau (2004) explain that shocks to exchange rates usually represent temporary deviations from the long-run value. This can be explained by the fact that central banks are likely to respond to changes in exchange rates by altering interest rates, therefore exchange rates are said to be mean reverting. Bringing the future exchange rate to the left hand side of the equation will lead to the cancelling out of the future and current exchange rates. Therefore, rewriting this equation leads us to the second equation;

$$r_t = \rho_t + r_t^f \quad (2)$$

In equation (2) a shock resulting from a ratings downgrade for example, leads to an increase in the required risk premium ρ_t . This tells us that the risk premium is paramount in determining interest rate, albeit not the only factor. This study seeks to estimate the impact of ratings announcements through changes to risk premium on interest rate.

In order to estimate the impact of sovereign ratings announcements on risk premium, this study augments equation (2) to include the following explanatory variables;

$$\rho_{i,t} = \rho_{i,t-1} + \gamma X_{i,t} + \beta^d D_{i,t}^d + \beta^u D_{i,t}^u + \varepsilon_{i,t} \quad (3)$$

Where $\rho_{i,t-1}$ is the risk premium given in equation (2) at period zero, the variables that affect credit rating from literature are given as X_t , a variable for downgrades D_t^d , a variable for upgrades D_t^u , and error term ε_t . A system Generalised Method of Moments will be used to run panel data regressions on equation (3).

3.3 Impact of sovereign ratings changes on interest rate

The study proceeds to estimate the effect of sovereign credit ratings changes on interest rate, the study will utilise the Taylor Rule (standard open economy reaction function), which assesses the determining factors for interest rate (r at time t) in emerging market economies as given by Mohanty and Klau (2004).

The Taylor Rule equation given in Taylor (2001), is augmented to include the variables for an upgrade $D_{i,t}^u$ and a downgrade $D_{i,t}^d$ for announcements made at time t, in country i, α_0 is a constant and $\varepsilon_{i,t}$ is the error term. Furthermore, α when used on ratings revisions is given as a binary value 0 to denote no occurrence and 1 for occurrence of a comprehensive rating change in a year, while ϕ is a coefficient that estimates the significance of the explanatory variable. The equation is therefore written as follows:

$$r_{i,t} = \phi_r r_{i,t-1} + \phi_\pi \pi_{i,t-1} + \phi_y y_{i,t-1} + \phi_e \Delta e_{i,t-1} + \alpha_0 + \alpha^d D_{i,t}^d + \alpha^u D_{i,t}^u + \varepsilon_{i,t} \quad (4)$$

Where r_t is given as the nominal interest rates, (π_t) is annual rate of inflation, (y_t) is the output gap, (e_t) is log level of real effective exchange rate, and Δ is the first difference operator. The variables will be measured at an annual frequency. In addition to the variables given in Taylor rule, equation (4) is expanded to include dummies for two variables prevalent in literature that determine sovereign credit ratings changes. These are Level of Economic Development and Default History.

Level of economic development and default history are measured by a dummy variable using a binary value. Where 0 represents no default history and 1 represents the presence of a default on debt obligations for a sample nation in the last 30years. In the case of Level of economic development 0 represents countries that are classified as undeveloped and 1 represents countries that are in transition or developed. The study adopts the United Nations Country classification for level of economic development and Moody's default history data, collected over the last 30 years.

Therefore rewriting equation (4) leads us to equation (5):

$$r_{i,t} = \phi_r r_{i,t-1} + \phi_\pi \pi_{i,t-1} + \phi_y y_{i,t-1} + \phi_e \Delta e_{i,t-1} + \sum_{i,t} X_t + \alpha_0 + \alpha^d D_{i,t}^d + \alpha^u D_{i,t}^u + \varepsilon_{i,t} \dots (5)$$

A system GMM will be utilised to run country specific regressions on equation (5).

$$\sum X_t \text{Determinants}_{i,t} = X_1 \text{Level of Economic Development}_{i,t} + X_2 \text{Default History}_{i,t}$$

3.4 Sovereign credit ratings determinants

GDP per capita is the total output of a country given as an average measure of peoples earning in a particular country, it is used as a measure of living conditions in the geographical area being sampled. According to Cantor and Parker (1996) higher earnings lead to a higher tax base which represents the country's ability to payback debt, which in turn serves as a proxy for political stability.

GDP Growth Rate measures a country's economic growth per annum. Cantor and Parker (1996) suggests that a high economic growth rate signals a country's trajectory towards positive fiscal balance and is therefore likely to service debt obligations with relative ease.

Inflation is a proxy for price increases and currency devaluation, in light of rising inflation rates. Central banks in emerging market economies try to maintain a steady level of inflation rate by using contractionary monetary policy. Cantor and Parker (1996) and Rowland (2004) explain that a high rate of inflation indicates structural anomalies in the government's finances. This is evidenced by a country's inability to meet budgetary expenses with money collected from taxes or attained through the issuance of government bonds. Monetary policy altering aimed at stimulating capital flow will lead to a rise in inflation. This short term fix raises living costs for citizenry and results in possible political instability.

External Debt Ratio; the study uses total external debt to exports ratio as defined Canuto (2004) as a measure of external debt. Canuto (2004) asserts that the wider the gap between total external debts of a specific country in relation to its ability to attract foreign currency through export of goods and services. The more burdensome it becomes to meet foreign debt obligations. A high debt ratio signals the likelihood of default. The debt ratio rises when the country's external debt increases more than its exports or local production.

Economic development; Cantor and Parker (1996) explain the inclusion of economic growth, by stating that rating agencies appear to factor a benchmark for which a certain level of economic development erodes the possibility of default risk. Therefore, a proxy for economic development is a simple indicator variable. The variable is used as a bilateral

classification of a country by the United Nations (as shown in table 3), to show whether a country is industrialised or not.

Table 3, UN Country Classification

Country Name	Country Code	UN Country Classification
Brazil	BRA	Developing economies
Chile	CHL	Developing economies
China	CHN	Developing economies
India	IND	Developing economies
Korea, Rep.	KOR	Developing economies
Mexico	MEX	Developing economies
Malaysia	MYS	Developing economies
Russian Federation	RUS	Economy in transition
South Africa	ZAR	Developing economies
United States	USA	Developed economy

Source: United Nations Data Bank

Default history, a country that has defaulted on its debt obligation in the recent past is deemed a credit risk. Beers and Nadeau (2015) provide two examples of sovereign default; the first is failure to meet a contractual obligation to pay interest or principal when they fall due to lenders (external or internal). The other is a failure by a state to meet payments on debt that has been guaranteed by the state where clear payment dates have been outlined. The study uses a dummy variable with a binary figure to demonstrate default history for the sample countries within the last 30 year period. Where the figure 1 represents a default in the last 30 years and 0 represents no default history.

4 Description of Data and Econometric Technique

4.1 Introduction

Chapter 4 provides a detailed description of data, data sources, units of measure and data frequency. The estimation models used on panel data described in 4.2 are covered in subsection 4.3.

4.2 Descriptive statistic results

Table 4 provides a summary of the statistics for the variables pertaining to the research sample of emerging market economies. We derived panel data for the period 1996 to 2016 for our test variables. Table 4 below shows an increase in risk premium as well as nominal lending rates and inflation over the periods spanning 1996 to 2000. This period encompasses the Asian financial crisis of 1998 which caused contagion in the Asian region, which forms a significant part of our sample. In addition Brazil was going through a period of hyperinflation brought about by a combination of structural features of that economy. According to Volpon (2016) the volatile in Brazil's inflation lead to increased policy rate instability, as a result; real rate continued to rise due to increased demand for a risk premium.

Yamazawa (1998) asserts that the Asian crisis started in Thailand with the collapse of the Bhat, as Thailand aimed to peg the local currency to the US dollar. The country ran low on foreign currency reserves causing a collapse of the local currency and the crisis spread as a result of financial contagion in the region.

Similarly the risk premium as well as nominal rates peaked from a 2007 level of 4.9% and 12.96% for risk premium and nominal rates respectively. To 9.18% and 14.27% in 2008 for risk premium and nominal interest rates respectively. The period was characterised by the global financial crisis that followed the collapse of subprime mortgages in the United States of America. According to Utt (2008) the failure in USA market subprime mortgage led to economic and financial market contractions globally. Utt (2008) further asserts that the result came about as 'high default risk' housing loans were repackaged and traded at higher unwarranted ratings, which eventually collapsed when the rate of default increased thus driving global economy in to a contraction.

Table 4 Annual means for empirical data

Year	Risk Premium	Nominal Rates	GDP per capita	GDP Growth	Debt Ratios	Inflation	Output Gap	Exchange Rates
1996	29,95%	38,22%	-375,84	5,73%	4,39%	15,37%	-4,55%	1,90%
1997	15,23%	23,67%	34,99	5,34%	-0,76%	8,24%	0,69%	-3,35%
1998	18,74%	27,09%	-786,67	0,64%	9,55%	9,33%	-9,79%	-3,68%
1999	15,44%	23,43%	115,34	5,02%	2,00%	13,61%	-3,64%	2,44%
2000	8,76%	17,99%	441,02	6,57%	-25,60%	6,06%	3,56%	-0,71%
2001	9,38%	16,31%	-165,73	3,31%	-1,77%	5,98%	-3,36%	-0,92%
2002	10,97%	15,65%	220,74	4,52%	-2,28%	5,46%	0,36%	-0,18%
2003	11,16%	15,28%	458,36	4,89%	-10,40%	5,68%	6,28%	0,72%
2004	8,85%	13,19%	655,71	6,52%	-15,86%	4,15%	7,66%	2,57%
2005	7,25%	13,44%	858,55	5,90%	-13,60%	4,64%	8,82%	1,55%
2006	5,12%	13,08%	926,83	6,88%	-2,85%	4,33%	10,04%	0,86%
2007	4,91%	12,96%	1059,96	7,09%	2,09%	4,86%	13,90%	-0,85%
2008	9,18%	14,27%	355,30	4,39%	-6,30%	7,72%	4,60%	-1,17%
2009	9,44%	12,69%	-912,23	0,13%	18,33%	4,73%	-10,83%	3,75%
2010	7,34%	10,59%	1826,29	6,76%	-3,31%	4,63%	20,49%	0,63%
2011	8,16%	11,41%	1345,84	5,29%	-2,56%	5,37%	13,77%	-0,54%
2012	7,42%	10,67%	118,12	4,26%	11,13%	4,34%	-3,97%	0,24%
2013	6,13%	9,38%	411,90	3,83%	5,44%	4,58%	0,07%	-0,80%
2014	6,60%	9,85%	19,96	3,47%	4,39%	4,64%	-4,16%	-1,76%
2015	7,91%	11,17%	-1407,97	2,48%	8,18%	5,04%	-20,11%	-1,44%
2016	8,42%	11,93%	-89,84	2,36%	7,75%	4,84%	-4,49%	-1,60%

Table 5, presents mean annual empirical data for the emerging market economies used in the sample for the period from 1996 to 2016.

4.2 Data Description

The data for Sovereign Credit Ratings for long-term debt is derived from Moody's, S&P & Fitch. According to Chen *et al.* (2016) S&P is the most active of three major CRA's and the results are least anticipated. However, the study found more rating revisions data from Fitch and Moody's than that available from S&P for our emerging markets sample and period. In order to ensure robustness of results, the study used an average of ratings revisions from both Moody's and Fitch. The study looks to eliminate lagged bias in results by only recording the first comprehensive revision in the year that a country gets rerated.

The sample is comprised of comprehensive upgrades and downgrades of long term foreign currency sovereign credit rating revisions over a twenty year period from 1996 to 2016 for nine emerging markets that are a representation of the major global regions. This paper adopts similar methods to those used by Chen *et al.* (2016) in the construction of a model to estimate the effect of changes in sovereign credit ratings on interest rates.

Data is collected for nominal interest rates, macroeconomic factors that determine interest rates and sovereign ratings changes. In addition, we utilise dummy variables for ratings revisions, default history and level of economic development. The data is obtained from

various sources including; Federal Reserve Economic Data, World Bank's World Development Indicators (WDI), the International Monetary Fund's International Financial Statistics (IFS), DataStream, the United Nations Statistics Division and Bruegel which is a European think tank specializing in economics. Table 4 provides a detailed description of the data used in our estimation, the sources and units of measure.

Description of Variables and Data Source

Table 5, Description of Variables and Data Sources

Variable Name	Definition	Unit of Measurement	Data Sources
Determinants of Sovereign Ratings			
Per capita income	GDP per capita 1996-2016	Thousands of US dollars	World Bank Data
GDP growth	Annual real GDP growth on a year-over-year basis, 1996-2016	Percent	IMF
Inflation	Average annual consumer price inflation rate, 1996-2016	Percent	Federal Reserve Bank of St. Louis
External debt	External debt stocks (% of exports of goods, services and primary income) 1996-2016	Percent	World Bank Data
Indicator for economic development	UN Country Classification as an industrialized country as of September 2015	Indicator variable: 1 = industrialized; 0 = not industrialized	United Nations
Indicator for default history	Default on foreign currency debt since 1990	Indicator variable: 1 = default; 0 = no default	Moody's
Determinants of Interest Rates			
Short term interest rate	Lending interest rate (%)	Percent	World Bank Data
Output gap	The deviation of actual GDP from potential output.	Percent	DataMarket, World Bank Data
Real effective exchange rate	This the log level of the real effective exchange rate where an increase means an appreciation and vice versa	Percent	Bruegel
Other Variables			
Moody's, and Fitch average, checked against S&P ratings	Ratings assigned as of January 01, 1996, by Moody's or Fitch, or the average of the two agencies' ratings	B1(B+)=3; Ba3(BB-)=4; Ba2(BB)=5;...Aaa (AAA)=16	Moody's, S&P & Fitch

Source: Various data sources as indicated in the data sources column

4.3 Econometric Technique

When estimating the effects of sovereign credit ratings revisions on interest rates, the changes to interest rates may be endogenous to revisions to sovereign credit ratings. This is because credit rating revisions bring rise to changes in interest rates. According to Chen *et al.* (2016) endogeneity may also occur as a result of an omitted variable or variables that exist or occur at the same time such as economic reforms or market sentiments. As such a correlation may exist between changes to ratings and the error term, leading to biased estimated coefficients. To negate the effects of endogeneity, the study utilised a panel data approach as described by Bond (2002), a system GMM and a difference-in-differences (DID) technique. The DID technique is conducted by studying the differential effect that sovereign credit ratings changes have on interest rates. The technique calculates the effects of rating revisions on interest rates before and after the rating event.

The study commences by checking for stationarity in the data collected, this was done by running an Augmented Dicky Fuller Test (Unit Root Test). The study then ran regression on equation (3) to estimate the effect of ratings revisions on risk premium using a system GMM. In order to estimate the effects of changes in sovereign credit ratings on interest rates; the study used a difference-in-differences model and then moved on to run separate regressions on equation (5), using a system GMM model.

4.4 Robustness checks

The study adopts various techniques to ensure robustness of the baseline results to alternate specifications and stationarity of results in Table 9. The study makes use of non-overlapping data from two leading ratings agencies Fitch and Moody's; to analyze the effects of sovereign credit rating revisions on the rerated country's interest rates. The study further takes into account alternative estimates by including dummy variables for; level of economic development and default history. The results are robust following the techniques detailed above, evidence that revisions in sovereign credit ratings do affect the interest rates in emerging market economies.

5 Empirical Results

5.1 Introduction

Chapter 5 details empirical results obtained from two estimation models, a system GMM and difference-in-differences technique. The chapter commences with a panel data estimation using a system GMM to analyse the effects of sovereign credit ratings on risk premium. Estimations for the effects of sovereign ratings changes are covered in 5.3 and 5.4. Subsection 5.3 employs a difference-in-differences technique to analyse pre and post ratings effects of ratings revisions on interest rates. Subsection 5.4 provides results for estimation of effects of ratings revisions on interest rates from a panel data regression using a system GMM.

5.2 Relation between risk premium and sovereign credit rating revisions

Effects on Risk Premium using system GMM

Table 5 presents the estimation results obtained from system GMM on panel data regressions using equation (3). Four panel data regressions were run to determine the relationship between revisions in sovereign credit ratings and risk premium. The study derived an average from the regression results (1) to (4). The study found that upgrades have an inverse relationship on risk premium as expected. A one notch positive rating revision resulted in 0.3% decrease in risk premium for the sample of emerging markets over the 20 year period. A negative rating revision has a direct relationship with risk premium as expected. This means that a negative rating change will result in higher risk premium. The results also show that a one notch negative revision will result in 6.0% increase in risk premium. The results are statistically significant at all levels and in line with literature Chen *et al.* (2016).

Our finding are consistent with Cantor and Parker (1996), confirming that downgrades have a more significant impact than upgrades. Furthermore, the study confirms evidence in emerging markets that negative sovereign ratings lead to a higher risk premium. This can be explained by the fact that investors seek a higher return when investing in more risky assets. While an upgrade reduces the required risk premium, the level of compensation is not asymmetric to that required by investors following a downgrade. Therefore, downgrades can lead economies that are in a recession into deeper crisis as suggested by Kaminsky and Schumkler (2002).

Table 6, System GMM estimation on risk premium

<i>Relation between credit rating revisions and risk premium using Generalised Method of Moments</i>					
Variable	(1)	(2)	(3)	(4)	Mean
Constant	0.027*** (0.007)	-0.102** (0.043)	0.011 (0.009)	0.206*** (0.005)	0.036
Upgrade	0,002 (0,006)	0,0278*** (0,008)	0,028*** (0,008)	-0,068*** (0,004)	-0,003
Downgrade	0,062*** (0,011)	0,057*** (0,013)	0,057*** (0,013)	0,066*** (0,004)	0,060
Risk Premium (-1)	0,591*** (0,046)	0,665*** (0,055)	0,665*** (0,055)		0,640
Inflation (-1)	0,116 (0,082)	0,234*** (0,085)	0,234*** (0,085)		0,195
GDP Per Capita (-1)	-0,000** (0,000)	-0,000* (0,000)	-0,000* (0,000)		0,000
GDP Growth (-1)	-0,162** (0,080)	-0,070 (0,123)	-0,070*** (0,123)		-0,101
External Debt Ratio (-1)	0,023 (0,016)	0,056*** (0,019)	0,056*** (0,019)		0,045
EconDev=0 x DefaultHistory=0		0,113** (0,046)		-0,078*** (0,003)	0,017
EconDev=1 x DefaultHistory=1			-0,113 0,046		-0,113
Dummies	No	Yes	Yes	Only	
Specification Tests					
Chi-square p-value	0,920	0,909	0,891	0,998	
R-squared	0,685	0,720	0,720	0,058	
Observations	72	72	72	72	

Note: Table 5 presents regression results estimated using a system generalised method of moments. The dependent variable is the annual risk premium rate. The instruments are Level of Economic Development and Default History. All sets of regression results include a constant term as reported. Upgrade is a comprehensive sovereign credit rating revision in the year of a positive revision. Downgrade is a comprehensive negative sovereign credit rating revision in the year of the revision. GDP per Capita is a comparison of a country's GDP on its purchasing power parity basis divided by population. GDP growth is measured as the average annual real GDP growth on a year-on-year basis. External Debt Ratio is measured as external debt stocks taken as a percentage of (exports of goods, services and primary income). Standard errors are given in parenthesis, level of significance is denoted by (10%*, 5%** and 1%***)

5.3 Relation between interest rate and sovereign credit rating revisions

Effects on Interest Rates using difference-in-differences technique

The study commences with an estimation of the effect of changes in sovereign credit ratings on interest rates, with a difference-in-differences technique as suggested by Chen *et al.* (2016). The approach is intended to remove biases and endogeneity in pre and post-rating amendments relative to interest rates. In addition, it seeks to eliminate biases that may have

arisen from other events when drawing comparisons between rating revisions to interest rates levels.

Table 7Table 6 presents mean and median annual interest rates from the sample of emerging markets collected over a 20 year period. The results given in the table are broken-down into two sample panels, the first being a full sample of ratings changes and the second is a subsample which only considers rating changes that result in rating revisions of two or more notches. The results for upgrades and downgrades are analysed separately for prior and post rating revisions. Data availability and ratings events dictate the number of observations used in this analysis. The findings demonstrate significant increases in interest rates following positive rating revisions.

In the first panel, the average annual interest rate is 21.1% for the three years preceding a positive rating change. While the three year post-rating interest rate average is at 16.2%. The average difference between the two periods is -4.9%, which is statistically significant at a 5% level according to a t-test. The three year average interest rate prior to a downgrade in sovereign credit ratings is 19.58%. While the three year post-negative rating revisions is 19.45%, a difference -0.135% which is statistically significant at a 1% level.

The negative sign on the mean difference in interest rates for the three year prior and three year post negative revision was unexpected. The results obtained from a difference-in-differences model, seem to suggest evidence that central banks manage to narrow the predictable effect on interest rates following a downgrade through monetary policy amendments. However, effects on interest rates following a positive rating revision do not attract similar interventions. This can be explained by the fact that positive revisions bring about stimulants for economic growth, through reduced cost of capital which in turn stimulates private investments as explained by Chen *et al.* (2013).

Furthermore, from the results obtained the study shows significantly large percentage differences between pre and post revisions. This can be explained by the high interest rates experienced in Brazil between 1994 and 2002. The exceedingly high nominal interest rates resulted from contractionary monetary policy employed by the Brazilian central bank in order to control hyperinflation. In that period, the Brazilian Central Bank raised the prime lending rate so high, that real fixed income debt yielded returns in excess of 20%.

The results for the five year prior and post rating periods for both upgrades and downgrades are similar to those from the three year duration periods. Thus positive credit rating changes are synonymous with reduced nominal interest rates in emerging markets. While evidence shows that downgrades for the countries sampled and period show a minor decrease in

nominal interest rate following a negative sovereign credit rating revision. The negative sign can be attributed to outliers in the sampled data.

Table 7, Difference-differences model estimation

Upgrades				Downgrades		
First Panel: Entire Sample						
	3-year-prior-rating	3-year-post-rating	Difference	3-year-prior-rating	3-year-post-rating	Difference
Mean	0.211	0.162	-0.049**	0.196	0.194	-0.001***
Median	0.208	0.161	-0.046**	0.184	0.181	-0.002**
Ratings Revisions	39	39		13	13	
	5-year-prior-rating	5-year-post-rating	Difference	5-year-prior-rating	5-year-post-rating	Difference
Mean	0.209	0.163	-0.047**	0.229	0.190	-0.040**
Median	0.198	0.159	-0.039**	0.233	0.180	-0.053*
Ratings Revisions	34	34		6	6	
Second Panel: With revisions resulting in larger than one notch						
	3-year-prior-rating	3-year-post-rating	Difference	3-year-prior-rating	3-year-post-rating	Difference
Mean	0.270	0.185	-0.084*	0.126	0.100	-0.025**
Median	0.278	0.181	-0.097*	0.126	0.100	-0.026**
Ratings Revisions	4	4		4	4	
	5-year-prior-rating	5-year-post-rating	Difference	5-year-prior-rating	5-year-post-rating	Difference
Mean	0.357	0.169	-0.188			
Median	0.304	0.169	-0.136			
Ratings Revisions	4	4		4	4	

Note: Table 6 presents three year and five year mean interest rates prior to and post positive and negative ratings changes. The first panel is a full sample consisting of all ratings changes while the second panel is a sub-sample with only ratings changes larger than 1 notch. The variations between pre and post rating revisions are examined with the use of a t-test. Level of significance is denoted by (10%*, 5%** and 1%***).

Effects on Interest Rates using system GMM

Table 8 shows results obtained from panel data regressions using a system GMM model, for the relationship between nominal rates and sovereign credit ratings revisions. The findings show that following a positive rating revision, interest rate levels are set to increase by 0.958%. The results are significant at 5% significance level and the coefficient show that impact of upgrades on interest rates is minimal. The positive sign for the coefficient is not in line with literature Chen *et al.* (2016), who found that upgrades lead to lower interest rates (bond yields). An analysis of data on nominal interest rates could explain the misspecification

due to outliers of nominal interest rates from data collected on Brazil over the sample period. The observed high interest rates were brought on by contractionary monetary policy following periods of hyperinflation in that country.

The results following a downgrade are synonymous with previous literature Chen *et al.* (2016) who found that following downgrade interest rates had a negative coefficient. With results showing that a one notch negative rating revision results in 3.22% increase in nominal interest rates, significant at all levels. The results affirm similar further findings from studies conducted by Kaminsky and Schumkler (2002) and Pukthuanthong-Le *et al.* (2007). They found that downgrades lead to increased bond spreads as presented in the literature review. An upgrade in ratings will lead to an increase in equity prices and capital flows into the rerated country, paving the way for heightened investments as a result of reduced cost of capital. In the event of a downgrade, interest rates increase as a result of increased default risk as signalled by CRA's and bond spreads will increase.

The regression results show statistically significant coefficients at all levels and with correctly specified signs for; lagged nominal interest rates, output gap and real effective exchange rates. Inflation has a negative coefficient and is insignificant when analysing regression results for equation (4) the Taylor Rule equation. The results are otherwise significant at 5% level of significance when regressed in the augmented Taylor Rule. The results suggest that a rise in inflation will lead to a decrease in interest rates. The results for inflation are different from those obtained by Mohanty and Klau (2004) who found a positive correlation between inflation and interest rates. The negative coefficient seems to suggest a strong presence of contractionary monetary policy over the sample period.

Table 8, System GMM estimation on nominal interest rates

<i>Relation between credit rating revisions and interest rate using Generalised Method of Moments</i>					
Variable	(1)	(2)	(3)	(4)	Mean
Constant	0.001 (0.004)	-0.004 (0.003)	-0.001 (0.004)	-0.007 (0.008)	-0.003
Upgrade		0.011** (0.004)	0.006 (0.007)	0.012*** (0.004)	0.010
Downgrade		0.035*** (0.005)	0.025*** (0.009)	0.036*** (0.006)	0.032
Nominal Interest Rates (-1)	0.995*** (0.058)	1.001*** (0.046)	1.004*** (0.056)	1.007*** (0.051)	1.002
Inflation (-1)	-0.062 (0.044)	-0.103** (0.041)	-0.145** (0.080)	-0.098** (0.041)	-0.102
Out-put Gap (-1)	0.011** (0.0045)	0.035*** (0.009)	0.034*** (0.011)	0.034*** (0.009)	0.053
Real Effective Exchange Rate(-1)	-0.210*** (0.027)	-0.098*** (0.033)	-0.064 (0.071)	-0.094*** (0.031)	-0.117
EconDev=0 x DefaultHistory=0				0.003 (0.007)	0.003
EconDev=1 x DefaultHistory=1			0.006 (0.007)		0.006
Dummies	No	Yes	Yes	Yes	
Specification Tests					
Chi-square p-value	0.910	0.451	0.656	0.520	
R-squared	0.940	0.938	0.946	0.946	
Observations	81	81	81	81	

Table 7, presents regression results estimated using a system generalised method of moments. The dependent variable is the annual nominal interest rate. The instruments are Level of Economic Development and Default History. All sets of regression results include a constant term as reported. Upgrade is a comprehensive sovereign credit rating revision in the year of a positive revision. Downgrade is a comprehensive negative sovereign credit rating revision in the year of the revision. Inflation is measured as the average annual consumer price inflation rate. Output Gap is given as percentage being the deviation of actual GDP from potential output. Effective exchange rate is measured as the log level of the real effective exchange rate where an increase means an appreciation and vice versa. Standard errors are given in parenthesis, level of significance is denoted by (10%*, 5%** and 1%***)

Effects on Interest Rates using system GMM without Brazil

Without dispelling the findings above, we conducted a second set of regressions excluding Brazil from the data set, the estimation results are presented in Table 8. From a set of four regressions, the study derives an average estimation for the effect of ratings revisions on interest rates. Taking into account various macroeconomic factors present in the Taylor Rule, level of economic development and default history. The study finds that a one notch upgrade in ratings for emerging markets leads to a 0.35% decrease in interest rates. A one notch downgrade leads to 0.51% increase in interest rates. The results for a downgrade are

statistically significant at 10% level of significance when using an augmented Taylor Rule with variables for ratings changes only.

The coefficient on interest rates is statistically significant and the signs are correctly specified. An upgrade in ratings will lead to increase in bond spreads denominated in the currency of the rerated country. This will attract capital flows into the rerated country, paving the way for heightened investments as a result of reduced cost of capital. In the event of a downgrade, interest rates increase as a result of increased default risk as signalled by CRA's.

The results obtained after omitting Brazil show all variables now poses coefficients with correctly specified signs. Lagged nominal rates have a positive sign and on average account for 81% of movements in nominal interest rates in emerging markets. Inflation has a positive coefficient and found to have no significance in determining nominal interest rates in emerging market economies. Output gap was found to have a positive coefficient and statistically significant at all levels. Finally, exchange rates were found to have a negative coefficient and statistically significant at levels. The results are robust following a change in specifications of control variables.

The results from the study excluding Brazil in the sample confirms findings by (Kaminsky and Schumkler 2002; Pukthuanthong-Le et al. 2007 and Chen et al 2016). That downgraded countries, experience increased costs of capital and that upgrades lead to a decrease in interest rates. The effects of downgrades are therefore, capital flight, higher cost of capital in international markets, among other things. This leads to lower investments in the rerated country, as the heightened cost of capital makes new investments and servicing of current obligations much more expensive. A downgraded country will also experience lower government spending, leading to higher levels of unemployment, higher living expenses, etc. All of these adverse factors will lead downgraded country to lower economic growth and the possibly into an economic downturn.

Table 9, System GMM estimation on Nominal Interest Rates Excluding Brazil

Relation between credit rating revisions and interest rate using Generalised Method of Moments

Variable	(1)	(2)	(3)	(4)	Mean
Constant	0.013*** (0.004)	0.006* (0.004)	0.009** (0.004)	0.01** (0.008)	0.001
Upgrade		-0.006 (0.004)	-0.002 (0.005)	-0.002 (0.005)	-0.004
Downgrade		0.008* (0.004)	0.004 (0.005)	0.003 (0.005)	0.005
Nominal Interest Rates (-1)	0.765*** (0.062)	0.860*** (0.004)	0.812*** (0.087)	0.812*** (0.087)	0.821
Inflation (-1)	0.029 (0.046)	0.038 (0.051)	0.026 (0.067)	0.026 (0.067)	0.049
Out-put Gap (-1)	0.005*** (0.002)	0.004*** (0.002)	0.003** (0.001)	0.003** (0.001)	0.004
Real Effective Exchange Rate(-1)	-0.168*** (0.027)	-0.146*** (0.043)	-0.153*** (0.052)	-0.153*** (0.052)	-0.165
EconDev=0 x DefaultHistory=0				-0.009 (0.005)	-0.009
EconDev=1 x DefaultHistory=1			0.009 (0.005)		0.009
Dummies	No	Yes	Yes	Yes	
Specification Tests					
<i>Chi-square p-value</i>	0.756	0.751	0.764	0.764	
<i>R-squared</i>	0.742	0.728	0.739	0.739	
Observations	81	81	81	81	

Note: Table 8 presents regression results estimated using a system generalised method of moments. The dependent variable is the annual nominal interest rate. The instruments are Level of Economic Development and Default History. Upgrade is a comprehensive sovereign credit rating revision in the year of a positive revision. Downgrade is a comprehensive negative sovereign credit rating revision in the year of the revision. Inflation is measured as the average annual consumer price inflation rate. Output Gap is given as percentage being the deviation of actual GDP from potential output. Effective exchange rate is measured as the log level of the real effective exchange rate where an increase means an appreciation and vice versa. Standard errors are given in parenthesis, level of significance is denoted by (10%*, 5%** and 1%***)

Unit Root Tests

From the raw data collected it was noted that; inflation, GDP per Capita and GDP growth for Brazil and India were non-stationary. The study treated the data by running a first difference to achieve stationarity. Table 9 below shows results for raw data in the fourth column and results after differencing to order 1 are in column five.

Table 10, Unit Root Test

Panel data unit root test: annual data				
Variables	ADF-Fisher Chi-square	ADF-Choi Z-stat	Before differencing	After differencing
Inflation	100,87*** (0.000)	-7.50*** (0.000)	I(1)	I(0)
GDP per Capita	67,82*** (0.000)	-5,66*** (0.000)	I(1)	I(0)
GDP Growth	75,22*** (0.000)	-5,88*** (0.000)	I(1)	I(0)
Exchange Rates	84,35*** (0.000)	-7,02*** (0.000)	I(0)	I(0)
External Debt Ratio	67,33*** (0.000)	-6,16*** (0.000)	I(0)	I(0)
Nominal Rates	33,53*** (0.01)	-2,61*** (0.00)	I(0)	I(0)
Output Gap	64,28*** (0.000)	-5,39*** (0.000)	I(0)	I(0)
Risk Premium	54,80*** (0.000)	-4,62*** (0.000)	I(0)	I(0)

Note: Table 8 illustrates the results from an Augmented Dicky Fuller test ADF- Fisher Chi square and ADF-Choi Z-stat for unit root, before and after first differencing. Standard errors are given in parenthesis, level of significance is denoted by (10%*, 5%** and 1%***)

Graphical illustration of raw panel data collected for the nine emerging markets is provided in figure 1. Figure 2 is a graphical illustration of stationary panel data for all variables collected for the emerging markets sample.

Figure 1, Raw Data

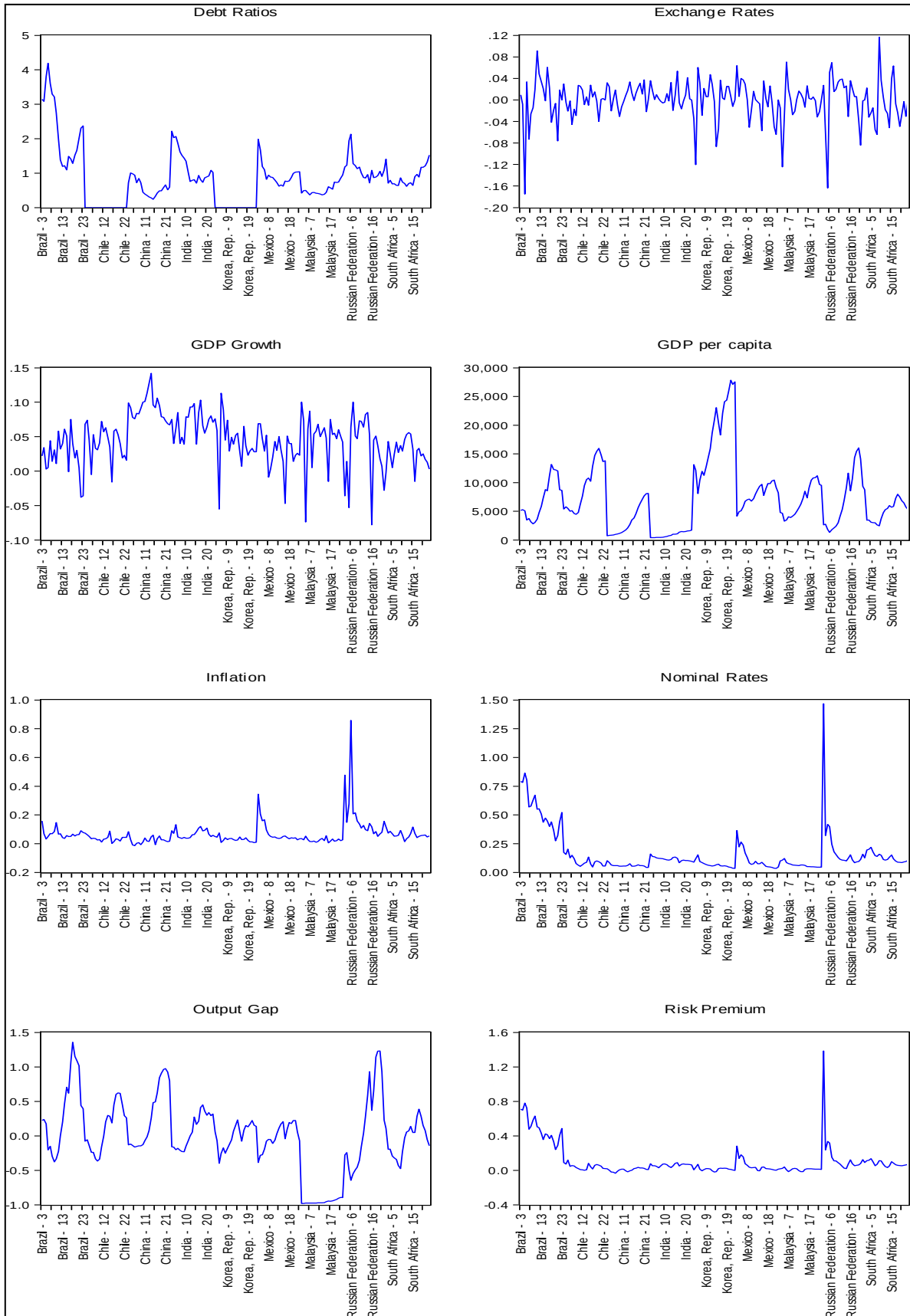
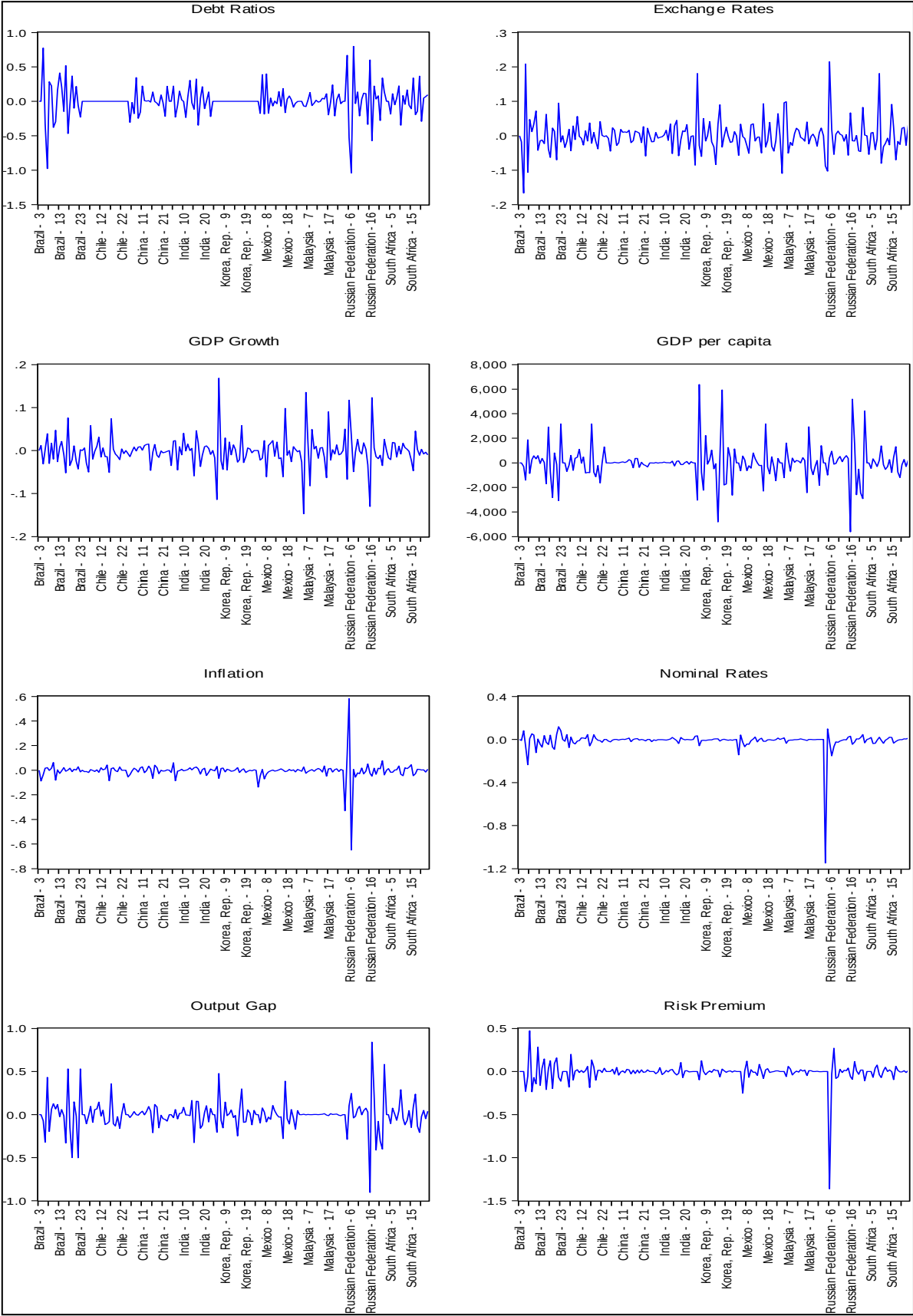


Figure 2, Stationary Data



6 Conclusion

This study assessed the effects that sovereign credit ratings revisions have on interest rates, with a focus on emerging market economies. Most research to date has focused on the effects of credit ratings; on financial market assets, investments, economic growth, etc. To fill this gap in literature, this paper estimated the effects of sovereign credit ratings revisions on interest rates, the study adopt a system GMM on panel data and a difference-in-differences in our estimation.

The paper set out by asking two research questions as follows;

1. What is the effect of changes to sovereign credit ratings and to what extent do these changes affect interest rates in emerging market economies?
2. Are these effects of sovereign credit rating changes on interest rates asymmetric?

The study set out to answer these questions by investigating the effects on interest rates following ratings revisions. In doing so, the paper takes into consideration other macroeconomics factors that influence interest rates as evidenced in the standard open economy reaction function suggested by Mohanty and Klau (2004). The study further considered various determinants of sovereign credit ratings that were found to be significant by Cantor and Parker (1996). This study adopted a similar estimation technique to the one employed by Chen *et al.* (2016) in their estimation of the relationship between ratings revisions and economic growth. To ensure robustness of results this study used an average of long term sovereign debt rating results from Moody's and Fitch collected over a 20 year period for 9 emerging market economies. The countries were selected from the major global regions so as to establish significant estimations that are suitable for the worlds emerging market economies.

According to Chen *et al.* (2016), sovereign credit ratings are meant to reflect a country's ability to service its financial obligations. Therefore, credit ratings inform investors of a country's default risk, and based on that assertion, investors assume a certain level of compensation for taking on such risk. Risk premium is associated with compensation of assumed risk on investments. Using a system GMM model, the study estimated the interplay between ratings revisions and risk premium, being the channel through which ratings revisions affect interest rates. This study found that a one notch positive revision in sovereign credit ratings leads to a decrease in risk premium of approximately 0.3%. A one notch downgrade on the other hand results in an increase in risk premium of 6%.

The study then ran a separate system GMM regression to estimate the effect of ratings revisions on nominal interest rates. The findings were that, a one notch positive revision leads to an increase in interest rates of approximately 0.958%. The results were contrary to literature (Kaminsky and Schumkler 2002; Pukthuanthong-Le *et al.* 2007 and Chen *et al.*) who suggest that positive ratings revisions lead to a decrease in interest rates. However, it can be explained by evidence of outliers in the nominal interest rates data collected for Brazil. The South American country experienced high interest rates as a result of contractionary measures employed to curb hyperinflation over the sample period. The results obtained following downgrades show a significant increase in interest rates of approximately 3.22% for a one notch decrease in ratings. The positive sign on the coefficient sign is consistent with literature (Kaminsky and Schumkler 2002; Pukthuanthong-Le *et al.* 2007 and Chen *et al.*). This affirms Kaminsky and Schumkler's (2002), findings that downgrades can intensify negative effects of an economy in recession.

The study then carried out an alternate estimation excluding Brazil from the panel data used in the system GMM model. The results obtained showed that a one notch upgrade (downgrade) leads to 0.35% and (0.51%) increase (decrease) in interest rates in emerging markets economies. These results were found to correspond with previous findings by (Kaminsky and Schumkler 2002; Pukthuanthong-Le *et al.* 2007 and Chen *et al.*), and can be relied upon for emerging market economies.

In answering the second research question, the paper provides evidence in the results that show that impact of sovereign ratings changes on interest rates are not asymmetric. Downgrades in sovereign credit ratings have a larger impact on interest rates in comparison to upgrades. In fact, results show that an upgrade in sovereign ratings leads to a minimal increase in interest rates. One notch upgrades therefore, yield insignificant benefits in reducing cost of capital in emerging market economies.

As part of future research, it would be interesting to analyse the robustness of the results after accounting for further factors such as; financial liberalization, financial crisis, investor protection and quality of institutions.

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