GRADUATE SCHOOL OF BUSINESS
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THE IMPACT OF SOVEREIGN CREDIT RATING CHANGES ON FINANCIAL MARKET RETURNS IN AFRICA

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DECLARATION

I declare that the work on which this thesis being submitted to the Graduate School of Business at the University of Cape Town in fulfilment of the requirements for the degree of Doctor of Philosophy is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in any other university.

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DECEMBER 2017

ABSTRACT

In both developed and developing countries, the extent to which sovereign credit rating announcements bridge the information gap between investors and issuers of securities is debatable. Thus, this thesis investigates the effects of the information provided by credit rating agencies on financial markets in 30 African countries during the period of 1994 to 2014 in order to determine whether long-term foreign currency sovereign credit rating announcements contain material information that influences the secondary market stock and bond returns.

The analyses draws the following findings. First, African financial markets are weakly sensitive to sovereign credit rating announcements, which implies that there is no significant evidence of excess market returns influenced by sovereign credit rating announcements. Hence, it is inferred that the announcements of sovereign credit ratings do not significantly change the African financial market returns because they are already perceived to be risky markets, and thus attract mostly passive and long-term investors. Second, the changes in sovereign ratings do not have the same implications for both stockholders and bondholders as shown by the weak positive association between sovereign credit ratings and stock and bond markets. Third, there are marginal regional sovereign rating spillover impacts that are quickly absorbed into capital markets trading long-term securities. However, there are marginal spillover effects that persist over longer time periods in sovereign ratings of countries in the same region from a sovereign rating change in a neighbouring country. These results imply that the regional bilateral linkages between countries serve as channels of capital and sovereign credit rating information flow. Lastly, the sovereign credit ratings do not significantly impact bond market efficiency. In contrast, stock markets show evidence of weak form efficiency implying that long-term sovereign credit ratings positively affect equity market efficiency in Africa.

Thus, the empirical findings in this thesis show that the operations of credit rating agencies and their sovereign credit ratings appear to be less important in the operation of stocks and bond markets in Africa. Governments should however take cognizance of

the long-term information exchange between investors and borrowers, and the consequential nature of credit ratings to proactively manage the risks of negative sovereign credit rating announcements.

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LIST OF ACRONYMS

AR	Abnormal Return
AAR	Average Abnormal Return
AfDB	African Development Bank
AMEX	American Express Company
AMU	Arab Maghreb Union
APEC	Asia Pacific Economic Cooperation
ARCH	Autoregressive Conditional Heteroskedasticity
CAR	Cumulative Abnormal Returns
CEN-SAD	Community of Sahel-Saharan States
COMESA	Common Market for Eastern and Southern Africa
CRA	Credit Rating Agencies
CRSP	Center for Research in Security Prices
CSI	Country Stock Index
DAX	Deutscher Aktienindex
DCC	Dynamic Conditional Correlation
DJIA	Dow Jones Industrial Average
EAC	East African Community
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EGARCH-M	Exponential GARCH-in-mean
EMH	Efficient Market Hypothesis
FDI	Foreign Direct Investment
FTSE	Financial Times Stock Exchange
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GARCH-M	GARCH-in-mean
GDP	Gross Domestic Product
GVAR	Generalized VAR
IFC	International Finance Corporation
IGAD	Intergovernmental Authority for Development

IMF	International Monetary Fund
JSE	Johannesburg Stock Exchange
MDGs	Millenium Development Goals
NASDAQ	National Association of Securities Dealers Automated Quotations
NYSE	New York Stock Exchange
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
RWH	Random Walk Hypothesis
SADC	Southern African Development Community
SARB	South African Reserve Bank
S&P	Standard and Poor's
SBI	Sovereign Bond Index
SCR	Sovereign Credit Rating
STR	Smooth Transition Regression
UEMOA	West African Economic and Monetary Union
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
US	United States
VAR	Vector Autoregression
VIX	Volatility Index
WAMZ	West African Monetary Zone
WB	World Bank
WDI	World Bank's World Development Indicators

DEDICATION

I dedicate this thesis to my parents, Esnath and Moses (the late), it has always been your wish that I be educated.

CHAPTER 1

INTRODUCTION

1.1 Background

Traditionally, sovereign borrowing for national governments across the world have been through bilateral agreements between countries, loans from multinational financial institutions and floating sovereign securities on capital markets. According to the Organisation for Economic Co-operation and Development (OECD) report (2015), sovereign borrowing through selling bonds on both international and domestic capital markets has grown to become an attractive and relatively easy way for central governments to access capital for structural developments rather than borrowing from supernational organisations such as the World Bank (WB) and International Monetary Fund (IMF) (Vernazza, 2014). The IMF reports that national governments have become the largest capital market borrowers, and their credit standing serves as a key benchmark for the world's capital markets (Arezki *et al.*, 2011). Sovereign debts, globally, have been steadily increasing in the past 20 years as national governments have been issuing foreign currency bonds in order to finance infrastructure and stimulate economic growth (Mateev, 2012). Investors, therefore constantly seek an accurate understanding of sovereign default risk to assess sovereigns' creditworthiness when setting a required return (Elkhoury, 2008). Thus, Sovereign Credit Rating[1] (SCR) has become important for both emerging and developed nations.

In the 1990s, unfavourable economic and financial conditions led many African countries to undertake economic reforms. With the support of IMF and the WB, structural adjustment programmes were rolled aimed at achieving private-sector-led growth through a market based system (Beegle *et al*., 2016). Financial liberalisation was a significant component of these reforms, with countries granting their central

[1] Cantor and Packer (1996) define SCRs as assessments of the relative likelihood that a borrowing government will default on its obligations. Governments generally seek credit ratings to ease their own access to international capital markets, where most investors, particularly from developed countries, prefer rated securities over unrated securities of apparently similar credit risk.

banks autonomy to structure their monetary policy, liberalise interest rates, abolish direct allocation of credit and most importantly, develop a conducive environment for proper functioning of financial markets (Carmen and Ioannis, 2003). Many analysts were optimistic that Africa's economy could double its growth trend in the new millennium, recommending African countries to embrace more open financial policies to improve access to international capital markets (Sachs and Warner, 1997).

Today, more than two decades after the initiation of liberalisation in most African countries, the financial reforms appear to have had limited effect on the Africa's economies, mainly because they failed to adequately deal with structural and institutional issues in the sector (Joffe, 2015). Consequently, capital to finance private sector projects is still unavailable; and when it is available, the cost of credit is beyond the reach of the economically active population, thus constraining private sector growth (Kose *et al.*, 2009). Hence, liberalization did not close the gap in the provision of services by the formal sector (Collier, 2014). Kasekende (2015) further emphasises that the removal of barriers to entry did not necessarily introduce competition because new financial institutions are usually small and fragile. In the same spirit, Makina (2005) points out that, governments' exit from the financial sector control did not necessarily remove patronage networks because government owned financial institutions were replaced by highly connected private banks with oligopolistic behaviour, providing lines of credit to politically connected corporates and individuals.

African governments have also failed to make significant progress in liberalizing capital account transactions, maintaining controls over capital receipts and outflows, and controlling portfolio investment (Carmen and Ioannis, 2003; Fowowe, 2013). Following the weak financial sector support, corporate lending is still heavily geared towards the short end of the market and few institutions engage in long-term lending (Zins and Weill, 2016). On the other hand, banks have been avoiding funding informal sectors, citing excessive risk exposures (Ergun and Ozlen, 2012). This situation in turn creates disintermediation and financial inefficiencies, thus reducing the effectiveness of monetary policy on macroeconomic aggregates (Kose *et al*., 2009).

In Asia, Eastern Europe and Latin America in contrast, liberalization has led to financial deepening as measured by the credit and monetary aggregates (Fowowe, 2013). Carmen and Ioannis (2003) argue that, despite failing to deliver positive outcomes as expected, financial market independence remain the most attractive feature of the African markets. Thus, Carmen and Ioannis advocate that cleaning the financial system after decades of overregulation is a gradual process which can also be very costly considering that central banks need recapitalization. Kasekende (2015) adds that the success of the financial reforms also depends on political willingness to take hard decisions aimed at strengthening financial services, technology, infrastructure, efficiency, monetary policy management and corporate governance in critical institutions.

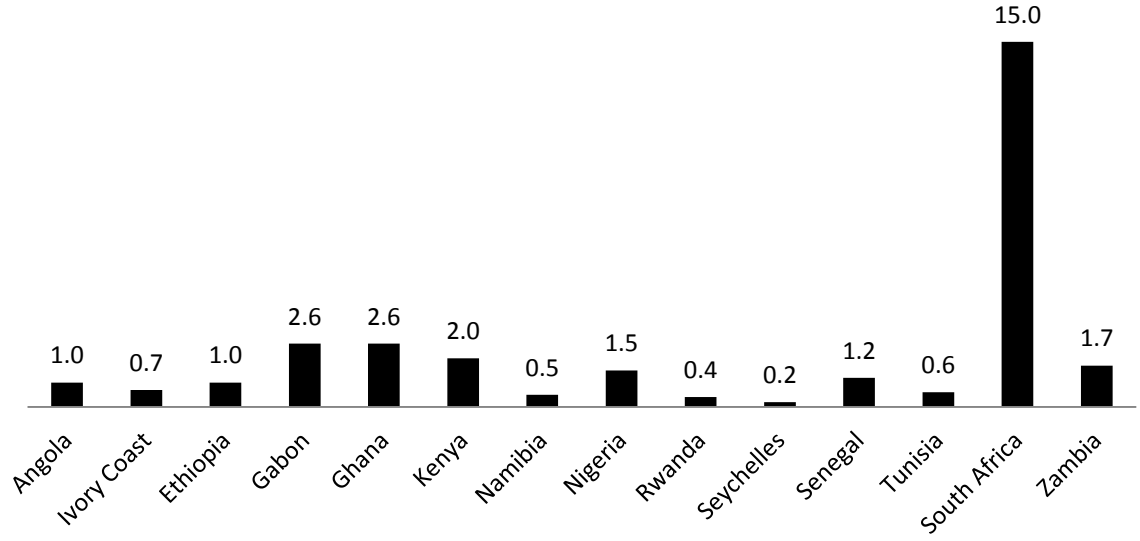
Despite these constraints, Africa remains one of the world's fastest-growing continents with a Gross Domestic Product (GDP) of 6 percent, expected to be maintained up to 2023 (Young, 2013). In recent years, most African nations have seen improved governance associated with political stability, and strengthened regulatory and legal systems (Mcmillan and Harttgen, 2014). Fatnassi *et al*. (2014) however attribute the continent's economic growth to sovereigns' access to international capital markets. Hence, the continent has increasingly moved into the global limelight as a promising investment destination despite preconceived risks of investing in its turbulent environment (Flor and Hesel, 2015).

Capital flow has been increasing despite a number of negative fundamentals such as; illiquid markets, high political risk, currency volatility, commodity price shocks, climate change and disease outbreaks (Massa, 2009). Foreign Direct Investment (FDI) flows to Africa increased from less than US$ 15 billion in 2001 to about US$ 57 billion in 2014, with declines in 2009 and 2010 due to the global financial crisis (United Nations Conference on Trade and Development (UNCTAD), 2015). Net portfolio equity inflows grew from approximately US$7 billion in 2001 to reach US$ 16 billion in 2010. Bond inflows increased from close to US$ 2 billion in 2001 to US$ 7 billion in 2007, but turned

negative in 2008 due to the global financial crisis (World Bank, 2015).

Approximately 38 percent of the capital flow into African markets has been through sovereign debt, which constitutes debt instruments issued by the national government of a country; usually denominated in a foreign currency (Mu *et al.*, 2013). The bond markets have been steadily growing in recent years with most countries benefiting from greater access to financing and deepening global financial markets, though the local debt markets remain under-developed in terms of depth and breadth (Joffe, 2015). Africa's bond (local and Eurobond) markets have witnessed one of the greatest periods in bond issuance with approximately $15 billion floated by Sub-Saharan region governments between 2011 and 2013 (Wallace and Sivabalan, 2015). Global investors have been moving their capital into African bond markets in search of high yields given the current low interest-rate environment in many of the developed markets, which has lured many governments to issue large bonds to finance their funding deficits, with almost all the bond issues being over-subscribed (Patel, 2014). Figure 1.1 shows the total of sovereign bonds issued by each African country with a sovereign rating as at December 2014.

Figure 1.1: Total Eurobond Issuance for each African country (US$Billion)



Source: Primary data

On the other hand, many African countries have unstable economies, and consequently, their governments are often forced to issue sovereign bonds in United State Dollars (US$) (Andrianaivo and Yartey, 2010). Hence, as can be seen from Table 1.1 below, governments have been incurring significant foreign currency denominated external debts, exposing their position to exchange rate fluctuations (Joffe, 2015) and default risk (Wallace and Sivabalan, 2015). Consequently, the sovereign bonds need to be issued at a discount to compensate for these associated risks (Stulz, 1999).

In addition to US dollar denominated bonds, many African countries have also started issuing Eurobonds, with 28 African countries issuing a combined US$447 billion Eurobonds as at December 2014 (Masetti, 2015). However, Pretorius and Botha (2014) argue that high levels of government debt results in lower levels of private investment leading to lower future economic growth once the debt reaches significant levels of around 90 percent of GDP. Hence, total domestic government borrowing position of each specific country needs to be considered to ensure that additional government debt will not have a negative impact on the long-term economic growth of the country. The IMF (2016) further urge governments to build proper yield curves to enable the development of corporate bond markets and of local currency domestic debt markets, instead of issuing debt at whichever maturity is cheapest.

Table 1.1: Sovereign rated external debt (US$ Billions)

Country	2013	2014	Country	2013	2014
Angola	24.00	28.62	Lesotho	0.89	0.90
Burkina Faso	2.56	2.85	Libya	6.03	5.24
Benin	2.37	2.64	Morocco	39.85	43.99
Botswana	2.43	2.26	Mali	3.42	3.63
DR Congo	6.08	6.56	Mauritius	10.92	11.83
Congo	3.45	3.76	Malawi	1.56	1.88
Ivory Coast	11.29	13.03	Namibia	5.31	5.99
Cameroon	4.92	5.78	Nigeria	18.67	20.93
Cape Verde	1.48	1.62	Rwanda	1.69	1.78
Egypt	45.75	41.32	Seychelles	2.71	2.82
Ethiopia	12.56	15.55	Senegal	5.22	6.54
Gabon	4.32	4.74	Uganda	4.36	4.97
Ghana	15.83	17.20	Tunisia	26.83	27.66
Gambia	0.52	0.55	South Africa	137.10	145.10
Kenya	13.47	17.16	Zambia	5.60	6.73

A sovereigns' credit profile depends on a number of economic, social, and political factors that underlie their sovereign ratings. Cantor and Packer (1996) outline eight variables that are relatively significant in determining sovereign ratings because they are repeatedly cited in the three international credit rating agencies' reports. An unfavourable change in these factors leads to credit downgrading, which is a negative change in the rating of a government's credit standing (Bissoondoyal-bheenick, 2005). These variables are briefly explained in Table 1.2 below.

Table 1.2: Determinants of SCRs

Variable	Measurement	Description
Per capita income	Measures the average income earned per person in a given country in a specified year.	The greater the potential tax-base of the borrowing country, the greater the ability of a government to repay debt.
GDP growth	The monetary value of all the finished goods and services produced within a country's borders in a year.	A relatively high rate of economic growth suggests that a country's existing debt burden will become easier to service over time.
Inflation	A sustained increase in the general price level of goods and services in an economy per year.	A high rate of inflation points to structural problems in the government's finances.
Fiscal balance	The difference between government tax revenue and its spending.	A large fiscal deficit absorbs private domestic savings and suggests that a government lacks the ability to tax its citizenry to cover current expenses or to service its debt.
External balance	Exports of goods and services minus imports of goods and services.	A large current account deficit indicates that the public and private sectors together rely heavily on funds from abroad.
External debt	The total debt a country (government, corporations or citizens) of that country owes to foreign creditors.	A higher debt burden should correspond to a higher risk of default.
Economic development	An increase in the capacity of an economy to produce goods and services, compared from one period to another.	Once countries reach a higher level of economic development, the chances of defaulting are low.
Default history	The failure or refusal of the government of a sovereign state to pay back its debt partly or in full.	A country that has defaulted on debt in the recent past is widely perceived as a high credit risk.

SCRs are determined by a credit rating agency (CRA)[2] which rates a debtors' ability to repay their debts on time and assesses the likelihood of default (Pukthuanthong-Le *et*

[2] The major internationally recognized rating agencies are Moody's, Standard and Poor's and Fitch

al., 2007). There are also discrete short-term and long-term credit ratings, which measures the likelihood that the rated entity may default within one year (short-term) or more (long-term). However, the credit rating methodology varies from one CRA to the other, making it difficult to objectively identify these qualitative criteria. Thus, identifying the relationship between two agencies' criteria and actual ratings is difficult, in part, because some of the criteria are not quantifiable (Cantor and Packer, 1996). Table 1.3 presents the sovereign rating methodologies applied by all the three international rating agencies.

Table 1.3: Sovereign Credit Rating methodologies

Standard and Poor's	Moody's	Fitch
Ratings seek to capture the probability of occurrence of default $\rho(d)$ not the severity of default. They provide no assessment of expected time in default, mode of default resolution or recovery values more generally.	Rating focus on expected loss L_e, which is a function of both probability of default and expected recovery rate, r_e, after default has occurred; $L_e = \rho(d).(1 - r_e)$	These are hybrid ratings, focusing only on the probability of default until the point when default occurs and differentiating on the basis of expected recovery rates after default has occurred.

Source: Bhatia (2002)

The above methodologies show that the information published by CRAs is largely subjective and its precision depends on individual agency's methodology (Bhatia, 2002). Despite the variation in rating methodologies, the main objective of rating agencies is to provide a rating watch and a rating outlook on debt issuers, debt obligations and also debt instruments (Zheng, 2012). Hence, the credit rating information serves as guidance to average investors especially in asymmetric markets. Frydman and Schuermann (2008) assume therefore that, an average investor seek CRAs' opinion and make decisions based on it.

Gande and Parsley (2004) assert that financial markets are driven by new and relevant information and that information efficiency is one of the vital fundamentals for the financial markets development. In the same spirit, Kaminsky and Schmukler (2001)

acknowledge that CRAs play a key role in financial market transactions but question the relevancy of the information provided to the market. Given the complex nature of most financial products (Weernink and Weernink, 2011), providing objectively accurate information on rating watches and outlooks is difficult (Kräussl, 2000; Chee *et al.*, 2015; Dmitrieva *et al.*, 2015).

Thus in summary, over the last two decades, financial constraints have been a major impediment towards exploitation of Africa's growth potential. However, globalization has pushed the continent to liberalise financial markets to enable development and stimulate economic growth. This had also opened new lines of credit for developing countries to access international markets through sovereign borrowing. Hence, sovereign borrowing has grown to become an attractive and relatively easy way for central governments to access capital for economic developments, doing away with traditional borrowing from supernational institutions. However, Africa's sovereign debt is perceived to be risky by international investors for a number of reasons, among them; inefficient markets, information asymmetry, political instability, lack of policy clarity, weak regulatory systems, negative external balances, and fiscal deficits, as such it is classified as high-yield debt. International investors therefore constantly seek an accurate understanding of sovereign default risk to assess sovereigns' creditworthiness of Africa's securities when setting a required return. Thus, the role of sovereign rating agencies in providing credit ratings has become important. However, questions have been raised on whether credit rating changes is new and relevant information with the ability of move financial markets or not, a subject still highly debatable.

1.1.1 Africa's Sovereign Credit Ratings

South Africa was the first African country to receive a sovereign rating in 1994, followed by Tunisia in 1995, Mauritius and Egypt in 1996. South Africa was also the first issuer of cross-border debt, and to date it is the only country with a sizable debt market in Africa (Ntswane, 2014). Senegal requested a sovereign rating in 2000 followed by Botswana, and by 2003, thirteen sovereigns had received credit ratings including Ghana, Cameroon, and Benin with support from the United Nations Development Programme

(UNDP) initiative (Billmeier and Massa, 2007). Table 1.4 below sets out the number of times a country's sovereign rating has changed from the first sovereign rating up to 2014.

Table 1.4: Number of African Countries' Sovereign Rating Changes

Country	Year first Rated	Moody's	S&P's	Fitch
Angola	2010	6	2	8
Burkina Faso	2004	-	3	-
Benin	2004	-	4	2
Botswana	2003	5	1	-
DR Congo	2013	-	1	-
Congo	2013	-	3	4
Ivory Coast	2014	-	-	5
Cameroon	2003	-	1	14
Cape Verde	2003	-	4	10
Egypt	1996	16	10	53
Ethiopia	2014	-	-	3
Gabon	2007	-	5	9
Ghana	2003	-	3	45
Gambia	2002	-	-	3
Kenya	2007	-	1	11
Lesotho	2002	-	-	14
Libya	2009	-	-	4
Morocco	1999	4	3	13
Mali	2004	-	-	1
Mauritius	1996	9	-	-
Malawi	2003	-	-	4
Namibia	2005	1	-	12
Nigeria	2006	-	6	13
Rwanda	2006	-	4	10
Seychelles	2010	-	-	10
Senegal	2000	3	3	-
Uganda	2005	-	3	9
South Africa	1995	11	5	64
Tunisia	1994	7	6	13

Zambia	2011	-	3	8
Total		**62**	**71**	**342**

Governments often seek sovereign ratings in pursuit of broader objectives such as fostering deeper local capital markets, attracting foreign direct investment and supporting private sector access to the global capital markets (Kaminsky and Schmukler, 2001). Hence, credit ratings and published empirical research plays an important role in supporting greater public-sector financial transparency (S&P, 2010).

1.1.2 Effects of SCRs on Africa's Stock Exchange Markets

The number of Africa's active stock exchanges rose from just eight in 1989 to twenty nine as at December 2014, with a total market capitalization of approximately US$ 2.4 trillion (Billmeier and Massa, 2007). The development of stock markets in Africa has boosted domestic savings, increasing the quantity and quality of investment from both domestic and international investors (Andrianaivo and Yartey, 2009). Well functioning stock markets have enhanced the operations of domestic financial systems in general and capital markets through the growth of sovereign ratings which also increased transparency (Yartey, 2008). Table 1.5 shows the level of capitalisation and the founding year of each of Africa's stock exchanges.

Table 1.5: Africa's stock markets capitalisation

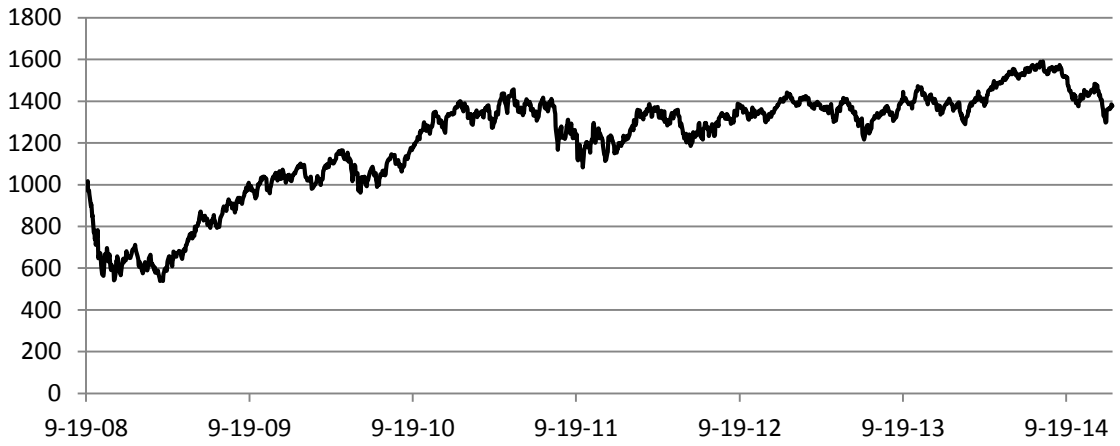
					2013	2014
Economy	**Exchange**	**Code**	**Founded**	**Listings**	**Capitalisation (US$ Billions)**	**Capitalisation (US$ Billions)**
Algeria	Algiers Stock Exchange	SGBV	1997	5	0.147	-
Botswana	Botswana Stock Exchange	BSE	1989	44	4.78	4.4
Cameroon	Douala Stock Exchange	DSX	2001	2	0.28	0.3
Cape Verde	Bolsa de Valores de Cabo Verde	BVC	2005	4	0.089	0.081
Benin Burkina Faso Côte d'Ivoire Guinea Bissau Mali Niger Senegal Togo	Bourse Régionale des Valeurs Mobilières	BRVM	1998	39	10.5	11.7
Egypt	Egyptian Exchange	EGX	1883	247	61.5	70.03
Ghana	Ghana Stock Exchange	GSE	1990	35	29.4	20.11
Kenya	Nairobi Securities Exchange	NSE	1954	64	20.6	25.57
Libya	Libyan Stock Market	LSM	2007	7	3.04	-
Malawi	Malawi Stock Exchange	MSE	1995	14	13	15.74
Mauritius	Stock Exchange of Mauritius	SEM	1988	88	8.5	8.66
Morocco	Casablanca Stock Exchange	Casa SE	1929	81	54.8	53.44
Mozambique	Bolsa de Valores de Mozambique	BVM	1999	3	1	-
Namibia	Namibia Stock Exchange	NSX	1992	34	136.9	148.48
Nigeria	Nigerian Stock Exchange	NSE	1960	223	114.2	116.4
Rwanda	Rwanda Stock Exchange	RSE	2008	5	1.9	1.93
Seychelles	Seychelles Securities Exchange (Trop-X)	SSE	2012	4	0.011	0.033

Somalia	Somalia Stock Exchange		2012	-	-	-
South Africa	Johannesburg Stock Exchange	JSE	1887	402	970.5	1150.5
Sudan	Khartoum Stock Exchange	KSE	1994	54	1.8	2.1
Swaziland	Swaziland Stock Exchange	SSX	1990	10	-	-
Tanzania	Dar es Salaam Stock Exchange	DSE	1998	17	10.46	12.8
Tunisia	Bourse de Tunis	BVMT	1969	56	8.6	9.32
Uganda	Uganda Securities Exchange	USE	1997	17	8.3	9.49
Zambia	Lusaka Stock Exchange	LuSE	1994	16	10.2	-
Zimbabwe	Zimbabwe Stock Exchange	ZSE	1948	64	5.4	4.33

According to AIM Africa (2015), since 1995, Africa's stock markets have been among the best-performing capital markets in the world despite their small size and low liquidity and high volatility. In 2004, six African countries (Ghana, Uganda, Kenya, Egypt, Mauritius and Nigeria) were among the world's 10 best-performing stock markets, while in 2005, Egypt, Uganda and Zambia were in the top five. In 2006, Malawi out-performed every other market in the world. However, the shock waves of the global financial crisis significantly affected Africa's financial development and performance, negatively affecting key drivers of stock market development leading to tightened credit conditions, increased risk aversion, gloomy growth prospects and reduced foreign investors' appetite for investment in African markets.[3] The average performance of African stock markets was captured in the All Africa Standard and Poor Index (launched in 2008) as shown in Figure 1.2 below.

[3]Nigeria stock exchange, for example, fell 46 percent in 2008, becoming the world's worst performing market as evidenced by drying up of external resources and a decrease in private sector credit growth (Massa, 2009).

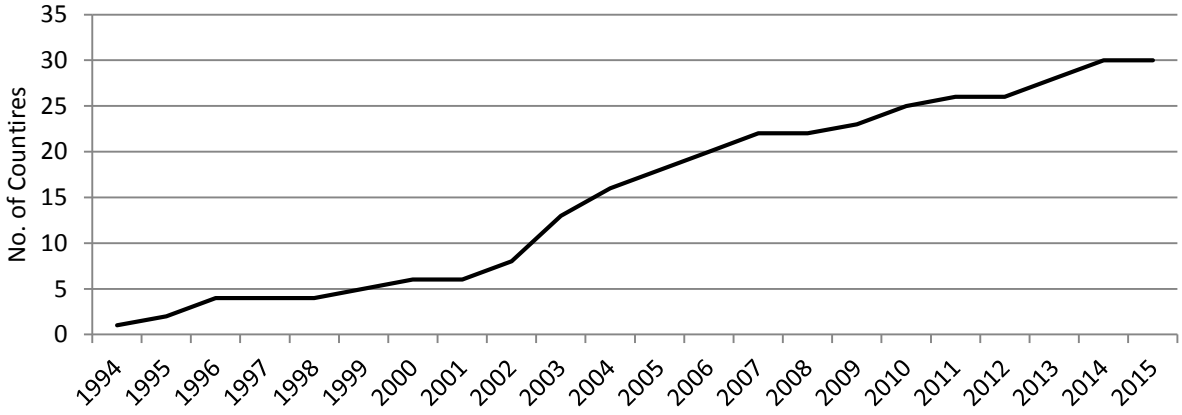
Figure 1.2: All Africa's S&P Stock Index



Source: Standard & Poor's

Despite this robust performance, Africa's equities markets have not been spared by the global financial crisis, which caused equity investors to withdraw their funds, leaving only the South African, Nigerian, Kenyan, and Mauritian stock exchanges active (Ntswane, 2014). Billmeier and Massa (2007) highlight that besides a lack of size; post crisis African stock markets (with the exception of South Africa) are characterized by a high degree of illiquidity. The number of African countries receiving SCR from the three major rating agencies has been steadily growing as shown in Figure 1.3.

Figure 1.3: The growth of SCRs in Africa



Source: Primary Data

Despite an increase in average capitalization levels in most African bourses, a number of exchanges still operate manual systems which are not equipped to handle sizeable capital inflows (Yartey and Komla, 2007; Afego, 2015). Hence, stock markets have not been performing efficiently, raising concerns about their feasibility as a source of finance given the huge costs and the poor financial structures (Andrianaivo and Yartey, 2009). This lack of efficiency severely reduces the attractiveness of Africa's stock markets for equity investors (Mlambo and Biekpe, 2007; Ajao and Osayuwu, 2012; Phan and Zhou, 2014).

Indicators of stock market development show that on average, 25 percent of listed companies are not actively traded creating pockets of inefficiencies (Mohtadi and Agarwal, 2001; Odera, 2012). Most African stock exchanges have very low turnover ratio of less than 5 percent compared with around 29 percent in global stock market turnover (Luchtenberg and Vu, 2015). Despite the availability of sovereign rated financial securities, low liquidity implies low business volume and greater difficulty in supporting markets with a country's own trading system and market analysis (Brunnermeier and Pedersen, 2009). In addition to information inefficiencies and periodic illiquidity, many African stock markets are still small and often dominated by a handful of large corporations[4]. This has left most exchanges vulnerable to manipulations from these huge corporations and increased exposure to insider trading (Jayakumar *et al.*, 2012).

Trading activity is further impeded by outdated trading, clearing and settlement systems, which can take months to complete a single transaction. This has created large gaps between buy and sell orders, ultimately eroding public confidence in the integrity of stock exchanges (Heerden Van *et al.*, 2013). Slow information production hampers activity and turnover, and renders financial integration difficult because most markets do not have central depository systems, and some restrict foreign participation. Such

[4]For example, the conglomerate Dangote Group makes up about 30 per cent of the Nigerian Stock Exchange and in Mauritius only 10 companies accounts for 85.7 percent of its stock exchange (Museru *et al.*, 2014).

bottlenecks have induced inactivity in secondary markets of credit rated securities (Andrianaivo and Yartey, 2009).

Investors who buy into African securities are very cautious and sensitive to new information because of transactional lags combined with information asymmetry and lack of transparency (Odera, 2012). Hence, SCR changes are expected to unveil new (private) information about a country and thus they may fuel stock price booms or downturns. A sovereign downgrade, being more important for fear of losses, ignites a stock market downturn because most rational investors perceive a downgrade as a negative market future prospect. Such news has capacity to trigger a market panic as investors coordinate to a new equilibrium (Senbet and Otchere, 2008). Pukthuanthong-Le *et al.* (2007) however report that, in emerging markets, investors usually respond to false signals from a sovereign's placement on credit watchlist.[5] The magnitude of a stock market's reaction to a SCR is therefore based on investor's sentiment to transparency and transaction lags (Yartey and Komla, 2007).

Pinches and Singleton (1978), Griffin and Sanvicente (1982), Dichev and Piotroski (2001), Pukthuanthong-Le et al. (2007), Klimavičienė (2011) and Bissoondoyal-Bheenick and Brooks (2012) examined the effect of SCRs on stock market find mixed evidence. Pinches and Singleton (1978), Griffin and Sanvicente (1982) find significant evidence of negative stock price reactions to credit rating downgrades but no evidence of significant reactions to rating upgrades. In contrast, Dichev and Piotroski (2001), Pukthuanthong-Le et al. (2007), Klimavičienė (2011) and Bissoondoyal-Bheenick and Brooks (2012) find statistically significant evidence stock market reaction to both SCR downgrade and upgrade announcements under different environments.

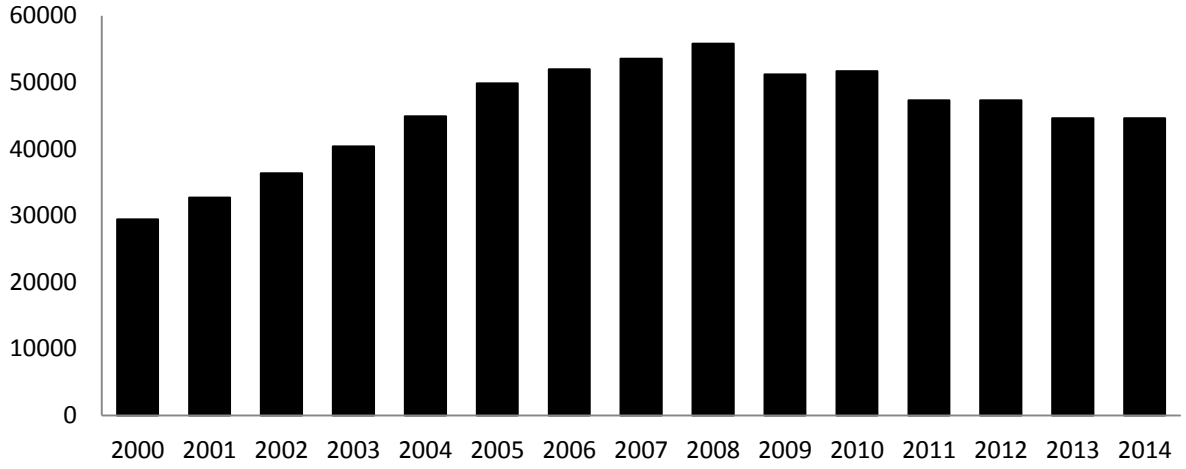
1.1.3 Effects of SCRs on Africa's Debt Markets

Most African countries have been relying on foreign donors and loans from international

[5] An announcement made by CRAs to alert investors that a country's credit rating is under review with a possibility of change. Though when a country is added to a credit watch does not necessarily mean it will be downgraded, but chances are high that this announcement is usually followed by a credit rating downgrade.

financial institutions to supply part of their foreign currency needs, as well as to finance part of their domestic investments (Patel, 2014). Major donor aid to Africa has been declining since 2008, breaking a long trend of annual increases starting around 2000 (Masetti, 2015), as evident in Figure 1.4 below, which shows the official development assistance. Disregarding years of exceptional debt relief, this was the first drop in aid flows since 1997 (Beegle *et al.*, 2016). The Organisation for Economic Co-operation and Development (OECD)[6], has been tightening their budgets by streamlining aid levels as a way of encouraging economic independence, increase trade and curbing corruption (Moyo, 2009).

Figure 1.4: Africa's Official Development Assistance (ODA) in US$ Billion



Source: OECD Development Assistance Committee 2015 data.

Infrastructure development has been pointed out as a necessary factor for economic growth (Wallace and Sivabalan, 2015). Africa's governments often cite a lack of adequate funding and resources as a significant impediment to exploiting their country's growth potential because national budget provisions are insufficient to fund infrastructure needs and support economic growth (Mu *et al.*, 2013). Rapid growth, better economic policies, low commodity prices, and low global interest rates saw a sharp rise in the demand for international sovereign bonds issued by African countries

[6] An international economic organisation of 34 first world countries aimed to stimulate economic progress and world trade.

(Wallace and Sivabalan, 2015). The issuance of international sovereign bonds is part of a number of African countries' strategies to restructure their debt, and establish sovereign benchmarks to help develop the sub-sovereign and corporate bond market (KPMG International, 2015). These fundamentals have invariably forced African governments to improve financial discipline and transparency through meeting minimum requirements for capital market borrowing (Ntswane, 2014).

Though African bond markets are still in their infancy, there has been high activity in domestic primary markets compared to secondary markets (Heerden Van *et al*., 2013). The debt markets have however been dominated by government securities, mostly of short duration, mainly because corporate debt markets are largely non-existent, with the exception of South Africa and to a limited extent some West African markets, such as Côte d'Ivoire, Ghana, Gabon, Senegal and Nigeria (Beegle *et al.*, 2016).

The low interest rate environment that prevailed when the sovereign bond market was launched in Africa is set to continue due to low commodity prices, low oil prices and droughts, which makes it harder for oil-producing states, resources-dependent countries and agro-based economies to service their debts (Jorion and Zhang, 2010). In the medium term, heady economic growth may not continue if debt proceeds are not adequately managed and used for current productive spending. This concern has been driving Afro-sovereign bond market pessimists to closely watch sovereign rating changes (Olabisi and Stein, 2015). Sovereign rating announcements have therefore been an important information source for active investors who set to adjust their portfolio structures through the sovereign ceiling channel (Almeida *et al.*, 2014).

Although company specific variables (such as accounting variables) are important in explaining credit risk profile assigned to a company, sovereign ratings both act as a ceiling for corporate ratings and have direct implications on the borrowing costs incurred by corporates when participating in the international debt market. Thus, if the sovereign is poorly rated, the corporates may be limited in their ability to secure attractive funding at competitive rates from the international financial markets. The remarkable appetite for

African sovereign bonds raises a number of questions regarding short-term and medium-term sustainability of bond flows to the region (Collier, 2014). Recent trends and developments on the global economy indicate that push factors are becoming less favourable to African economies; record-low interest rates that prevailed in the United States are set to increase, and risk appetites of foreign investors may decline accordingly (Mcmillan and Harttgen, 2014).

1.1.4 Summary

The low yields in developed financial markets have pushed international investors to shift their focus to developing markets for high yields driven by high economic growth prospects, thus placing Africa on the spotlight. In addition, the presence of international institutional investors has also boosted market depth and breath, and the quality and quantity of investments in Africa. However, these international investors prefer internationally rated securities because of perceived risk from transactional lags, illiquid secondary markets combined with information asymmetry and lack of transparency. This has compelled African countries that plan to float US dollar and Eurobonds to seek SCRs. Thus, a sovereign rating announcement has become one of the major sources of new and tradable information, and a crucial step in Africa's financial market development. When a country's sovereign rating is announced it is expected to unveil new information about the shift in fundamental factors that affects a country's microeconomic environment. Investors are therefore expected to adjust their portfolios accordingly; particularly in the event of a sovereign downgrade, which heightens the fear of losses and thus may ignite a stock market downturn, and macroeconomic and socio-political instability; a phenomenon Pukthuanthong-Le *et al.* (2007) have dismissed as investors' knee-jeck response to false signals that are not backed by fundamentals.

1.2 Thesis Statement

A sovereign credit rating is among the most important fundamentals considered by investors when determining their required return in securities pricing (Mateev, 2012). When a sovereign credit standing is downgraded, bondholders adjust their expected yield to maturity upwards while stockholders also increase their cost of capital

(Pukthuanthong-Le *et al.*, 2007). This situation pushes financial securities' prices down depending on individual investor's risk perception and tolerance. Average investors therefore regard CRAs as new information sources about the state of the creditworthiness of a nation, and they thus use the information as a benchmark to determine their required returns (Creighton *et al.*, 2007). In addition, CRAs also have a perceived role in predicting sovereign credit outlooks, which provides investors with information to trade with caution (Masciandaro, 2013). Matolcsy and Lianto (2007) and Ikram and Nugroho (2014) add that SCRs provide quality assurance to unsophisticated investors about inherently complex financial products making it easier for them to make informed investment decisions.

However, the information conveyed by CRAs has constantly come under scrutiny from academics and finance practitioners, citing gross mistakes and inaccuracy which have, in some cases, been blamed for triggering financial crises (Li *et al.*, 2004; Şensoy, 2013; Vernazza, 2014). These weaknesses include flaws in the credit rating model inputs (Baghai *et al.*, 2014), insufficient due diligence in the credit rating process (Konijna and Rijkena, 2011), insufficient consideration of market and macroeconomic developments in assigning rating to sovereign debt instruments (Kräussl, 2005), failure to take account of structured securities' interdependencies and inadequate disclosure of the SCR models and model assumptions (Elkhoury, 2008).

On the other hand, CRAs blame sovereign defaults on unexpected market shocks and unprecedented economic declines that are difficult to predict (Gande and Parsley, 2004). Furthermore, CRAs argue that they are not legally bound by their SCRs because it is merely their opinion and thus they cannot be held liable under the First Amendment to the US Constitution (Baghai *et al.*, 2014). Therefore, over-reliance by investors on sovereign ratings constitute negligence on their part when analysing investment options (Masciandaro, 2013). However due to information asymmetry in African markets, most investors rely on publicly available information to make major investment decisions (Mobarek and Keasey, 2000; Jefferis and Smith, 2005; Creighton *et al.*, 2007).

Hence, regardless of the questionable information sufficiency in credit rating announcements, Bissoondoyal-Bheenick and Brooks (2012) claim that Africa's financial markets tend to react to SCR announcements by the three international CRAs. Agarwal *et al.* (2015) add that the economic consequences of these sovereign rating actions is significant as they affect the efficiency and stability of capital markets within and across countries. Agarwal *et al.* also posit that in some cases, there is a 'linguistic tone' in the rating reports which contains new information beyond the credit rating actions. Thus, based on the preceding discussion, this thesis empirically investigates the following thesis statement:

Africa's markets show statistically significant evidence that sovereign rating reports contain new tradable information and sovereign credit rating announcements impacts stock and bond markets differently. In addition, when credit rating announcements are made, there is a spillover effect to neighbouring countries' financial markets that share similar fundamentals. Lastly, SCRs positively impact the efficiency form of African financial markets and thus the informational role of credit rating institutions in shaping market efficiency is significant.

1.3 Research Questions

This study investigates the effects of the information provided by CRAs on African financial markets to determine whether SCR announcements contain material information that influences the secondary market securities pricing model and debt markets' interest rates. The above thesis statement is explored through the following four research questions.

1.3.1 Research question 1: Do sovereign rating announcements influence excess bond and equity returns?

The liberalisation of African markets in recent years (Makina, 2005) elevated the role of CRAs in the international economy, a subject of ongoing debate (Creighton *et al.*, 2007). Sovereign rating agencies have been heavily criticised within the context of emerging market financial crises. It has been suggested that they are unable to predict

financial crises and they are too slow to react (Morseth and Norgaard, 2011) even when signs of impending crises are widely visible (Amstad and Packer, 2015). However when CRAs react, their announcements trigger further market panics and overreactions (Li *et al.*, 2004). These arguments are largely based on the assumption that sovereign rating announcements actually provide financial markets with new information (Jorion and Zhang, 2010), even though the empirical evidence hitherto relating to this issue is still inconclusive. Thus, the importance of sovereign rating news is still highly debated in emerging markets.

Research to date has focused on the impact of credit rating announcements at the company level. In general, it has been found that rating downgrades are informative as compared to upgrades, which are not (Hand *et al*., 1992; Ferreira and Gama, 2007; Matolcsy and Lianto, 2007). The few studies completed to date have produced mixed results, providing ambiguous evidence that rating actions impact security prices (Cantor and Packer, 1996; Bissoondoyal-Bheenick and Brooks, 2012; Alsakka and Gwilym, 2013; Ntswane, 2014). The impact of sovereign rating announcements on financial markets is important for investors in understanding of the price discovery process, particularly in relation to the type of information that financial markets incorporate into asset prices (Odders-White and Ready, 2006). As investment portfolios are being internationalised, those responsible for managing investment capital are facing the need for greater and more accurate information regarding country risk and how a country risk re-assessment can impact their portfolios (Gande and Parsley, 2004). Since sovereign ratings function as a major country risk indicator, it is also important to have a good understanding of the impact that sovereign rating announcements have on financial asset prices (Hooper *et al.*, 2008).

Thus in addition to the first primary question, this study also investigates the following sub-questions:

(i) Is there a significant relationship between sovereign rating announcements and bond yields?

(ii) Is there a relationship between sovereign rating announcements and stock returns?

1.3.2 Research question 2: What is the effect of a SCR on bond and equities markets?

It is widely accepted that stocks and bonds do not move in the same direction as rising stock prices are associated with rising bond yields and falling bond prices (Stivers and Sun, 2002). It is argued that investors commonly sell bonds to raise money to buy stocks and sell stocks to raise money to buy bonds, which affects the prices of both asset classes (Maslov and Roehner, 2004). Hence, stocks and bond prices move in opposite directions because of their inverse responses to macroeconomic fundamentals (such as interest rates and inflation) (d'Addona and Kind, 2006), while fighting for the same money from investors (Ncube and Brixiov, 2015).

A sovereign rating change situation occurs when CRAs feel that the future economic prospects of a country have changed due to a material and fundamental shift in its macro-environment (Griffin and Sanvicente, 1982). A ratings upgrade (downgrade) implies that the borrower's credit risk profile has improved (deteriorated), which would reduce (increase) the required rate of return on its debt, thereby increasing (reducing) its security price. The required return, is the minimum rate of return an investor will accept for an investment, which fairly compensate the level of risk in the investment. In security valuation, it is the required return that is used to value security prices using discounted cash flow analysis. Hence, a sovereign rating downgrade (upgrade) is considered to be negative (positive) information by the market (Hand *et al.*, 1992; Ammer and Clinton, 2004; Mateev, 2012) whereby, a SCR announcement should lead to either a positive (upgrade) or negative (downgrade) stock market and bond market reaction. However, empirical evidence of this effect on both stock and bond markets is still inconclusive, as Zaima and McCarthy (1988) and Goh and Ederington (1993) argue, it is possible that sovereign rating downgrade announcements do not necessarily have negative implications for stockholders because investors can transfer funds from bonds into stocks when a country is downgraded.

The hypothesis that bonds and stocks react negatively (positively) to SCR downgrades (upgrades), whereby a downgrade (upgrade) leads to both stocks and bonds reacting in the same direction thus raises three sub-questions:

(i) Do stocks and bonds react negatively (positively) to a sovereign credit downgrade (upgrade) announcement?

(ii) How do stockholders and bondholders adjust their required return following a SCR announcement?

(iii) What is the association between Africa's bond and stock returns following SCR announcements?

1.3.3 Research question 3: What is the effect of SCR spillover on neighbouring countries' financial markets?

Africa's financial markets have become increasingly integrated into the global financial market (Andrianaivo and Yartey, 2009). There have been interrelationships in markets fundamentals so that if a credit rating changes in one country, there is evidence of changes in the aggregate market returns of other countries (Corbet, 2014). The magnitude of the spillover effect is a result of geographic proximity (Ferreira and Gama, 2007), emerging market status (Gande and Parsley, 2005), type of announcements (Kaminsky and Schmukler, 1999), the source country experiencing the rating change (Kalotychou *et al.*, 2014), and the rating agency from which the announcements originate (Arezki *et al.*, 2011).

Ferreira and Gama (2007) and Arezki *et al.* (2011) confirm that geographic distance is inversely related to the spillover impact whereby sovereign rating announcements have a more pronounced effect in countries nearer to each other. However, this finding is still contested for three reasons. First, Flores (2010) argues that negative spillover effects cannot be explained by fundamental linkages and similarities between countries because of asymmetry in the sovereign debt market's treatment of positive and negative information. Second, Christopher *et al.* (2012) argue that if investors view the stock markets in a region as having common characteristics, they tend to shift funds away

from the downgraded country's stock market in favour of other stock markets in the region. Additionally, Bissoondoyal-Bheenick (2012) also posit that investors are more inclined to withdraw funds from the surrounding regional markets as well as the downgraded market, causing its regional bond market co-movement to rise. Lastly, Boninghausen and Zabel (2013) report that negative spillover effects from sovereign downgrades are only pronounced for countries within the same region. However, Longstaff *et al*. (2011) contested that, when there is a sovereign credit improvement, international bond investors shift funds away from other bond markets in the region in favour of the affected market and this leads to a fall in regional correlations. Hence, responses of neighbouring financial markets to a change in a country's sovereign rating may arise from contagion, herding or speculative activities. Thus, the third question being investigated is divided into two sub-questions:

(i) Does a change in one country's credit rating cause significant spillover effects on other sovereign credit rated countries' financial markets and,

(ii) Under what economic and market conditions are spillover effects, if any, significant?

1.3.4 Research question 4: Do SCRs positively affect capital market efficiency?

There is general consensus that a credit rating is one of the major external forces that influence financial markets by imposing financial discipline on market participants (Duygun *et al.*, 2016) and contribute to market efficiency by providing accurate, clear and reliable assessments of the solvency of financial market participants (Ekins and Calabria, 2012). Thus, the function of credit ratings is to enhance transparency and efficiency in financial markets by reducing the information asymmetry between borrowers and lenders (Gande and Parsley, 2014). In contrast, other studies argue that the informational effects of rating agencies on financial markets is irrelevant in developed markets because they are efficient (Fama, 1965; Fama, 1970; Ojah and Karemera,1999; Norden and Weber, 2004; Hooper *et al*., 2008). Furthermore, Schorno and Wittry (2011) add that the significant decline in the reputation of CRAs following the global financial crisis suggests that their role in influencing financial market efficiency is diminishing. In addition, Kiff *et al.* (2010) argue that credit ratings hinder financial market

efficiency because security issuers may use ratings to increase information asymmetry through "rating shopping" from agencies that assign high ratings in order to reduce borrowing costs. It is thus hypothesised that, if credit ratings enhance financial market efficiency, then inefficient markets should become more efficient in the long-term following credit rating announcements.

Although the literature on African financial market efficiency has been growing, to date, studies that test the effects of SCR announcements on financial market efficiency are rare. This study thus seeks to answer the following two sub-questions:

(i) Does the level of market efficiency change following sovereign credit announcements?

(ii) Does the presence of sovereign credit ratings have an effect on market efficiency?

1.4 Limitations

There are a few limitations with this research that are related to data and the methodologies.

1.4.1 Data Limitations

The SCRs announcements, daily stock and bond market indices data used in all the empirical chapters is subject to the following limitations. First, there are relatively few SCR events in Africa compared to those in developed economies. Although the period of analysis is 20 years, in the first 10 years, only less than half of the sample countries had been credit rated. Until 2014, only 30 out of the 54 African countries had received credit ratings from one (or more) of the three international rating agencies, usually because the countries do not have functioning bond and/or stock markets. Furthermore, the simultaneous announcements of SCRs by the three international rating agencies in response to the same fundamental changes at different times might have different impact on financial markets that could be difficult to discern. In addition, the occurrences of other confounding events such as civil unrests, strikes, political and economic turmoil make it difficult to ascertain the impact of a particular sovereign rating event on security

returns.

Second, approximately a quarter of the listed companies are not actively traded, which creates pockets of inefficiences, and very low transaction turnover ratios (Luchtenberg and Vu, 2015), which translate to low liquidity. The thin trading which is dominated by a few large corporates exposes most exchanges to manipulation and insider trading, which distort the indices returns data (Jayakumar *et al.*, 2012).

Third, the debt market that provides platforms for secondary trading of sovereign bonds is largely non-existent in almost half of the sovereign rated countries. This severely constrains both liquidity and efficiency in African financial markets, making credit rating announcements less relevant.

Lastly, Africa's financial markets are characterized by limited information, a lack of transparency, low institutional quality and poor regulatory frameworks. This could potentially distort the relationship between credit ratings announcements and Africa's financial market securities (Patel, 2014; Ravi and Hong, 2014; Smith and Dyakova, 2014).

1.4.2 Methodology Limitations

There are some methodological limitations to the empirical analyses used to investigate the research questions in the following chapters that are briefly described as follows. In Chapter 2, the event study method is applied to examine the behaviour of African financial market following SCR announcements. However, the application of event studies in the analysis and inference of long-term effects is debatable because its proponents, Brown and Warner (1985), recommend it as analysis best suited for assessing short-term responses to an event. However Reisen and von Maltzan (1998) and Kaminsky and Schmukler (2001) argue that there is precision in estimating the market models for longer horizons. Thus, they recommend using an event study method for assessing the impact of any change in market fundamentals even for long-term time horizons. Chapter 2 also applies the GARCH technique, which models time varying

conditional variances to estimate volatility clustering around SCR events. The GARCH model has limitations in that its parameters are well specified under relatively stable market conditions (Corhay and Rad, 1996) but may fail to capture some highly irregular phenomena, extreme market fluctuations, such as market swings and rebounds, and other unprecedented events that lead to significant structural changes.

In Chapter 3, DCC-GARCH examines the relationship between stocks and bond returns following SCR announcements. Althought the DCC-GARCH models can detect possible changes in conditional correlations over time by capturing the dynamic investor behaviour in response to news and innovations (Zhang and Chan, 2009), it may not fully capture the outliers observed in asset return series. The Granger Causality test is applied in Chapters 3, 4 and 5. In Chapter 3 it is used to analyse the net effect of sovereign ratings on both stocks and bond returns, in Chapter 4 to examine SCR spillovers on neighbouring countries' financial markets, and in Chapter 5 to investigate the semi-strong efficiency in incorporating sovereign rating announcements. The Granger causality results however do not show the reaction time and magnitude of spillover effects across countries and financial markets, and the sensitivity of the type and nature of the assets being traded in each of the regional financial markets. In addition to the Granger Causality test, Chapter 4 also uses Impulse Responses to assess the effect of credit rating shocks on security returns and the response of neighbouring countries' bonds and stock markets to an impulse in another country in the same region. There are however chances of misidentification of impulses (Koop *et al*., 1996), which my result in distortions and errors in the responses.

Finally in Chapter 5, the Ljung–Box Q test and Runs test is used to examine the weak form efficiency, and the variance ratio test is used to examine the random walk hypothesis. The Engle-Granger Cointegration test is further applied to investigate the semi-strong efficiency in incorporating sovereign rating announcements. Althought the Ljung-Box test is known to be robust especially in finite samples (Burns, 2003), it may sometimes fail when the distribution of sample data is extremely long-tailed (Stoffer and Toloi, 1992). The Ljung-Box test however relies on the assumption that the set of

autoregression disturbances are conditionally homoskedastic and the model regressors are strictly exogenous (Cumby and Huizinga, 1992), which is not the case in financial market data that is usually overlapping and often shows the presence of conditional heteroskedasticity in the error process. The Runs test also suffers from the potential insensitivity to departures from randomness for run lengths in evaluating the independence of disturbances in time series regression models (Ley and Paindaveine, 2013). It also has the wrong "type 1 error"[7] rate (Baringhaus and Henze, 2016) because it does not distinguish where runs occur in a sequence, it makes no predictions regarding what might happen if other frequencies were observable, and it ignores the possibility of any sort of classification error (random or systematic).

The variance ratio test, which is regarded by Kim and Kim (2010) as a stronger random walk test, ignores the joint nature of testing for the random walk hypothesis. Thus, it has been argued that the variance ratio statistics draws misleading conclusions when time-varying volatility is present in the data (Charles and Darne, 2009). Lastly, the Engle-Granger Cointegration test has limitations in the estimation of the long-run cointegration equilibrium regression models (Engle and Granger, 1987), which in practice means that it is possible to find that one regression shows that the variables are cointegrated, whereas reversing the order shows no cointegration.

1.5 Merit of the Research and Contribution to Literature

The study of credit rating effects on financial markets is a relatively new area of study in Africa, arising in the early 1990s as emerging markets began to attract the attention of international institutional investors. This thesis makes four major contributions to the financial markets and credit ratings literature in emerging markets.

First, this study is amongst the first to statistically explore the relevance of SCR in the securities pricing model using African data. Although the literature on credit ratings and financial markets in developed countries has been growing, studies that test the effects

[7] Falsely infer the existence of something that is not there.

of SCR announcements on financial markets in emerging countries are still sparse. This thesis is thus based on a less examined sample, which draws new evidence on the relationship between SCR and financial markets. The dynamic nature of Africa's emerging capital markets and its limited links with the global markets creates information asymmetry. African markets are thus characterized by limited information, high-risk assets, liquidity challenges, relatively few participants, lack of transparency, low institutional quality, and greater uncertainty. Hence, generalizing Africa's financial markets as equal to other regional emerging markets could be detrimental and thus this study draws conclusions from new and specific data.

The second contribution of this study is the expanded range of empirical tests that are applied to investigate each research question. In contrast, most studies in the literature commonly use just one test; for example, the key studies of Gande and Parsley (2004), Pukthuanthong-Le *et al.* (2007), Ferreira and Gama (2007), Flores (2010), and Boninghausen and Zabel (2013) investigate the impact of sovereign ratings changes on financial markets using only the event study method.

Third, this study is amongst the first to empirically examine the impact of SCRs on bonds and equity markets using sovereign rating announcements by all the three international CRAs (Moody's, Standard and Poor's and Fitch). Most pioneering studies such as Weinstein (1977), Pinches and Singleton (1978) and Dichev and Piotroski (2001) analyse financial markets reaction to rating announcements made by Moody's, the relatively modest of the three rating agencies. Other formative studies on SCRs announcements such as Konijna and Rijkena (2011), Bissoondoyal-Bheenick and Brooks (2012) and Agarwal *et al.* (2015) use credit ratings announcements from Standards and Poor's, the oldest provider of credit ratings since 1860. A number of other important studies such as Reisen and von Maltzan (1998), Li *et al.* (2004) and Kraussl (2005) used rating data from both Standard & Poor's and Moody's which are widely regarded as the two major sovereign rating agencies that accounts for approximately 80 percent of the world's credit rating business.

Forth, generally the analyses of the impact of SCR announcements in the majority of studies are centred around credit rating upgrades and downgrades between rating notches, sidelining changes in credit rating outlooks and addition to credit watchlist. Major studies on this topic such as Zaima and McCarthy (1988), Goh and Ederington (1993), Goh and Ederington (1999), Kim and Nabar (2003), Leonard and Olinsky (2013), Gande and Parsley (2014) and Flor and Hesel (2015) ignore the impact of credit rating outlooks and addition to credit watchlist in their analyses. Thus this study contribute to literature by expanding the scope of analysis to incorporate the impact of credit rating outlooks and addition to credit watchlist, which are also SCR announcements. Furthermore, this study examines the effects of SCR changes on both the stock and bond markets rather than just focusing on the impact on either equities or bond markets. This is uncommon in the literature as most seminal studies such as Weinstein (1977), Hertel (2013) and Crosta (2014) only focus on the bond market whilst Pinches and Singleton (1978), Griffin and Sanvicente (1982), Dichev and Piotroski (2001), Pukthuanthong-Le et al. (2007), Klimavičienė (2011) and Bissoondoyal-Bheenick and Brooks (2012) focus on the stock market.

Finally, the findings of this thesis could be used for policy formulation because if a sovereign rating change is found to be relevant information to capital markets, then it is by extension critical to policy-makers as well. A significant change in a sovereign credit profile will affect the cost of borrowing for the government, corporates and individuals. By extention, this has a net effect on Gross Domestic Product (GDP), external debt levels, exchange rates, fiscal balance and ultimately, household disposable income. Furthermore, monetary authorities are increasingly using the information contained in the prices of these assets to gauge market growth, inflation expectations and market views on economic prospects. Hence, understanding the relationship between stocks and bond returns in relation to credit ratings has a direct impact on policy formulation and implementation, and investors' asset allocation and risk management strategies. Therefore, it is crucial for fiscal and monetary policy-makers to understand the effects of rating impacts on financial markets.

1.6 Layout of the study

This thesis is structured as a set of inter-linked chapter-based studies with each chapter investigating a research question. The four primary research questions are thus covered in four chapters that proceed as follows. Chapter 2 investigates if sovereign rating change announcements influence excess bond and equity returns. A combination of an event study method and GARCH technique is applied to investigate the credit rating puzzle to determine how investors respond to credit rating announcements. Chapter 3 explores the net effect of sovereign ratings on both stocks and bond returns using a combination of Granger Causality and DCC-GARCH.

Chapter 4 applied both the Granger Causality test and the Impulse Responses to assess the spillover effect of credit rating shocks on security returns and the response of neighbouring countries' bonds and stock markets to an impulse in another country in the same region. Thenafter, the Ljung–Box Q test, Runs test, Engle-Granger Cointegration test, Variance Ratio test and the Granger Causality test are used to examine the weak form efficiency, and the variance ratio test is used to examine the impact of SCRs on the efficiency of bond and equity markets. Finally, Chapter 6 then concludes the study with a summary of the key findings, implications, and recommendations in relation to the literature, and suggestions on avenues for future research.

CHAPTER 2

DOES SOVEREIGN RATING CHANGE ANNOUNCEMENT INFLUENCE EXCESS BOND AND EQUITY RETURNS?

2.1 Summary abstract

This chapter examines whether new sovereign credit rating announcements are valuable and relevant information to bond and equity markets in 30 African countries that received a sovereign credit rating during the period 1994 to 2014. The results of applying a combination of GARCH models and event study techniques show that the financial markets do not significantly react to SCR announcements. These findings suggest that there is a very weak relationship between sovereign credit rating changes and security yields in African markets, possibly because these African markets are already perceived to be risky. Hence, it can be concluded that sovereign credit rating announcements are largely irrelevant information to financial markets in low credit rated countries as investors would have already discounted the risk into current security prices.

2.2 Introduction

In the late 1980's and early 1990's, the rapidly deteriorating economic and financial conditions in African countries as a result of political conflicts arising from colonial imbalances, climate change induced droughts, shortages of foreign exchange, and falling commodity prices (Overseas Development Institute, 1982) forced many economies to undertake a process of financial liberalization (Kenny and Moss, 1998). These structural frameworks were aimed at moving away from a command economy towards market based economic systems that would develop and foster functional financial markets and thus stimulate private sector-led economic growth (Creighton *et al.*, 2007).

Whilst liberalization enhanced the competitiveness and improved the efficiency of financial markets, it also increased investors' risk exposure due to market volatility (Kose *et al.*, 2009). These innovations led to the birth of many complex derivatives and structured financial products (for example; asset backed securities, options, forwards, etc.), which require experts to evaluate their risk profiles (Causevic, 2003). Hence, investors have come to rely on expert advice and recommendations when making decisions about these assets. Average investors therefore regard CRAs as new information sources about the state of the creditworthiness of a nation, and they thus use the information as a benchmark to determine their required returns and bond yields (Creighton *et al.*, 2007), which is the discounting factor in security prices. The uncertainty in financial assets has thus elevated the role of CRAs in the international economy as sources of relevant information required for informed trading (Makina, 2005) and by helping to reduce the creditworthiness information asymmetry between markets and investors (Elkhoury, 2008).

Basel II further cemented the importance of rating agencies by incorporating the ratings of CRAs into the rules for setting credit risk weights (Hooper *et al.*, 2008). However, the failure of CRAs to predict major events such as the 1998 Asian crisis, the bankruptcies of Enron, WorldCom and Parmalat, and the 2008 financial crisis has raised questions concerning their rating processes, accountability, and ability to predict and respond to financial crises (Elkhoury, 2008; Morseth and Norgaard, 2011; Amstad and Packer, 2015). Furthermore, when CRAs change a country's credit rating profile, their announcements may trigger market panics and over-reactions (Li *et al.*, 2004) as sovereign ratings provide financial markets with new information (Jorion and Zhang, 2010).

Although the literature on SCRs and financial markets in developed countries has been growing, studies that test the effects of SCR announcements on financial markets in emerging countries are still sparse. This chapter examines whether a sovereign rating announcement influences excess bond and equity returns in 30 African countries that received a SCR during the period 1994 to 2014 and makes three contributions to the

financial market and SCR literature. First, it uses an under-researched sample so as to draw new evidence on the relationship between SCR and financial markets. Second, it is amongst the few studies that empirically examine the impact of SCR changes on financial markets using sovereign rating announcements by all the three international CRAs (Moody's, Standard and Poor's and Fitch). Lastly, this chapter examines the effects of SCR changes on both the stock and bond markets rather than just focusing on the impact on either equities or bond markets.

This chapter proceeds as follows. Section 2.2 reviews the literature devoted to the information content of a SCR report, the associated information asymmetry, the cost of capital and abnormal return effects, Section 2.3 then describes the sovereign rating data and Section 2.4 devises the GARCH and event study approaches used to conduct the analysis. The findings are discussed in Section 2.5 and the study then concludes with a summary of the key findings in Section 2.6.

2.3 Literature review

Examinations of the effects of sovereign rating changes were first explored in the 1970s when a new paradigm of financial innovation was adopted by financial institutions and securities broker-dealers who sought to soften capital and liquidity requirements. The associated complexity of financial markets and the growth in the complexity of financial instruments then inspired this seminal body of literature on the assessment of creditworthiness.

2.3.1 Information Content of a SCR Report

Among the first to study SCR impacts was Weinstein (1977), who conducts an event study using monthly United States bond data over the period from 1962 to 1974, but finds no significant abnormal returns caused by SCR news announcements. Pinches and Singleton (1978) examine monthly stock prices data and also find no evidence of upward or downward drift in the cumulative abnormal returns before or after the month of the rating announcements. Thus, they subsequently argue that the information content of a SCR report is too weak to significantly influence financial market prices.

Notably, Griffin and Sanvicente (1982) are acknowledged as among the first to apply an event study method on SCR to an emerging country. Examining Turkey's stock market using monthly data covering the period from 1970 to 1980, they find that in contrast to Weinstein (1977) and Pinches and Singleton (1978), there is significant evidence of negative stock price reactions to credit rating downgrades but no evidence of significant reactions to rating upgrades.

However, it can be argued that there may be particular information content present in the SCR report that affect financial markets. Thus, Cantor and Packer (1996) examine the determinants of SCR and its impact on borrowing costs. Using a model comprising the eight variables[8] that are repeatedly cited in rating agency reports as determinants of sovereign ratings. They observe that the more the number of variables included in a SCR report, the greater its influence on financial markets. Complementary to Cantor and Packer, Muragu (1990), Hand *et al*. (1992) and Dhillon and Johnson (1994) further report that the inclusion of the determinants in a SCR report depends on the CRAs' opinions, which is highly qualitative and subjective. Hence, the three CRAs rarely assign the same rating grade to a sovereign. These studies thus indicate that SCRs reports effectively summarize crucial macroeconomic information. However, a key limitation of these studies is that the quantitative models cannot explain all the variations in cross-country ratings because there are possibly other qualitative social and political considerations that are excluded when determining a SCR.

Reisen and von Maltzan (1998) conduct an event study on a sample of all credit ratings assigned by Moody's and S&P's during the period 1987 and 1996. Their results show that stocks and bonds only respond positively to changes in SCRs downgrade reports, especially in emerging economies, thus supporting Cantor and Packer's (1996) contention that negative sovereign rating announcements significantly raise sovereign bond spreads and stock returns. Thus, Reisen and von Maltzan conclude that the bond

[8] Per capita income, GDP growth, inflation, fiscal balance, external debt, economic development, external balance, and default history.

and stock market volatility is driven by CRAs downgrade announcements in the countries concerned while there is insignificant change in yield when sovereign upgrade is announced. Although these findings imply that SCR reports contain information of concern to investors, they do not address why financial markets show inconsistent abnormal returns after a sovereign rating downgrade is announced.

Hence, Agarwal *et al.* (2015) apply Naïve Bayesian algorithms to test the hypothesis that credit rating reports contain new default-related information beyond credit rating actions (such as credit rating changes, credit watch, and outlook) using 3046 rating actions from S&P covering the period of 1998 to 2010. The results find evidence that SCR reports do contain new information beyond the credit rating action itself, which Agarwal *et al*. call a linguistic tone[9]. They subsequently argue that it is possible that technical analysts could possibly use the linguistic tone to predict future rating changes.

The results of these studies show that the hypothesis that SCR reports contain information of concern to investors is still inconclusive. While earlier studies argue that the information content of a SCR report is weakly significant, later studies suggest that SCR reports contain new default-related information beyond credit rating activities in the form of a 'linguistic tone', which technical analysts may use to predict future rating changes at the expense of average investors. However, this then raises the potential risk of information asymmetries because average investors without technical expertise cannot discern that linguistic tone.

2.3.2 Information Asymmetry

In recent decades, the increase in financial sophistication has resulted in the creation of complex financial instruments, whose risk cannot be easily quantified (Lambert *et al.*, 2012). Issuers of these instruments, together with finance professionals design strategies to reduce risk and maximize opportunities because they are experienced. They thus have access to more information about the securities than those who invest

[9] An implied pitch in the SCR report's grammatical language which express emotional information and conveys emphases.

in them, producing information asymmetry (Armstrong *et al.*, 2011). Therefore, asymmetric information creates an imbalance of power in financial transactions, which can cause transactions to go awry through adverse selection (Lu *et al.*, 2010), moral hazard (Kim and Verrecchia, 1994), or information monopoly (Ravi and Hong, 2014).

Hence, CRAs act as information intermediaries that independently produce new information and verify public announcements on the borrowers' creditworthiness, thus correcting informational imbalances between issuers and investors (Brown *et al.*, 2009). This is achieved through their valuation role by gathering, analyzing, and disseminating information relevant for assessing credit quality and making the results of their analyses widely available to market participants (Frost, 2007). Thus, CRAs bridge the information gap between issuers of securities and investors by measuring credit risk profiles of issuers (Rhee, 2015).

Dichev and Piotroski (2001) investigate the European long-term stock return movements following a credit rating change using Fama–MacBeth regressions to test a sample of 4700 Moody's sovereign rating announcements over the period of 1970 to 1997. They find significant abnormal returns for stocks that are not included in computing weighted indexes. Securities that are not part of a weighted index are not constantly subject to analysts' scrutiny. Hence, information about these securities is not frequently published, limiting the ability of investors and prospective investors to make informed decisions. Klimavičienė (2011) examines the OMX Baltic[10] All-Share index data for the period 2000 to 2009 using ordinary least squares. They find that there is price impact of negative events that is several times larger than that of positive events, which they call an asymmetric reaction. Hence, further to Dichev and Piotroski (2001), Klimavičienė (2011) posits that abnormal returns are a product of an asymmetric reaction especially after a sovereign downgrade.

These studies however, do not take into account that, in developing countries information asymmetry goes beyond analyst coverage in computing weighted indexes.

[10] OMX Tallinn, OMX Riga, and OMX Vilnius

Thus, Kraussl (2005) uses Ordinary Least Squares (OLS) in an event study analysis on S&P and Moody's rating actions between 1997 and 2000, and finds that SCR downgrades generate a strong financial market reaction in emerging market economies. In order to further examine the possible reasons for these reactions, Erbas (2005) examines 28 emerging sovereigns' capital flows and regulatory rankings to investigate the associations between institutional quality rankings and portfolio investment. Erbas then finds that SCR's effects may be stronger in emerging markets because of lack of transparency, low institutional quality and greater uncertainty. Hence, Erbaş concludes that emerging markets are susceptible to thorough rating agencies' evaluations and because of information asymmetry in emerging markets, SCR changes generate stronger market reactions accordingly.

It has therefore been shown that SCR change generate a stronger market reactions in emerging markets compared to developed markets. However there is no consensus on the empirical reasons why this is so, with some literature citing information asymmetry whilst others argue that it is the nature of institutional quality and transparency. Thus, CRAs bridge the information gap between issuers of securities and investors by measuring credit risk profiles of issuers, and thus correct informational imbalances. Hence, some studies posit that securities that are not constantly subject to analysts' scrutiny usually have limited information and thus limit the ability of investors to make informed decisions. It therefore follows that financial securities with high information asymmetries are perceived to be high risky and consequently attract a higher cost of capital.

2.3.3 Cost of Capital

It is a fundamental principle of financial economics that high risk assets should offer high returns (Fama and French, 1993). This risk-return tradeoff underlies the conceptual framework of asset pricing and investment decisions in efficient markets because investors pay a premium for bearing additional credit risk (Stulz, 1999). On these grounds, it is logical to conclude that SCR announcements directly affect the credit risk profile of all the companies operating in a country, and hence on the cost of capital.

Pukthuanthong-Le *et al.* (2007) study the impact of changes in sovereign ratings and outlooks on stock prices change by estimating a market model for an event study methodology on a comprehensive database of 34 countries, covering emerging and developed regions over the period 1990 to 2000. They find significant increase in cost of capital following a sovereign downgrade caused by high inflation, low fiscal balance, and high sovereign debt. Discounting expected cash flows with a high cost of capital reduces stock values. Pukthuanthong-Le *et al.* however do not address the effects of a rating change on investors' appetite to hold a rated security.

Kisgen and Strahan (2010) thus test the hypothesis that regulation-based credit rating directly affect investors' required return, bond yield and firm's cost of capital using 47 stocks and 90 bonds rated by the three international CRAs between 2001 and 2005. Their results show that as hypothesized, regulation-based credit ratings directly affect investors' required return, bond yields (especially around the investment-grade cutoff), and firm's cost of capital. If regulation recommends that securities should obtain credit ratings, investors will be biased towards rated securities. Their results thus suggest that the effects of a SCR announcement on the cost of capital may not be explained by simple tradeoff theories where firms balance financial distress costs against tax benefits of debt financing. Hence, downgraded securities would suffer a larger increase in its cost of capital than would be expected solely from the implied increase in probability of firms' distress.

Furthermore, Ratha *et al.* (2011) estimate a regression model specified with eight explanatory variables common in the three CRAs models to assess the financial market reaction to SCR for unrated emerging economies. They report that bond yield movements have a higher association with SCR announcements than stock price movements. A possible reason for this dynamic is because the bond yield is linked to credit risk, thus making it more susceptible to SCR announcements (which confirms Fama and French, 1993) while stocks respond by smaller margins to SCR announcements because they are already perceived as a relatively more risky asset

class (Lamont, 2014). Hence, Ratha *et al.* conclude that CRAs provide financial markets with new tradable information which directly impact cost of borrowing.

Bissoondoyal-Bheenick and Brooks (2012) assess the impact of sovereign rating announcements on the stock market returns by estimating four market models[11] in an event study methodology to test abnormal returns using a sample of all the rating announcements for US, UK, France, Germany, Netherlands, Belgium, Croatia, Austria and Norway for the period 1975 to 2010 from S&P's. They find statistically significant evidence that only SCR downgrade announcements result in an increase in the cost of capital and not vice-versa. Conversely, Morseth and Norgaard (2011) dispute that even SCR upgrade announcements affect cost of capital in developed financial markets, although their impact may sometimes not be symmetrically discernible. Contrary to Pukthuanthong-Le *et al*. (2007) and Kisgen and Strahan (2010), who generally conclude that SCR announcements has a bearing on cost of capital through potential financial distress, Morseth and Norgaard (2011) argue that there is a negative impact on stock return connected to all positive rating announcements, although it is difficult to find a plausible economic reason behind this rather than subjective qualitative aspects (Muragu, 1990). An inherent weakness in these studies is the assumption that financial markets are semi-strong efficient when reacting to rating unfavourable announcements, whereas in Africa's emerging markets, only the Johannesburg Stock Exchange (JSE) shows evidence of weak form efficiency while the others are non-efficient (Jefferis and Smith, 2005; Ajao and Osayuwu, 2012; Ntim *et al*., 2011).

The empirical studies on the cost of capital effects indicate that SCR announcements directly affects the credit risk profile of a country, and hence the cost of capital, ultimately affecting security values. Critics counter however, that the effects of a SCR announcement on cost of capital may not be explained by a risk-return tradeoff, but rather by subjective qualitative aspects. Thus, qualitative factors may explain the inconsistency in investors' adjusted required returns in response to the same SCR

[11] The market model, the quadratic market model, the downside model, and the quadratic downside model.

announcements. Hence, the varying response in cost of capital to announcements in SCR upgrades and downgrades generates excess returns because the cost of capital is the discounting element in determining security prices.

2.3.4 Abnormal Returns

A significant and growing body of literature has investigated the impact of a credit rating announcement on financial markets through the presence of abnormal returns during the event publication period (Ikram and Nugroho, 2014). One of the notable study by Mateev (2012) investigates evidence of abnormal returns during SCR announcements using OLS to estimate abnormal returns in an event study methodology on a sample of nine emerging market economies (Bulgaria, Latvia, the Czech Republic, Hungary, Poland, Romania, Russia, Slovakia, and Slovenia) over the period 1998 to 2007. He reports that bond yield spreads show evidence of positive abnormal returns whilst stocks show negative abnormal returns in response to a country's downgrade. Conversely, Mateev find no statistically significant evidence of abnormal returns in both bond and stock spreads of economies whose sovereign ratings are upgraded.

However, Hertel (2013) argues that abnormal returns are solely a result of speculation rather than a fundamental reaction. Using the cumulative abnormal returns of US denominated utility bonds rated by Standard and Poor's during the period 2000 to 2006, Hertel finds that, similar to Mateev (2012), there is significant evidence of abnormal returns on downgrade related announcements and no reliable abnormal returns for bond upgrades. Thus, investors are speculative about the downside risk that emanate from sovereign downgrades, which generate abnormal returns. Hence, Hertel concludes that abnormal returns are significantly stronger for credit downgrades towards speculative grade.

Contrary to Hertel (2013)'s conclusion, Jansen and Nikiforov (2015) argue that it may be inaccurate to assume that the majority of market participants are speculators, because speculators are temporary and opportunistic. Jansen and Nikiforov use 207,693 earnings announcements from NYSE, AMEX or NASDAQ listed companies spaning the

years 1984 to 2014 to test the hypothesis that speculators impact trading volume around information events using univariate, multivariate and robustness analyses. They find that speculators are much less committed to long-term trading in a specific stock because their trading decisions are not based on time-consuming fundamental analysis but rather on short-term speculative profits. Investors therefore do not stay in one market and thus cannot consistently influence abnormal returns because they only trade around information events for the short-term price momentum they generate rather than the intrinsic value of assets.

Similarly, Konijna and Rijkena (2011) question whether sovereign watchlist additions and outlook assignments can be classified as a credit rating event with default related information indicating possible future rating changes. Most studies on the effects of SCR announcements on financial markets test the significance of sovereign downgrade and upgrade while ignoring the possible effects of watchlist and outlook contributions to a sovereign change. Konijna and Rijkena thus investigate the extent to which watchlist and outlook information contributes to investors' expectations using an estimate default prediction model and outlook announcements from S&P between 1991 and 2005. Their results show that assigning a watch for downgrade or a negative outlook already leads to an immediate significant negative abnormal return reaction upon announcement. Hence, the actual SCR change announcement has a less pronounced effect when preceded by a watchlist addition.

Despite the finding of Konijna and Rijkena (2011), Crosta (2014) questions whether investors might use credit watchlists and outlooks to 'smooth' ratings changes. Applying a composite marginal likelihood approach to estimate a multi-year ordered probit model for each of the three major CRAs of 90 developing countries for the years 2002 to 2013, Crosta finds significant abnormal bond returns following negative watch announcements. He further observes that abnormal returns in response to watch and outlook changes are higher for countries whose credit rating is closer to the investment-speculative grade boundary, which Costa called a 'rating-sensitive boundary'. His analysis thus accords with Konijna and Rijkena (2011), and suggests that credit

watchlists and outlooks are a crucial source of information that can reliably be used as a tool to anticipate future rating movements that might be detrimental for specific rating-sensitive investors, such as mutual funds and insurance companies. Therefore, rating-sensitive investors can lighten their exposure in risky securities before future actions by smoothing their portfolio transition.

More recently Baum *et al.* (2016) apply GARCH models to examine the sovereign rating announcements from Moody's, S&P and Fitch CRAs during the Eurozone debt crisis of 2010–2012. Baum *et al*. find that SCR announcements do significantly influence abnormal returns whereby CRA downgrades, watchlist and outlook announcements impact the value of security prices and also increase price volatility. They thus conclude that abnormal returns and volatility are a result of investors' rebalancing of their security portfolios to reduce their exposure to riskier borrowers when new SCR announcements are made.

Thus in conclusion, the literature on the impact of SCR announcements and the role of credit ratings in addressing information asymmetry on stock and bond returns is still inconclusive. Furthermore, to date, no study has been conducted on African markets, which are characterized by limited information, high risk assets, liquidity challenges, relatively few participants, lack of transparency, low institutional quality, and greater uncertainty. It is thus hypothesised that if SCR's are valuable information to financial market investors, then they should adjust their portfolios after such announcements, thus causing excess returns in bonds and stock markets. Furthermore, if SCR announcements impact financial markets, then CRAs may be contributing to the stability of financial markets in emerging countries.

2.4 Data Description

The analysis of SCR influence of financial markets in this study makes use of all SCR announcements, daily bond yield and daily stock returns data for the period 1 January 1994 (when Africa's first SCR was assigned to South Africa) to December 2014. The focus is on the historical sovereign ratings for each African country that has a SCR by

any or all of the three CRAs (Standard and Poor's, Moody's, and Fitch) which dominate the SCR industry.[12]

As the analysis focuses on the impact of a SCR announcement on financial markets, countries that do not have sovereign ratings have been excluded. Hence, the analysis covers a sample of 30 African countries that have sovereign ratings as at December 2014. These include Angola, Burkina Faso, Benin, Botswana, Democratic Republic of Congo, Republic of Congo, Ivory Coast, Cameroon, Cape Verde, Egypt, Ethiopia, Gabon, Ghana, Gambia, Kenya, Lesotho, Libya, Morocco, Mali, Malawi, Mauritius, Namibia, Nigeria, Rwanda, Seychelles, Senegal, South Africa, Tunisia, Uganda, and Zambia. However, of the 30 countries that have sovereign ratings six have no functional stock exchanges but they have been included in the sample as they have active bond markets and a sovereign credit ratings. The event of interest is any sovereign rating news announcement[13] about any of the 30 African countries from the period 1994 to 2014, which is published on respective websites by any or all of three international CRAs. The SCR announcements data is also cross compared with the SCR events published by *Tradingeconomics*[14] and *Countryeconomy*[15] to confirm credibility and data reputation.

The movements in stock returns capture the impact of a sovereign announcement on the stock market, thus the stock index in each country is used to estimate the market returns over the sample period. For the Bourse Régionale des Valeurs Mobilières (BRVM), which serves eight West African countries, a change in each country's rating is examined in relation to the overall stock market index. On the other hand, the S&P Africa 10-year sovereign bond index (USD) is used as benchmark to calculate normal bond market returns. In countries that issue multiple sovereign bonds at different times, the representative bond with the most time-series observations is chosen to insure greater consistency throughout the sample. The sovereign bond yield and stock return

[12] According to Standard and Poor's (2014), these three rating agencies cover more than 95 percent of SCRs.
[13] Downgrades, upgrades, outlook or watchlist.
[14] https://tradingeconomics.com
[15] https://countryeconomy.com

data was collected from Bloomberg and Reuters.

Consistent with the factors highlighted in the literature, the analysis also includes the overall state of the economy measured by interest rates and gross domestic product (GDP). Both quarterly GDP and quarterly central bank repurchase interest rates data was collected from the World Bank's World Development Indicators (WDI). These macroeconomic factors capture a country's economic activity and growth, which generate income that could potentially influence the analysis of SCR impacts. Interest rate changes directly influence business and household credit extension and interest expenses, and thus creditworthiness.

2.5 Methodology

To analyse the effects of sovereign rating announcements on financial market, the study uses an event study to examine the dynamic response of capital markets around the time of sovereign rating announcements in accordance with Campbell *et al.* (1996), Kothari and Warner (2007) and Dutta (2014). The analysis use capital markets to represent the financial markets as they represent long-term and relatively low volatility in asset prices. The study considers a sovereign credit announcement as an "event" and then examines if security prices before and after the event display abnormal returns in excess of their expected return (Fama *et al.*, 1969). The change in sovereign stock returns is the index return for sovereign *i* at time *t* (IR_{it}), which is determined using the following equation:

$$IR_{it} = ln\left(\frac{I_{it}}{I_{it-1}}\right) \tag{2.1}$$

Where I_{it} is the index for sovereign i at time t and I_{it-1} is the index for sovereign i at time $t-1$.

To calculate change in sovereign bond returns $(\mathrm{BY_{it}})$ the following equation is applied to the sovereign bond daily yield:

$$BY_{it} = ln\left(\frac{Y_{it}}{Y_{it-1}}\right) \quad (2.2)$$

Where Y_{it} is the bond yield for sovereign i at time t and Y_{it-1} is the bond yield for sovereign i at time $t-1$.

Following the methodology in Kaminsky and Schmukler (1999), Kaminsky and Reinhart (2000), Morset and Nørgaard (2011) and Mateev (2012) who have also investigated the effects of credit rating announcements using event studies, the S&P value-weighted All Africa index is used as the benchmark for calculating normal market returns. The S&P All Africa index is preferred because it is a comprehensive benchmark for the African continent constructed in US dollars, combining the constituents of the S&P Pan Africa, S&P South Africa Composite and S&P Zimbabwe BMI, covering companies listed in 13 countries: Botswana, Côte d'Ivoire, Egypt, Ghana, Kenya, Mauritius, Morocco, Namibia, Nigeria, South Africa, Tunisia, Zambia and Zimbabwe. The index is weighted by float-adjusted market capitalisation and is Africa oriented as most of its listed companies operate purely in or derive the majority of their revenue from the African continent. To estimate the expected returns, the market model is applied. If we let the market index return be conditional expectation $E(R_{it})$, to estimate expected returns for sovereign i at time t, the market model is specified as follows:

$$E(R_{it}) = \beta_1 + \beta_2 E(R_{mt}) + e_{it} \quad (2.3)$$

Given that $E(e_{it}) = 0,\ E(e_{it}, e_{it-j}) = 0\ and\ Var\ (e_{it}) = \sigma_{it}^2$

Where e_{it} is the stochastic error term, β_1 and β_2 are model parameters estimated by ordinary least squares regression, and $E(R_{mt})$ is expected market return at time t.

To complement the market model in estimating expected returns, the study also constructs the Generalized Autoregressive Conditional Heteroskedasticity (GARCH)

econometric technique to estimate volatility clustering around SCR events. Unlike the market model, the GARCH model captures volatility clusters in returns from the reaction to the announcements of stock and bond markets of the rated country. As recommended by Baum *et al.* (2016), the GARCH (p,q) is estimated using the following specification;

$$\sigma_t^2 = \omega + \alpha_1 u_{t-1}^2 \dots\dots\dots\dots + \alpha_p u_{t-p}^2 + \phi_1 \sigma_{t-1}^2 \dots\dots\dots\dots + \phi_q \sigma_{t-q}^2 \qquad (2.4)$$

$$\sigma_t^2 = \omega + \sum_{p=1}^{n} \alpha_p u_{t-p}^2 + \sum_{q=1}^{m} \phi_q \sigma_{t-q}^2 \qquad (2.5)$$

Where $\omega, \alpha \text{ and } \beta$ are non-negative are constants equal to 1, $\alpha_t \text{ and } \phi_t$ are unknown coefficients, u_{t-p}^2 are lagged errors, and σ_{t-q}^2 are lagged volatilities.

The GARCH parameters are estimated by the Method of Maximum Likelihood (Reusens and Croux, 2015). The analysis also run the model using both the student-*t* and the GED distributions, to examine if they have significant effect on the results. It is hypothesised that if the GDP and interest rates (in the variance equation) are significant in the GARCH multivariate model, then their influence on bond and stock returns (in the linear equation) are significant. Thus they have exogenously significant influences on the volatility of capital market returns. As recommended in Cappellari and Jenkins (2003) and Sigworth (2007), the estimators of the GARCH model assumes that the residual term follows a standard normal distribution, as often applied in GARCH(1,1) models to increase parsimony and predictive strength, and maximised as follows:

$$\text{Maximize: } \prod_{t=1}^{n} \left[\frac{1}{\sqrt{2\pi v}} exp\left(\frac{-u_i^2}{2v} \right) \right] \; or \; \sum_{i=1}^{n} -\ln(v) - \frac{-u_i^2}{v} \qquad (2.6)$$

$$where; \; v = \frac{1}{n} \sum_{t=1}^{n} u_i^2$$

Once the parameters are estimated, predicted returns in the sovereign rating event window can be calculated by entering in the market returns. The abnormal return of a sovereign i, on a trading day t (AR_{it}), is an index produced by Kothari and Warner (2007), Bissoondoyal-Bheenick and Brooks (2012) and Hertel (2013) as follows:

$$AR_{it} = R_{it} - E(R_{it}) \tag{2.7}$$

Where R_{it} is the actual return for a sovereign $i's$ stock index at time t, R_{it} is the actual return for a sovereign i' s bond index at time t, and $E(R_{it})$ is the expected return for a sovereign i at time t.

An event window period of 21 trading days[16] around the SCR news is applied to estimate the expected return for both bond yield and stock returns. The 21 day event window is the average event window recommended by Kothari and Warner (2007) that allows the full effect of the information announcements to be included when assessing event reactions.

After determining abnormal returns (ARs), if the influence of the event during the event window is not exclusively on the event date itself, it may be necessary to calculate the Average Abnormal Return (AAR) and the Cumulative Abnormal Returns (CAR). These are used to assess the aggregate effect of the abnormal returns. The two analyses are specified as follows:

$$AAR_{\mathrm{it}} = \frac{1}{N} \sum_{t=-10}^{+10} (AR_{it}) \tag{2.8}$$

$$CAR_{\mathrm{it}} = \sum_{t=-10}^{+10} (AR_{it} + AR_{it-1}) \tag{2.9}$$

[16]Split into 10 days before the event, 10 days after the event and 1 day as event day.

Where AR_{it} is the abnormal return of a sovereign i at time t and N is the sample size, which is the number of days in the event window.

To test the significance of the event impact on the financial markets, t-statistics are calculated whether the sample returns significantly differ from expected return for all the abnormal returns within the event window (as in studies by Erbaş, 2005; Klimavičienė, 2011; Mateev, 2012; Hertel, 2013; Ikram and Nugroho, 2014; Cooke and Bailey, 2015). The greater the magnitude of the t-statistic (either positive or negative), the greater the evidence that a SCR announcements have significant impacts, while the closer the *t*-statistic is to 0, the more likely there is no significant impact. The time-series *t*-test of Strong (1992) is applied as follows:

$$t_{\alpha} = \frac{AR_{it}}{std(AR_{it})} = \frac{R_{it} - [\beta_1 + \beta_2 E(R_{mt}) + e_{it}\,]}{s_{it}/\sqrt{n}} \qquad (10)$$

Where t_{α} is the student *t*-test at $\propto$ significance level, and $Std(AR_{it})$ is the standard error of abnormal returns of sovereign i at time t. In line with the estimation of the market model in equation 3, the standard deviation is measured over the estimation window for the time series *t*-test.

2.6 Empirical Results

The results of the panel unit root tests presented in Table 2.1 show that the four series (10-year sovereign bond index, S&P benchmark bond index, country stock index and S&P All Africa stock index) are stationarity at the 1 percent level. Thus, the unit root test results show that the statistics of the series are time invariant, which fulfils the main assumption of econometric theory (Varian, 2014).

Table 2.1: Panel Unit Root Test Results

	10-year sovereign bond index		S&P benchmark bond index		Country stock index		S&P all Africa stock index	
Null: Unit root (assumes common unit root process)								
Levin, Lin and Chu t*	-295,713	***	-339,784	***	-61,3595	***	-154,132	***
Null: Unit root (assumes individual unit root process)								
Im, Pesaran and Shin W-stat	-273,2	***	-288,422	***	-66,566	***	-154,41	***
ADF - Fisher Chi-square	1037.91	***	442.096	***	2238.03	***	2367.20	***
PP - Fisher Chi-square	836.051	***	442.096	***	1467.38	***	294.731	***

*** represents significance at the 1 percent level.

Table 2.2 below presents the results of the GARCH multivariate model and as can be seen, the influence of interest rates and GDP on both the country stock and 10-year sovereign bond indices are significant. These results show that interest rates and GDP (the major variables reflecting the overall performance of an economy (Kaminsky and Schmukler, 2001; Hull *et al.*, 2004; Chen *et al.*, 2016)) have exogenously significant influences on the volatility of capital market returns. Additionally, both the ARCH and GARCH parameters are significant, which shows that volatility in financial markets is approximately a result of both internal and external variance. However, the GARCH parameters (coefficients) shown in Table 2.2 lie within the normal range prescribed by Corhay and Rad (1996) and Zivot and Wang (2006). For daily data, the GARCH reaction parameters α and β usually ranges below 0.98 (for relatively stable market) and above 0.98 (for a nervous market). This suggests that though there is significant external volatility from interest rates and GDP within the 21-day SCR event window, their combined variance pressure on security prices is not enough to significantly influence financial market stability. The S&P All Africa Index's insignificant and small coefficient indicates that it does not significantly explain announcement responses of the country stock index. Hence, there is an insignificant association between a country's stock index and the S&P All Africa Index, possibly reflecting the nascent state of Africa's stock market integration.

Table 2.2: GARCH Mean and Variance Regression

Country Stock Index			10-Year Sovereign Bond Index		
C	0,815		C	0,005	
	2917,316	***		*5463,512*	***
S&P All Africa Index	0,001		S&P Benchmark Index	0,013	
	0,883			*224,315*	***
Variance Equation:			*Variance Equation:*		
C	0,096		C	0,000	
	2088,600	***		*944,811*	***
RESID(-1)^2	0,950		RESID(-1)^2	63,894	
	5,375	***		*4237,506*	***
GARCH(-1)	0,001		GARCH(-1)	0,001	
	3,698	***		*99,084*	***
GDP	0,958		INTEREST	0,001	
	-76,787	***		*83,257*	***
INTEREST	0,965		GDP	0,007	
	-76,461	***		*-724,298*	***
R-squared	0,393		R-squared	0,002	
Adjusted R-squared	0,393		Adjusted R-squared	0,002	
S.E. of regression	0,439		S.E. of regression	0,099	
Log likelihood	7794,845		Log likelihood	200436,100	

z-Statistic in italics. *** represents significance at the 1 percent level.

Having gained insight into the stationarity and external volatility behaviour of the variables, the discussion next turns to the results of the event study that sought to determine if financial markets react to SCR events announcements. Table 2.3 below presents a summary of SCR events announcements used to test the significance of abnormal returns (AR) in the 21-day event windows. The AR is averaged to give a general outcome of statistical significance using the *t*-test. The table shows that the average abnormal returns test statistics are not significant at the 5 percent (1.96) confidence interval within the 21-day window for all the countries except South Africa. This result could be because of the well-developed regulatory and legal framework in South Africa (Heerden Van *et al.*, 2013), and the relatively larger stock exchange (the largest in Africa and the 17th largest exchange in the world by market capitalization)

(Zhou and Sornette, 2009), which allows the country's stock exchange and debt markets to offer leading technology, surveillance and quick settlements (Yartey, 2008). The results in Table 2.3 generally find no evidence of upward or downward drift in abnormal returns after a SCR announcement. It can therefore be argued that the information value of a SCR in African countries other than South Africa is too weak to significantly influence bond and stock prices, possibly because most of these financial markets are grossly underdeveloped with sporadic trading activities (Billmeier and Massa, 2007; Massa, 2009).

While the average ARs for thirteen countries are significant at the 10 percent level (1.645)[17], this may be a result of a combination of factors such as the Libyan Civil War, which caused the Libyan Financial Market to close in February 2011; some countries having no stock exchanges[18]; or a lack of liquidity[19] and thus trading volume, which does not allow SCRs to be reflected in stock prices. The remaining ten countries[20] show no sign of abnormal returns even at 10 percent significant level within the event window. These results are contrary to Cantor and Packer (1996), Reisen and von Maltzan (1998) and Agarwal *et al*., (2015) who find that stocks and bonds respond significantly to the announcements of changes in SCR downgrade in emerging economies but may reflect the structural deficiencies in these African financial markets, such as inadequate oversight and lack of adaptive regulatory structure[21]. Hence, these findings imply that SCR reports do not contain information of concern to investors in the ten countries with insignificant abnormal returns.

[17] These countries are Botswana, Cape Verde, Egypt, Ghana and Lesotho, Libya, Morocco, Namibia, Nigeria, Rwanda, Seychelles, Tunisia and Zambia.
[18] These include Ethiopia, DRC, Congo, Gabon, Gambia, and Lesotho.
[19] This could include countries that form part of the West African regional stock exchange Bourse Régionale des Valeurs Mobilières SA (BRVM), which includes Burkina Faso, Côte d'Ivoire (Ivory Coast), Benin, Mali, Senegal, Guinea, Bissau, Niger and Togo.
[20] Cameroon, Burkina Faso, Senegal, Benin, Congo Republic, Gambia, Kenya, Malawi, Mauritius, and Uganda.
[21] For example, Cameroon does not have an index because of a high number of failed trading. Since the establishment of Cameroon's Douala Stock Exchange (DSX) in 2001, the exchange only had two listed companies by 2014.

Table 2.3: Summary of SCR events and average Abnormal Returns (AR) t-test

Country (Stock Index)	Country (Bond Index)	No. of Downgrades	No. of Upgrades	No. of Outlooks	No. of Watchlist	Average Abnormal Returns-t-test
BSE (DCIBT)	Botswana (SPFIBWU)	1	-	4	-	1,95*
DSX	Cameroon (SPFIEGC)	1	1	5	-	1,45
BVC	Cape Verde (SPSCBCV)	2	-	6	-	1,76*
BRVM (BRVMCI)	Benin (SPFIBWN) Burkina Faso (SPFIEGB) Senegal (SPFISNU)	2	-	6	1	1,55
-	Congo Republic (SPSCBCR)	1	1	-	-	1,05
EGX 100 (EGX100)	Egypt (SPFIEGU)	11	3	30	2	1,73*
GSE (ASIX)	Ghana (SPFIGHU)	2	1	6	-	1,86*
-	Gambia (SPFIKQGM)	2	-	-	-	1,24
-	Lesotho (SPFILSU)	-	1	-	-	1,77*
LSM	Libya (SPIFLYU)	4	-	-	-	1,87*
NSE (NASI)	Kenya (SPFIKEU)	-	-	2	-	1,22
MSE (MALSMV)	Malawi (SPFIMAU)	1	1	1	-	1,36
SEM (MDEX)	Mauritius (SPFIMUU)	1	-	2	3	1,5
CasaSE (MASI)	Morocco (SPFIMOU)	1	-	2	-	1,75*
NSX(OVRLNM)	Namibia (SPFINAU)	-	-	2	-	1,74*
NSE (NGSEINDEX)	Nigeria (SPFINGU)	1	1	4	-	1,91*
RSE (ALSIRW)	Rwanda (SPFIRWU)	-	3	3	-	1,79*
SSE	Seychelles (SPFISYU)	-	3	-	-	1,77*
JSE (FTWIZAFL)	South Africa (SPFIZAU)	5	5	17	1	1,96**
BVMT (TUNINDEX)	Tunisia (SPFITNU)	9	4	6	2	1,93*
USE (ALSIUG)	Uganda (SPFIUGU)	1	-	3	-	1,06
LuSE (LASILZ)	Zambia (SPFIZMU)	2	-	4	-	1,94*

* represents significance at 1 percent level (>2.575),

** represent significance at 5 percent level (>1.960), and

*** represents significance at 10 percent level (>1.645)

The next step of the analysis is to test the significance of the returns using the AR *t*-test on the credit rating announcements. The results set out in Table 2.4 below show that a few countries with a BBB rating class react significantly negative in response to a SCR downgrade announcement (when they were thus downgraded from BBB+ to BBB), including Mauritius, Tunisia and South Africa (at the 5 percent (-1.96) significance level); and Namibia, Morocco and Mauritius (at the 10 percent (-1.645) significance level). The remaining countries do not show significant evidence of abnormal returns when a SCR change is announced. Thus, these results indicate that countries with financial markets

that are already perceived to be risky (below investment grade and almost perennially on the CRA's watchlist), do not react significantly to SCR downgrade announcements. This accords with Michaelides *et al.* (2015) and Mohapatra (2016), who report that SCR announcements generate stronger market reactions in markets that are susceptible to information asymmetry, such as in emerging market economies.

Table 2.4 further shows that there has been a relatively few number of SCR upgrades announcements, suggesting that in Africa, once a sovereign is downgraded, upgrading thereafter is difficult. In addition, almost all SCR upgrades show no significant sign of abnormal returns both at the 5 percent and 10 percent significance levels. This is also consistent with Dallocchio *et al.* (2006) and Mateev (2012) who observed no significant abnormal returns after a SCR upgrade announcements. A possible reason for this result is that investors tend to be more cautious about downside risk and passive on the upside (Mateev, 2012).

Table 2.4: SCR Significance Test Results

	Sovereign Credit Downgrades Significance Scale						
Credit Rating Scale for Fitch/S&P (Moody)	[<-1.96]	[-1.96;-1.65]	[-1.64;-1.28]	[-1.27;1.27]	[1.28;1.64;]	[1.65;1.96]	[1.96]>
A (A2) to A- (A3)	-	-	1	-	-	-	-
A- (A3) to BBB+ (Baa1)	-	-	-	1	-	-	-
BBB+ (Baa1) to BBB (Baa2)	2	1	1	1	-	-	-
BBB (Baa2) to BBB- (Baa3)	-	-	2	2	-	-	-
BBB- (Baa3) to BB+ (Ba1)	-	-	3	4	-	-	-
BB+ (Ba1) to BB (Ba2)	-	-	3	2	-	-	-
BB (Ba2) to BB-(Ba3)	-	-	3	2	-	-	-
BB- (Ba3) to B+(B1)	-	-	-	3	-	-	-
B+ (B1) to B (B2)	-	-	-	2	-	-	-
B (B2) to B- (B3)	-	-	-	2	-	-	-
B- (B3) to CCC+ (Caa1)	-	-	-	1	-	-	-
CCC+ (Caa1) to CCC (Caa2)	-	-	-	1	-	-	-

	Sovereign Credit Upgrades Significance Scale						
Credit Rating Scale for Fitch/S&P (Moody)	[<-1.96]	[-1.96;-1.65]	[-1.64;-1.28]	[-1.27;1.27]	[1.28;1.64;]	[1.65;1.96]	[1.96]>
A- (A3) to A (A2)	-	-	1	-	-	-	-
BBB+ (Baa1) to A- (A3)	-	-	-	-	-	-	-
BBB (Baa2) to BBB+ (Baa1)	-	-	-	1	-	-	-
BBB- (Baa3) to BBB (Baa2)	-	-	-	-	-	-	-
BB+ (Ba1) to BBB- (Baa3)	-	-	-	1	-	-	-
BB (Ba2) to BB+ (Ba1)	-	-	-	2	-	-	-
BB-(Ba3) to BB (Ba2)	-	-	-	1	-	-	-
B+(B1) to BB- (Ba3)	-	-	-	2	-	-	-
B (B2) to B+ (B1)	-	-	-	2	1	2	-
B- (B3) to B (B2)	-	-	-	1	2	-	-
CCC+ (Caa1) to B- (B3)	-	-	-	1	1	-	-

>+/- 2.575 represents significance at 1 percent level

>+/- 1.960 represent significance at 5 percent level, and

>+/- 1.645 represents significance at 10 percent level

The effects of a SCR negative outlook announcement are shown in Table 2.5 below. Out of the 92 SCR negative outlook changes, only 8 events show significantly negative abnormal returns at the 5 percent level and 46 at the 10 percent significance level. These results suggest that a negative outlook has a significant impact on the majority of African financial markets, possibly because assigning a negative outlook is a signal of an impending downgrade (Konijna and Rijkena, 2011; Crosta, 2014; Baum *et al*., 2016). Hence, the actual SCR announcement may ultimately have a less pronounced effect

when preceded by a negative outlook.

However, for the same SCR negative outlook announcement presented in Table 2.5, there are 4 events that show a significantly positive reaction at the 10 percent significance level. These significantly positive abnormal returns following a negative outlook announcement are contrary to Konijna and Rijkena (2011) and Crosta (2014)'s findings that a SCR downgrade and a negative outlook announcement leads to an immediate significant negative abnormal return reaction upon announcement. This suggests that the positive abnormal returns could be driven by other fundamental economic variables rather than the rating announcements, or by speculation about the SCR change before the announcement dates thus pushing the security returns in the opposite direction (Hertel, 2013; Jansen and Nikiforov, 2015).

The results for the positive outlook presented in Table 2.5 indicate that African countries had a total of 9 SCR positive outlook announcements during the period 1994 to 2014, with only 4 events showing significantly negative abnormal market reactions at the 10 percent level. The remaining 5 outlook events show insignificant returns at the 10 percent significance level, which indicates that the market is not moved by positive outlook announcements; and therefore, there are no abnormal returns. Unlike previous studies by Konijna and Rijkena (2011), Hertel (2013), Crosta (2014) and Baum *et al*. (2016) who combine both positive and negative outlooks in their analysis, this study observes that positive outlooks are not relevant information to investors, and thus there are no significant excess returns for the positive outlooks. Hence, the results imply that positive outlook credit announcements have a little effect on stocks prices adjustments.

Table 2.5: SCR Outlook Significance Test Results

	Sovereign Credit Negative Outlook Significance Scale						
Credit Rating Scale for Fitch/S&P/Moody	[<-1.96]	[-1.96;-1.65]	[-1.64;-1.28]	[-1.27;1.27]	[1.28;1.64;]	[1.65;1.96]	[1.96]>
Positive to Stable	-	4	21	18	5	2	-
Stable to Negative	1	2	19	15	4	1	-
Under review (Watch)	1	-	6	8	5	1	-
	Sovereign Credit Positive Outlook Significance Scale						
Credit Rating Scale for Fitch/S&P/Moody	[<-1.96]	[-1.96;-1.65]	[-1.64;-1.28]	[-1.27;1.27]	[1.28;1.64;]	[1.65;1.96]	[1.96]>
Negative to Stable	-	4	-	1	-	-	-
Stable to Positive	-	-	4	-	-	-	-

>+/- 2.575 represents significance at 1 percent level

>+/- 1.960 represent significance at 5 percent level, and

>+/- 1.645 represents significance at 10 percent level

Thus in summary, the results show that the observed pattern of credit rating announcements provide weak and inconsistent informational content to Africa's emerging financial markets. The information value of a SCR in African countries other than South Africa is too weak to significantly influence bond and a stock prices. In addition, the extent of the market reaction varies depending on the type of credit rating information. Evidence suggests that the effect of SCR upgrades and positive outlook changes on both bond and stock markets is insignificant whilst a downgrade and negative outlook has a weakly significant impact on the majority of African financial markets, possibly because investors are more conscious about the downside risk and passive on the upside.

2.7 Conclusion

This chapter examined whether a sovereign rating announcement influences excess bond and equity returns in 30 African countries that received a SCR during the period 1994 to 2014. The results of GARCH and event study analysis finds that the African financial markets are weakly sensitive to SCR announcements, which implies that there is no significant evidence of excess market returns influenced by sovereign credit rating announcements. Hence, it can be inferred that the announcements of sovereign credit

ratings do not significantly change the African capital markets because they are already perceived to be risky markets, and thus attract mostly passive and long-term investors. Most of the African countries' SCRs are below investment grade and consequently suffer from illiquidity challenges. These results further suggest that both foreign and domestic investors in African financial markets are resilient when investing in low growth economies that have uncertainties associated with sub-investment grade credit ratings. Thus, these results indicate that the hypothesis that CRAs may be contributing to the instability of financial markets in emerging countries (Kaminsky and Schmukler, 2001; Elkhoury, 2008) does not apply to Africa's financial markets.

CHAPTER 3

WHAT IS THE EFFECT OF A SOVEREIGN CREDIT RATING ON BOND AND EQUITIES MARKETS?

3.1 Summary abstract

This chapter investigates the net effect of sovereign credit rating announcements on long-term foreign currency denominated bonds and stock markets in 19 African countries over the period of 1994 to 2014. Using a combination of Granger Causality tests and Dynamic Conditional Correlation (DCC) models, the results show that there is a positive relationship between Africa's stock and bond markets, but weak positive associations between sovereign credit ratings and bond and stock markets. These results imply that both stocks and bonds react negatively (positively) to sovereign credit downgrade (upgrade) announcements. The chapter further finds that sovereign rating changes affect bond prices more than stock prices because of the volatility in the magnitude of a sovereign downgrade on the default risk premium and bond yields in African markets.

3.2 Introduction

Historically, rising stock prices are associated with rising bond yields and falling bond prices (Stivers and Sun, 2002) because investors commonly sell bonds to raise money to buy stocks and sell stocks to raise money to buy bonds (Maslov and Roehner, 2004). Hence, stocks and bond prices move in opposite directions because of their inverse responses to macroeconomic fundamentals and thus the type of securities that investors buy reflects their level of confidence in the future of a country's economy (Zaima and McCarthy, 1988). For example, when investors are optimistic about future economic growth prospects, they invest more in stocks, which offers a higher return in the long-term but are perceived to be a riskier asset class because they are volatile in the short-term and there is no guarantee of positive returns. In contrast, when they are pessimistic about a country's economic future, they invest in bonds because bonds pay

a fixed rate of return, which may only increase if the country's risk profile increases and thus their prices are less volatile than stock prices (Chen *et al.*, 2014). However, over the last decade, stocks and bond prices have begun to show signs of a positive correlation, possibly as a result of quantitative easing (Favero *et al.,* 2010) and low inflation expectations, which influence securities prices through their interest rate component (Rankin and Idil, 2014). The movements of stock and bond prices is also affected by portfolio reallocation whereby capital flows across countries' borders as foreign investors invest or divest from both stocks and bonds.

On the other hand, the efficient market hypothesis argues that financial markets are driven by investors' reactions to new information (Fama, *et al.,* 1969). Thus, investors reduce their required rate of return when new information is positive and vice-versa (Alexeev and Tapon, 2011). Hence, a sovereign rating downgrade (upgrade) is considered to be negative (positive) information by the market (Hand *et al.*, 1992; Ammer and Clinton, 2004; Mateev, 2012) whereby, a SCR announcement should lead to either a positive (upgrade) or negative (downgrade) stock market and bond market reaction. However, empirical evidence of this effect on both stock and bond markets is still inconclusive, as Zaima and McCarthy (1988) and Goh and Ederington (1993) argue, it is possible that rating downgrades do not necessarily have negative implications for stockholders because investors can transfer funds from bonds into stocks when a country is downgraded.

Relevant studies report conflicting evidence and inconsistent conclusions with regard to the relationship between the three variables of sovereign credit ratings, bond markets and stock markets. It can be hypothesised that if stocks and bond prices move in opposite directions because of their inverse responses to macroeconomic fundamentals (Stivers and Sun, 2002; Maslov and Roehner, 2004), then a SCR downgrade (upgrade) should lead to a negative (positive) reaction from either bonds or stock prices. On the other hand, if a sovereign rating downgrade (upgrade) is considered to be negative (positive) information by both the stocks and bond markets (Hand *et al.*, 1992; Ammer and Clinton, 2004; Mateev, 2012) then a SCR downgrade (upgrade) should lead to a

negative (positive) reaction from both bonds or stock prices. Hence, this chapter contributes to the SCR literature by examining the relationship between three variables; sovereign credit ratings, bond market and stock market using developing countries data so as to determine how each one react to a change in the other.

In order to investigate the relationship between SCR announcements, stocks returns and bond returns in 19 African countries over the period of 1994 to 2014, this chapter uses Granger Causality test and Dynamic Conditional Correlation (DCC) models to answer the following three questions: (i) do stocks and bonds react negatively (positive) to a sovereign credit downgrade (upgrade); (ii) how do stockholders and bondholders adjust their required return following a SCR change, and (iii), what is the association between Africa's bond and stock returns following SCR announcements? The remainder of this chapter is structured as follows. Section 3.2 reviews the literature devoted to investigating the net effect of SCR announcements on bond and stock markets, and the association between stocks and bonds in the context of credit rating changes. Section 3.3 then describes the stock returns, bond returns and sovereign rating data. Section 3.4 next presents the Granger Causality and Dynamic Conditional Correlation Generalised Autoregression Conditional Heteroskedasticity (DCC-GARCH) methodologies used to conduct the analysis. The findings are discussed in Section 3.5, and the study then concludes with a summary of key findings in Section 3.6.

3.3 Literature Review

Over the last decade, a large body of literature has explored the impact of SCR changes on financial markets, but only a few studies have been devoted to investigating the net effect of SCR announcements on bond and stock markets, and very few have examined the effect on markets in Africa. This literature review proceeds as follows. First, studies that are devoted to investigating whether bonds and stock returns react positively (negatively) to SCR upgrades (downgrades) are discussed. Thereafter, the literature on the association between stocks and bonds in the context of credit rating changes are explored. The literature review then concludes with a summary of studies that explore the net effect of SCR changes on securities returns.

Amongst the first to argue that stockholders do not react negatively to sovereign downgrades are Zaima and McCarthy (1988), who apply a wealth redistribution analysis on Standard and Poor's credit rating announcements between 1980 to 1981. They report that sovereign rating downgrades are accompanied by positive stock returns and widening bond spreads. Hence, they conclude that if a SCR changes, financial market reactions are a result of investors redistributing their wealth from bonds to stocks because a sovereign downgrade increases the default risk premium, bond yields, and investors' required return; which affects the bond prices more than stock returns.

Goh and Ederington (1993) concur with Zaima and McCarthy (1988) in arguing that a downgrade does not necessarily have negative implications for stockholders. However, Goh and Ederington further classify the rating downgrades into two classes: downgrades due to a country's deteriorating economic prospects and downgrades due to an increase in sovereign debt. They apply an event study methodology to investigate reactions of the New York Stock Exchange (NYSE) following Moody's announcements between 1984 and 1986. The results show that downgrades caused by deteriorating economic prospects have negative implications for stockholders because it reflects CRA's expectations of the sovereign's future income. In contrast, downgrades because of increased sovereign debt has a positive effect because it is generally a response to past known debt increases. Thus, when bonds are downgraded because the rating agencies foresee an increase in leverage, investors transfer funds from bonds to stocks, which cause bond returns to fall and stock returns to rise.

Dhillon and Johnson (1994) test the effects of economic productivity by examining how stock and bond prices reacted to 11 140 rating changes occurring between 1978 and 1987. They apply the mean-adjusted returns methodology to analyse bond and stock returns and find that a downgrade as a result of decreased productivity growth drives both the bonds and stocks down. Thus, the results support the findings of Goh and Ederington (1993) that both debt and stock markets are conditioned by expectations. They therefore expound the view that if the reason for a sovereign rating change is

based on projections, forecasts and expections of inside information, then both bonds and stocks react in the same direction.

Goh and Ederington (1999) apply an event study method to 1526 bond rating changes by Moody's between 1984 and 1990 to investigate whether downgrades caused by deteriorating economic prospects have negative implications for both stockholders and bondholders because it reflects CRA's expectations of the sovereign's future income. Their results find that the stock market reacts negatively (positively) to rating downgrades (upgrades) at the lower (higher) end of the rating scale such as at the substantial risk (prime) grade. Therefore, they conclude that the rating category, together with investors's expections and the economic status of a nation determines the reaction of security-holders to credit rating changes.

Similary, Kim and Nabar (2003) hypothesise that there is a cost imposed on bonds and stocks by sovereign downgrades information conveyed by CRAs. Their analysis uses the 184 stocks listed on NASDAQ and bond rating downgrades from Moody's Bond Survey for the period 1991 to 1995. The results of cross-sectional analysis support the cost imposition hypothesis as they find that firms' stock returns are positively related with their institutional stockholdings. Their findings suggest that, companies that have low-to-no institutional stockholding generate stronger negative stock and bond reactions because the rating agency becomes an important information provider. Also, in accordance with the pecking order of capital structure (Myers and Majluf, 1984), these companies are usually unable to generate enough cash internally, hence they turn to debt funding. Thus, they conclude that both bonds and stock returns of companies with high market-to-book values and high debt-to-equity ratios react significantly negative to bond downgrades.

Additionally, Leonard and Olinsky (2013) find support for Linciano (2004) after examining the impact of a bond downgrade on stock prices using an event study methodology on 20 271 downgrades from the three major rating agencies on publicly traded fixed income securities in the Mergent's Fixed Income Securities Database and

the Standard and Poor's 500 (S&P500) index between 2001 and 2011. Both studies find no statistically significant stock market reactions following a rating downgrade. However, Leonard and Olinsky argue that equity investors do not react significantly to downgrade announcements because the risk is already reflected in the company's stock prices while Linciano posits that stock prices do not respond immediately after a downgrade but rather gradually, which becomes statistically significant over time.

Gande and Parsley (2014) hypothesise that the most likely action investors take after a SCR downgrade is to transfer funds from bonds to stocks as bond yields and interest rates increase because of increased risk exposure whilst equity values decrease due to rising cost of capital. To test their hypothesis, Gande and Parsley examine the variance of firms' future cash flows to determine how they respond to sovereign bond rating downgrades. In line with Goh and Ederington (1993) and Zaima and McCarthy (1988), the results affirm their hypothesis and thus they conclude that stockholders are inherently holding an option on the value of the firm with an exercise price equal to the par value of the firm's debt. Therefore, an increase in the variance of the firm's cash flows pushes investors to redistribute funds from bonds to stocks.

Harumi and Tatsuyoshi (2015) find support for studies by Zaima and McCarthy (1988), Goh and Ederington (1993) and Gande and Parsley (2014) after examining the relationship between stock and bond returns. Using a smooth transition regression (STR) model to examine the volatility index (VIX), short rate and yield spread on the S&P 500, Deutscher Aktienindex (DAX) and Financial Times Stock Exchange (FTSE) monthly data for the period 1991 to 2012, they find that when a sovereign rating profile is downgraded, stocks respond positively as investors engage in an intensive 'flight-to-quality' behaviour, withdrawing from bonds to stocks and thus causing stock (bond) prices to rise (fall). However, they further find that the reaction is not constant over-time as the business cycle fluctuations have significant effects on risk management and asset allocation. Hence, some mean-reverting reactions of stock and bond returns after a downgrade may be observed. Thus, they argue that the reason behind a sovereign rating action is critical to understanding the direction of the market in reaction.

The majority of studies analysed so far have shown that sovereign rating downgrades are accompanied by positive stock returns and widening bond spreads as investors redistribute their wealth between stocks and bonds. However, as will be explored below, other studies counter that the reaction of each class of securities following a credit downgrade depends on the association between them. Thus, a number of studies have recently observed that there is evidence of a positive association between stocks and bonds following sovereign downgrades, further raising concerns of high portfolio risk amongst portfolio managers when a market variable such as sovereign rating changes. Conversely, other studies argue that the stock-bond association is time variant, and depends on the credit rating information announced. Despite conflicting evidence on the stock-bond association, portfolio investors usually prefer a mix of bonds and stocks for diversification (Rua and Nunes, 2009).

Flor and Hesel (2015) argue that there are differential relationships between SCR downgrades and intra-regional stock-bond return correlations, which are largely due to a common-lender effect in financial markets. Applying ordinary differential equations to analyse the differential relationship between SCR downgrades and intra-regional stock-bond return correlations, they find that similar to Shiller and Beltratti (1992), Campbell and Ammer (1993), Chan *et al.* (1997), Engsted and Tanggaard (2001), Stivers and Sun (2002), Guidolin and Timmermann (2005) and Andersen *et al.* (2007), there is a positive stock-bond return association. However, they further argue that sovereign upgrades are commonly associated with periods of monetary easing as the return correlation tends to rise accordingly; while downgrades trigger monetary tightening, leading to a decrease in the stock-bond association. Thus, they conclude that the positive stock-bond relationship is largely driven by the common discount rate effect between bond and stock market variables.

In contrast to the studies discussed above, another body of literature argues that the relationship between bond and stock returns is mostly negative, as funds are apportioned between bonds and stocks. Maslov and Roehner (2004) hypothesise that

stock and bond returns generally do not have a statistically significant association because the collective behaviour of investors loses some of its effect over time. Using quasi-experimental approach on the U.S. 10-year Treasury yields and the New York stock market index during the period 1954 to 2003 to test the reaction between stocks and bonds in response to a SCR change, they observe that stock returns have a strong correlation, but the negative stock-bond return correlations following market shocks fade away in over time. Thus, they argue that the decreasing stock-bond association points to a drastic change in the behaviour of investors following fundamental news dissemination. Hence, investors respond to sovereign downgrades by selling all their risky assets (such as stocks) to buy non-risky assets (such as Treasury bills and bonds) because of increase in credit risk.

Another set of studies further argues that the relationship between stocks and bond returns following a sovereign rating change depends on exogenous conditions. Andersen *et al.* (2007) argue that negative news such as sovereign downgrades only have a positive (negative) impact on the stock-bond relationship during economic expansions (contractions). They use structural GARCH and Lucas models to investigate the correlation between stock and bond returns and the effects of macroeconomic news announcements on the S&P500, FTSE100 and 30-Year United States (US) Treasury bond from 1998 to 2008. Their analysis shows that there is significant evidence that there are cashflow and discount rate effects which influence the stock-bond correlations, triggered by sovereign rating changes. Furthermore, they argue that the cashflow effect (discount rate effect) is usually more pronounced during economic contractions (expansions) resulting in low-to-negative (positive) stock-bond return correlations. Hence, they conclude that equity markets react differently to the same news depending on the state of the economy compared to bond market reactions.

Following Maslov and Roehner (2004)'s conclusion, Pukthuanthong-Le *et al.* (2007) hypothesize that there are country cross-asset effects caused by interactions between rating changes and securities returns, which triggers the collective behaviour of investors to buy safe investments when market fundamentals change. They thus apply

an event study technique on a comprehensive database of 34 countries covering the major regions in the world over the period 1990 to 2000 to examine the financial market impact of changes in ratings of one type of security on other assets. The results show that investors respond significantly to a downgrade across asset classes in times of a relatively healthy economy (as proxied by low inflation, high liquidity, low current account and low foreign currency debt), thus confirming their hypothesis. Hence, in accordance with Andersen *et al.* (2007), Pukthuanthong-Le *et al.* conclude that stocks outperform bonds during economic expansions whereas bonds outperform stocks during economic contractions, but either way there is a negative return correlation.

Johnson *et al.* (2013) counters that when inflation falls, it is not necessarily true that stock and bonds returns become negative because every business has its own cycle. Using an error correction model, they analyse the behaviour of the 10-year US Treasury bond yield against the S&P500[22] over the period from 1927 to 2013. They find that in the short run, the stock-bond correlation is negative as long as the business cycle dominates the effects of rates and inflation; whereas in the long run, the correlation may be higher and even positive due to the influence of inflation, risk aversion, and the smoothing of business cycles. Hence, they conclude that credit downgrades are among the key drivers of macroeconomic risk, and are thus responsible for a significant portion of the dynamics of stock-bond returns correlation.

In addition to whether stocks and bond returns have a positive or negative reaction to ratings changes, another group of studies investigates whether the stock-bond relationship is time variant. Ilmanen (2003) examines the correlation of U.S. stock and bond returns from 1929 to 2001 using regression equations, GARCH models and Granger causality tests following downgrade events. The results show that the stock-bond correlation is positive, except for the periods of 1929 to 1932, 1956 to 1965, and 1998 to 2001. Furthermore, he finds that the underlying causes of positive and negative stock-bond return correlations are economic and monetary policy cycles, inflation rates, and volatility shocks. Therefore, he argues that there is a positive causality from bond

[22] The S&P90 was used for periods prior to the release of the S&P500.

prices to stock prices resulting in positive stock-bond correlation as falling bond yields also cause discount rates to fall, whilst causality from stock prices to bond prices is negative. He concludes that in times of monetary easing, a positive correlation is evident because the prices of both bonds and stocks rise, whereas they decrease during monetary tightening. Hence, the changing stock-bond correlation is a sign of changing causality between the stock and bond markets following a sovereign downgrade.

Following Ilmanen (2003)'s recommendations, Christopher *et al.* (2012) investigates the transitory effects of SCRs on time-varying stock and bond market correlations by employing a bivariate GARCH (1,1) model with Engle's three-stage dynamic conditional correlation (DCC) estimation methodology covering a sample 19 emerging countries over the period 1994 to 2007. Similar to Ilmanen (2003) and Andersson *et al.*, (2008), Christopher *et al*. finds that stock and bond market co-movements within a region respond heterogeneously to sovereign ratings information. However, they argue that there is usually significant capital flight if a country with higher foreign currency debt is downgraded as investors are sensitive to default risk emanating from foreign currency debt. Thus, Christopher *et al*. concludes that investors shift their funds from downgraded countries with high foreign currency debt into the surrounding neighbouring countries within the region with low foreign currency debt.

Thus in summary, the central theme of these studies is that bond and stock market returns are conditioned by investors' expectations. And the state of economy during sovereign rating action determines the security that performs best. Therefore, sovereign downgrades do not necessarily have negative implications for all security-holders. Given that the relationship between stock and bond returns has always been of interest, one group of literature concludes that the positive or negative correlation between stocks and bonds is driven by stock market uncertainty emanating from sovereign rating actions. Conversely, other studies observe time variant stock-bond return correlations because markets react differently to the same news depending on the type of news and the state of the economy. Despite the conflicting evidence on the relationship between

bond and stock returns, investors still prefer a mix of bonds and stocks as an asset allocation strategy to diversify their portfolios and enhance their overall portfolio performance.

3.4 Data Description

The empirical analysis makes use of the daily bond yield, daily stock returns and sovereign ratings announcements of 19 African countries that received a SCR by any or all of the three largest CRAs (Standard and Poor's, Moody's and Fitch) over the period of 1994 to 2014.[23] Whilst there are 30 African countries with SCRs, 6 of them were excluded from the sample as they do not have both functional stock exchange and active bond market whilst the analysis requires data on both capital markets. To examine the net effect of credit rating announcements, the empirical analysis follows Afonso *et al.* (2011) by linearly transforming the rating symbols used by the three international rating agencies from ordinal rating scales into numbers. Table 3.1 below shows the rating scales used by the three international rating agencies whereby a higher credit rating denotes a lower probability of default and vice versa. Although S&P and Fitch use different symbols from Moody's in assessing sovereign risk, the corresponding rating grade is applied for the linear transformation comparison.

[23] These include Burkina Faso, Benin, Botswana, Ivory Coast, Cameroon, Egypt, Ghana, Gambia, Kenya, Morocco, Mali, Malawi, Mauritius, Namibia, Nigeria, Rwanda, Senegal, South Africa, Tunisia, Uganda, and Zambia.

Table 3.1: S&P, Moody's and Fitch rating system

Characterization of debt and issuer	Rating			Linear transformation
	S&P	Moody's	Fitch	
Highest quality	AAA	Aaa	AAA	23
High quality	AA+	Aa1	AA+	22
	AA	Aa2	AA	21
	AA-	Aa3	AA-	20
Strong payment capacity	A+	A1	A+	19
	A	A2	A	18
	A-	A3	A-	17
Adequate payment capacity	BBB+	Baa1	BBB+	16
	BBB	Baa2	BBB	15
	BBB-	Baa3	BBB-	14
Likely to fulfil obligations, ongoing uncertainty	BB+	Ba1	BB+	13
	BB	Ba2	BB	12
	BB-	Ba3	BB-	11
High credit risk	B+	B1	B+	10
	B	B2	B	9
	B-	B3	B-	8
Very high credit risk	CCC+	Caa1	CCC+	7
	CCC	Caa2	CCC	6
	CCC-	Caa3	CCC-	5
Near default with possibility of recovery	CC	Ca	CC	4
			C	3
Default	SD	C	DDD	2
	D		DD	1
			D	0

Furthermore, so as to consider other sovereign rating announcements, such as rating outlooks and addition to credit watchlist (under review), a change in a rating outlook to positive (negative) is accounted for by adding 0.5 (-0.5) to one credit rating notch, while a positive (negative) credit watch is accounted for by adding 0.25 (-0.25) to one rating-notch. The data for the three independent variables is analysed at first difference to capture changes over time.

Consistent with Christopher *et al.,* (2012), this study uses the daily S&P 10-year

sovereign bond indices, which track the performance of both local and foreign currency-denominated sovereign bonds. The index is designed specifically for Africa's emerging debt markets. To measure stock market performance, the daily S&P value-weighted stock indices denominated in United States dollars is used. These stock indices are weighted by float-adjusted market capitalisation and are African-oriented (the majority of listed companies operate purely in or derive the majority of their revenue from the African continent). The daily index returns accurately capture asset co-movements at a higher frequency in line with Zaima and McCarthy (1988), Goh and Ederington (1993), Kim and Nabar (2003) and Christopher *et al*. (2012). The bond and stock market data was obtained from Bloomberg and Reuters, while the SCR data was obtained from the respective credit rating websites.

3.5 Methodology

The analysis of the net effect of sovereign ratings on both stocks and bond returns makes use of the Granger causality test (Granger, 1988) to investigate the possible causal relationships between the factors. It is hypothesized that if foreign currency denominated bond (stock) returns Granger cause stock (bond) returns, then investors prefer to buy bonds (stocks), which they sell when a sovereign rating is downgraded to raise funds to buy stocks (bonds). Hence, bonds (stocks) react negatively (positive) to a sovereign credit downgrade (upgrade). As Granger (1988) proposed, the study tests the following hypothesis for identification of a causal effect of the stock market on the bond market and vice versa:

$$P(Y_{t+1} \in A|\Omega_t) \neq P\left(Y_{t+1} \in A\middle|\Omega_{-x(t)}\right) \qquad (3.1)$$

Where P is the probability, A is the set of security returns, Ω_t is the information available at time *t* in the market, and $\Omega_{-x(t)}$ is the modified market where the information Ω_{t} is excluded.

Based on Ilmanen (2003), the Granger causality test estimates the following two regression equations:

$$y_t = \beta_{10} + \sum_{i=1}^{n} \beta_{1i} y_{t-i} + \sum_{j=1}^{n} \beta_{1n+j} x_{t-i} + \varepsilon_{1i} \quad (3.2)$$

$$x_t = \beta_{20} + \sum_{i=1}^{n} \beta_{2i} y_{t-i} + \sum_{j=1}^{n} \beta_{2n+j} x_{t-i} + \varepsilon_{2i} \quad (3.3)$$

Where n is the number of lags that adequately models the dynamic structure, ε_i are white noise error terms, x represents stock returns, y represents bond returns, and β_i are constant coefficients.

Thereafter, to determine whether the model satisfies best fit requirements, the F-statistic is applied by testing the significance of the Granger causality using the following specifications:

$$F = \frac{\sum_{i=1}^{m} (\bar{Y}_i - \bar{Y})^2 / (K-1)}{\sum_{i=1}^{m} \sum_{J=1}^{n_i} \left(Y_{ij} - \bar{Y}_i\right)^2 / (N-K)} = \frac{Explained\ variability}{Unexplained\ variability} \quad (3.4)$$

Where $\bar{Y}_i$ denotes the sample mean for country *i*, n_i is the number of observations for each country, $\bar{Y}$ is the overall mean of the data, K is the number of countries, and $N - K$ and $N - 1$ are degrees of freedom under the null hypothesis.

Having examined the causal relationships among the factors, the next step of the analysis is to investigate the associations between stocks and bond returns using the Dynamic Conditional Correlation analysis, a multivariate Generalised Autoregressive Conditional Heteroskedasticity (DCC-GARCH) model proposed by Engle (2002) in accordance with D'Addona and Kind (2006), Andersson *et al.*, (2008), Peng and Deng (2010) and Gusset and Zimmwemann (2015). Examining the association between stock and bond returns is important in understanding the direction of their response when market fundamentals change. Thus, it is hypothesized that if the relationship between stocks and bond returns is significantly positive, then stocks and bonds move in the

same direction in response to the same sovereign rating change.

The advantage of using the DCC-GARCH model is that it detects possible changes in conditional correlations over time, which also captures the dynamic investor behaviour in response to news and innovations. It further estimates correlation coefficients of the standardized residuals and directly accounts for heteroskedasticity. Thus, the DCC-GARCH model estimates the time varying correlation in stock and bond returns better than constant correlation. As recommended by Peng and Deng (2010), the DCC-GARCH (1, 1) is a more accurate dynamic correlation process, which is determined as follows;

$$r_{it} = \gamma_{it} + \phi_i r_{it-1} + \varepsilon_{it} \tag{3.5}$$

$$\sigma_{it}^2 = \omega_i + \alpha_i \varepsilon_{it-1}^2 + \beta_i \sigma_{it-1}^2 \tag{3.6}$$

$$\sigma_{ijt} = \bar{\sigma}_{ij} + \alpha\left(z_{it-1} z_{jt-1} - \sigma_{ij}\right) + \beta\left(\sigma_{ijt-1} - \bar{\sigma}_{ij}\right) \tag{3.7}$$

$$z_{it} = \frac{r_{it}}{\sigma_{it}} \tag{3.8}$$

Where r_{it} represents the return on asset *i* at time *t*, σ_{it} is the conditional volatility of asset *i* at time *t*, σ_{ijt} is the time t conditional covariance between assets i and j, and $\bar{\sigma}_{ij}$ is the unconditional expectation of the cross product $z_{it} z_{jt}$.

3.6 Empirical Results

Table 3.2 presents the results of the panel unit root tests, which show significant evidence that the residuals of the three series (10-year sovereign bond index, SCR and country stock index) are first difference stationary at the 1 percent level. Hence, their joint probability distribution remains constant when shifted in time (Lee *et al.*, 2010), which indicates that the processes are mean-reverting and stochastic shocks have temporary effects (Starica and Granger, 2005).

Table 3.2: Panel Unit Root Test Results

	10-year sovereign bond index		Sovereign credit rating		Country stock index	
	t-Statistic	Probability	t-Statistic	Probability	t-Statistic	Probability
Null: Unit root (assumes common unit root process)						
Levin, Lin & Chu t*	-119.846	0.000***	-1.28	0.100	-151.154	0.000***
Null: Unit root (assumes individual unit root process)						
Im, Pesaran and Shin W-stat	-149.893	0.000***	-0.532	0.297	-148.316	0.000***
ADF - Fisher Chi-square	2905.270	0.000***	51.787	0.026***	2985.220	0.000***
PP - Fisher Chi-square	313.152	0.000***	50.513	0.034***	313.152	0.000***

*** represents significance at 1 percent level

The next step of the analysis is to test the causality between credit rating and securities returns using the Granger Causality test (Granger, 1988). The results set out in Table 3.3 below show that the null hypothesis of no Granger causality running from the country stock index to the 10-year sovereign bond index can be rejected at the 1 percent significance level. However, there is no significant evidence to reject the hypothesis that the 10-year sovereign bond index does not have a unidirectional Granger causal relationship with the country stock index. Thus, the results indicate that there is unidirectional causality running from stocks to bonds but not in reverse, which suggests that a change in stock prices provide a cue to investors to take a position in the bond markets. This result contrasts with Maslov and Roehner (2004) who used a quasi-experimental approach to study the U.S. financial market, and report that investors commonly prefer bonds first. The contrasting finding could be a result of the long-term revenue growth rate, simple business models and consistently high profitability in most Africa listed companies (Hou *et al.*, 2013; Mu *et al.*, 2013; Mcmillan and Harttgen, 2014), which drives stock returns up.

Furthermore, the test finds no significant evidence of Granger causality between credit ratings and the stock index. This result accords with Linciano (2004) and Leonard and Olinsky (2013) who argue that equity investors do not react significantly to sovereign downgrade announcements because the risk is already reflected in the company's stock

prices. Kenny and Moss (1998) and Wallace and Sivabalan (2015) further argue that investors have the perception that African stocks are risky because of political uncertainty, excessive economic booms and busts, and policy inconsistency. Thus, Yartey and Komla (2007) suggest that Africa stocks attract capital from risk tolarent investors who factor in high risk levels against possible high returns. Similarly, Andrianaivo and Yartey (2009) show that investors in Africa have skills to carefully evaluate economic and financial fundamentals, especially trade and fiscal balances. Subsequently, the result of this study find support for Yartey (2010) who argues that in Africa, stockholders' required return accounts for unexpected developments in the countries' political and economic climate.

The results in Table 3.3 also show that the null hypothesis of no Granger causality running from the SCR to the 10-year sovereign bond index can be rejected at the 1 percent significance level. In contrast, there is no evidence to reject the hypothesis that the 10-year sovereign bond index does not Granger cause a SCR. Thus, the results show that there is unidirectional causality running from sovereign ratings to bonds but not in reverse, which suggests that a credit rating change triggers a significant reaction in bond yields and prices. This finding accords with Zaima and McCarthy (1988) and Goh and Ederington (1993) who argue that a sovereign rating change does not necessarily have the same implications for both stockholders and bondholders because a sovereign downgrade increases the default risk premium, bond yields, and investors' required return, which thus affects bond prices more significantly than stock returns. These findings accord with Pukthuanthong-Le *et al.* (2007), who argue that the effect of a change in a sovereign rating profile is determined by the asset class that investors perceive to be safer when seeking to preserve their investment.

Three reasons can be advocated to explain investors' preference for holding stocks over bonds in Africa's markets. First, investors seek value for their investment (Chen *et al.*, 2005), and emerging markets stocks, despite their volatility, are cheaper and provide higher potential returns than bonds (Estrada, 2009; Hirshleifer *et al.*, 2013). Second, Africa's stocks, as of 2014, were trading at an average of 1.17 times book value, a 56

percent discount to developed markets stocks due to relatively low profitability (Assefa and Mollick, 2014). Lastly, investors are prone to 'flight-to-quality and safety', and thus they divest from stocks when returns and quality are not consumerate with their risk appetite causing prices to fall and investment in safer asset class to increase driving up prices accordingly (Harumi and Tatsuyoshi, 2015).

Table 3.3: Pairwise Granger Causality Tests

Lags	2		4		6		8	
	F-Statistic	Prob.	F-Statistic	Prob.	F-Statistic	Prob.	F-Statistic	Prob.
Z→Y	8.738	0.000*	4.311	0.002*	2.855	0.009*	2.150	0.028*
Y→Z	0.057	0.944	0.037	0.997	0.040	0.999	0.030	0.999
Z→X	2.852	0.058	1.669	0.154	1.254	0.275	0.948	0.475
X→Z	0.319	0.727	0.289	0.885	0.307	0.933	0.280	0.973
X→Y	14.093	0.000*	7.294	0.000*	5.080	0.000*	5.080	0.000*
Y→X	0.126	0.882	0.187	0.945	0.300	0.937	0.300	0.937

X represents country stock index Y represents 10-year sovereign bond index

Z represents sovereign credit rating → represents does not Granger cause

* represents significance at 5 percent level

In order to gain a more detailed understanding of the causality relationship between stocks and bond returns, the analysis further applies the Dumitrescu-Hurlin Panel Causality Test (Dumitrescu and Hurlin, 2012) to examine the homogeneity of causality. The results set out in Table 3.4 show that there is no homogenous causality between the stock and bond returns. Thus, the results indicate that stock returns across the African countries' stock exchanges cannot be used to explain the variance of bond yields in the long-run and vice versa. Similarly, there is homogeneous unidirectional causality from country stock index to sovereign ratings only from 6 lags (days) and higher, but not in reverse. Furthermore, the results show that the null hypothesis of no homogeneous causality running from sovereign ratings to 10-year sovereign bonds for higher lags (from 6 days) can be rejected but not vice versa. This finding is in line with Andersson *et al.*, (2008) and Christopher *et al.* (2012), who report that stock and bond markets respond heterogeneously to sovereign rating information. Thus, it can be concluded that the heterogeneity in causality is driven by regional shift of investors's funds from downgraded countries with high default risk into the surrounding

neighbouring countries with low foreign currency debt to neutralise their exposure.

Table 3.4 Pairwise Dumitrescu-Hurlin Panel Causality Test Results

Lags	4			6			8		
	W-Stat.	Zbar-Stat.	Prob.	W-Stat.	Zbar-Stat.	Prob.	W-Stat.	Zbar-Stat.	Prob.
Z→Y	2.831	-1.705	0.088	3.440	-3.046	0.002*	4.183	-3.933	0.000*
Y→Z	2.999	-1.459	0.145	7.035	1.228	0.220	7.545	-0.471	0.637
Z→X	4.467	0.678	0.498	5.834	-0.200	0.842	8.561	0.575	0.566
X→Z	3.388	-0.893	0.372	3.940	-2.452	0.014*	4.484	-3.623	0.003*
X→Y	3.997	-0.007	0.995	5.544	-0.545	0.586	6.378	-1.673	0.094
Y→X	2.982	-1.484	0.138	5.254	-0.890	0.374	6.523	-1.524	0.128

X represents country stock index Y represents 10-year sovereign bond index

Z represents sovereign credit rating → represents does not Granger cause

* represents significance at 5 percent level

Lastly, Table 3.5 and Figure 3.1 below presents the results of the DCC-GARCH(1,1) test, which analyses the correlations between credit ratings, stock returns and bond returns to determine how stockholders and bondholders adjust their required return following a SCR change. The estimation results show that the coefficients for all the parameters are positive and $\alpha_i+\beta_i$ is less than 1. Hence, as suggested in Peng and Deng (2010), the results indicate that there is a high persistence in the conditional variances. The mean-value of the dynamic conditional correlation coefficients of 0.415 (mean of DCC_{α_i} DCC_{β_i}) show a positive stock-bond correlation trend, which implies that there is a moderate positive linkage between Africa's stock and bond markets. However, the results show a weak positive correlation for both stock-credit rating and bond-credit rating (0.311 and 0.160 respectively), suggesting that there is a weak positive linkage between SCRs and Africa's stock and bond markets.

These results concur with Shiller and Beltratti (1992) and Stivers and Sun (2002), who point out that there is a positive relationship between changes in credit ratings, and stock and long-term bond prices. This is however contrary to d'Addona and Kind (2006) and Ncube and Brixiov (2015), who argue that stocks and bond prices move in opposite directions because of their inverse responses to macroeconomic fundamentals (such as

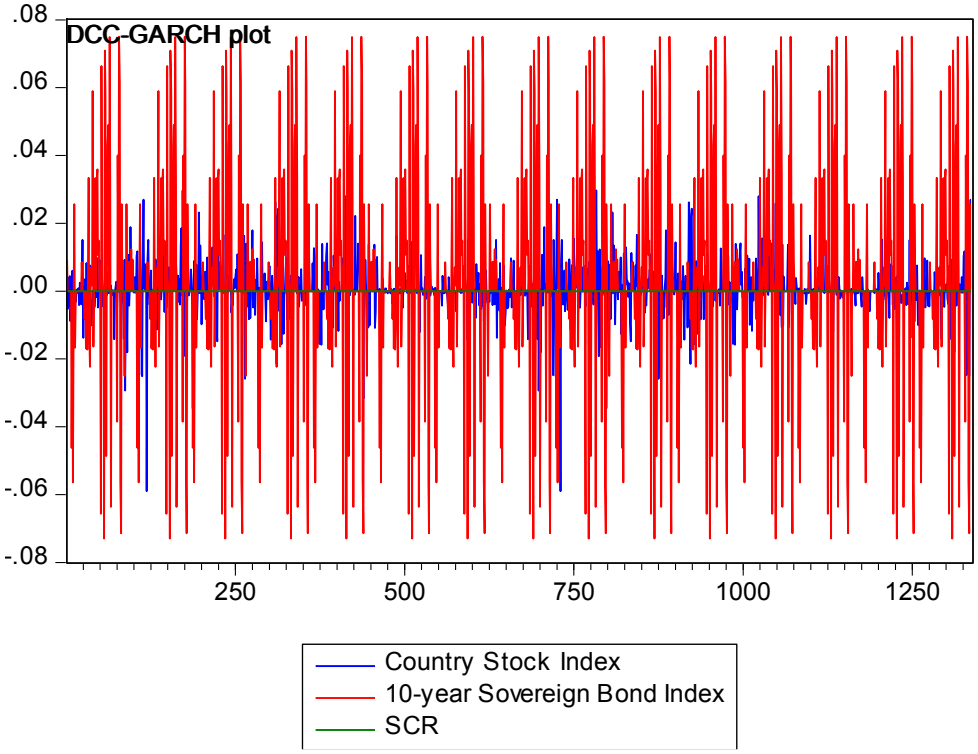
credit ratings, interest rates and inflation). However, Shiller and Beltratti (1992) and Stivers and Sun (2002)'s findings are more applicable to Africa's dynamics for three reasons.

First, both Africa's stock and bond markets are still under-developed (Roberts *et al.*, 2015) and thus credit ratings play a key information role. Second, institutional investors who buy stocks are usually the same investors who buy bonds, so credit ratings shape their risk perception on a country's macroeconomic fundamentals, which generally affect both bonds and stocks. Third, SCR changes affect bond prices more than stocks because the magnitude of a sovereign downgrade on the default risk premium and bond yields is volatile, both in the short and long-run.

Table 3.5: DCC-GARCH Test results

	Country stock index and 10-year sovereign bond index		Country stock index and Sovereign credit ratings		Sovereign credit ratings and 10-year sovereign bond index	
Covariance	0.000		0.014		0.007	
Correlation	0.311		0.160		0.081	
t-Statistic	1.970		2.947		4.448	
Probability	0.034		-0.011		0.018	
Parameters	Estimates	Std. error	Estimates	Std. error	Estimates	Std. error
ω_i	0.018	2.298	0.578	4.859	0.139	3.419
ϕ_i	0.065	-0.162	0.388	-0.614	0.841	-1.067
α_i	0.111	0.145	0.178	1.212	0.246	1.279
β_i	0.158	-0.060	0.277	-0.495	0.712	-0.930
σ_i	0.205	-1.136	0.477	-1.818	1.159	-1.500
γ_i	0.251	-0.213	0.677	-1.141	1.606	-2.070
DCC_{α_i}	0.392	0.533	0.174	0.815	0.256	1.097
DCC_{β_i}	0.472	0.402	0.133	0.136	0.306	-0.675

Figure 3.1 DCC-GARCH test time series plot



Thus in summary, the findings show that, there is unidirectional causality running from stocks to bonds as well as from credit ratings to bonds, suggesting that in Africa's emerging markets investors prefer buying stocks first, which they later sell when the credit profile of a country changes to raise money to buy bonds. Hence, financial markets' reactions are a result of investors redistributing their wealth between bonds and stocks. Despite the conventional perception that stocks are a risky class of asset, investors seek value for their investment, for which stocks provide higher returns potentially than bonds can. This implies that investors smooth their returns through bond-stock portfolio diversification to adequately compensate investors for both inflation and risk of default.

3.7 Conclusion

This chapter investigated the net effect of SCR announcements on foreign currency denominated bonds and stock markets in 19 African countries over the period of 1994 to 2014 using a combination of Granger Causality tests and Dynamic Conditional

Correlation (DCC) models. The results of the Granger Causality tests find evidence of unidirectional causality running from stocks to bonds and from credit ratings to bonds, but not in reverse, thus implying that investors prefer to buy stocks first and later sell them to buy bonds when a country's credit rating profile changes. In addition, the results show that a change in a SCR causes bondholders to raise their required returns and drives bond prices down, which leads to investors then transferring funds from stocks to buy cheaper bonds. Therefore, changes in sovereign ratings do not have the same implications for both stockholders and bondholders as shown by the weak association between SCRs stock market.

The results of the DCC-GARCH tests further show that there is a moderate positive relationship between Africa's stock and bond markets; and a weak positive association between SCR changes and bond and stock market movements. This result implies that both stocks and bonds react negatively (positive) to sovereign credit downgrade (upgrade) announcements, possibly because the type of securities that investors buy reflects their level of confidence in the future of a country's economy. Thus, there are three implications arising from these results. First, the state of the economy during sovereign rating announcements determines the security that performs best. Second, the linkage between stocks and bond returns decline as emerging countries become more creditworthy. Finally, it is imperative for African countries to pursue orthodox macroeconomic policies to avoid rating downgrades, which will negatively affect financial markets and thus hamper economic development.

CHAPTER 4

WHAT IS THE EFFECT OF SOVEREIGN CREDIT RATING SPILLOVERS ON NEIGHBOURING COUNTRIES' FINANCIAL MARKETS?

4.1 Summary abstract

This chapter investigates the spillover effects of long-term foreign currency sovereign credit rating announcements on foreign currency denominated bonds and stock markets in 19 African countries during the period of 1994 to 2014. Using a combination of Granger causality tests and impulse response function, the results show that there are marginal regional sovereign rating spillover impacts but these are quickly absorbed into capital markets trading long-term securities. The analysis further shows that there are long-term spillover effects in sovereign ratings of other countries in the same region from a sovereign rating change in one country. These results imply that the regional bilateral linkages between countries serve as channels of capital and sovereign credit rating information flow. Thus it is imperative for regional countries to pursue prudent developmental macroeconomic policies to avoid negative ratings that will have regional spillover effects.

4.2 Introduction

Since the advent of the 'third wave' of democratization[24] (Huntington, 1991) in the early 1970s, regional and global economies have gradually converged towards a single globalised financial market (Christopherson and Clark, 2007). Neighbouring economies that share relatively close fundamentals through trade and financial linkages are becoming more prone to common shocks that arise from channels of potential interconnection (Sun *et al.*, 2010) and the herding behaviour of market participants (Kose *et al.,* 2009). Thus, studies on financial contagion have been gaining momentum

[24] The post-1974 global democratic expansion when countries made transitions from authoritarian (predominantly military) rule and dictatorial regimes to electing democratic governments, which significantly outnumbered transitions in the opposite direction. There were however two prior waves occurring in 1828-1928 and 1943-1962 separated by reversal waves in the wake of the Great Depression in 1922-1942 and in 1958-1975.

since the 1990s, a decade distinguished by the occurrence of several contagious financial crises (Baig and Goldfajn, 1999; Kaminsky and Reinhart, 2000). These crises often began as country-specific shocks that later spread to affect financial markets in other countries (Flores, 2010).

Sovereign rating announcements can generate spillovers into neighbouring countries depending on the trade linkages and capital flow channels shared between countries (Luchtenberg and Vu, 2015). Literature however presents different and conflicting conclusions regarding the contagion and spillover effects of SCR announcements. Earlier literature presents evidence showing that SCR announcements unveil new relevant information about a country's creditworthiness which also affect neighbouring markets (Fleming *et al.*, 1998; Kaminsky and Schmukler, 1999; Kaminsky and Reinhart, 2000; Kaminsky and Schmukler, 2001; Kaminsky *et al.*, 2003). In addition, other studies argue that the responses of neighbouring financial markets to changes in another country's sovereign rating arise from contagion, herding or speculative activities of market participants (Khan and Park, 2009). Furthermore, others suggest that it is the rating agencies that exacerbate crises through their pro-cyclical behaviour (Ferri *et al.*, 1999) of upgrading countries in good times and downgrading them in bad times (Kiff *et al.*, 2010).

In recent years, studies on contagion and spillovers have increasingly focused on investigating inter-industry and cross-country spillovers during financial crises (Longstaff, 2010; Bekaert *et al.,* 2014; Luchtenberg and Vu, 2015), with only a few exploring the effects of sovereign rating events. Other studies argue that geographic distance (Ferreira and Gama, 2007; Arezki *et al.,* 2011; Boninghausen and Zabel, 2013), financial linkages, trade linkages and common characteristics (Ismailescu and Kazemi, 2010) determine the magnitude of sovereign rating spillovers as investors find channels to shift funds away from the downgraded country's stock market in favour of other stock markets in the region (Christopher *et al.*, 2012). Further investigations by Alsakka and Gwilym (2013) and Drago and Gallo (2016) however raise a number of contentions to these conclusions, arguing that the magnitude of sovereign spillover

depends on investors' risk appetites, the economic condition of the rated country and the number international rating agencies to affirm the credit rating change. Thus, the empirical evidence of the spillover effect of a SCR change on both stock and bond markets is still inconclusive.

Thus, in order to determine whether an announcement in one country's SCR has spillover effects in other credit rated countries, this chapter applies Causality tests to respond to two sub-questions: (i) does a change in one country's credit rating cause significant spillover effects on other sovereign credit rated countries' financial markets, and (ii), under what economic and market conditions are spillover effects significant? This chapter is thus structured as follows. Section 4.2 reviews the literature devoted to investigating the spillover effects of SCR announcements on bond and stock markets of other countries. Thereafter, section 4.3 then describes the stock returns, bond returns and sovereign rating data. Next, section 4.4 presents the Granger Causality tests used to conduct the analysis. Then findings are discussed in Section 4.5, and lastly the chapter concludes with a summary of key findings and recommendations in Section 4.6.

4.3 Literature review

Initial studies focus primarily on investigating the contagious effects of financial crises across geographically proximate nations that share macroeconomic risk factors. Among the seminal studies is Banerjee (1992), who develops a sequential decision model to investigate investors' herding behaviour which triggers financial contagion and spillovers. The results show that the investors' herding instincts are usually irrational as they optimize their portfolios by mimicking others rather than rationally analysing fundamentals. Thus, Banerjee concludes that herding behaviour is evidence of multiple price equilibriums as investors assume that others have better information than them, and thus disregard their own information and follow those deemed more informed.

Investors' herding behaviour is the opposite of overconfidence (Kukacka and Barunik, 2013), which occurs when individuals mimic each other rather than use their own private information (Scharfstein and Stein, 1990). The two major reasons why investors

herd are to seek safety in numbers and the pressure to conform (De Bondt and Thaler, 1995). Hence, herding can be manifested in various ways: rational herding, where market players intentionally mimic the behaviour of the most informed participants in times of uncertainty (Devenow and Welch, 1996; Welch, 2000); irrational or intentional herding, which is centred on crowd psychology where investors with insufficient information and inadequate risk evaluation forego rational analysis and blindly follow other investors' actions (Hirshleifer, 2001); and lastly, spurious herding, when members of a group are presented with similar decisions and information, which leads to a commonality of outcomes (Gavriilidis *et al.*, 2013).

Kodres and Pritsker (2002) concur with Banerjee (1992) that financial market spillovers are driven by investors who transmit idiosyncratic shocks as they rebalance their portfolio exposures through other countries' markets. However, Brown *et al.* (2009) further argue that the patterns and severity of financial spillovers depend on the level of information asymmetry in each market, the markets' sensitivity to shared macroeconomic risk factors, the transfer channels available to investors, and the capitalisation in each market.

This literature review proceeds as follows. First, studies devoted to investigating whether the nature of credit rating change announcement determines the spillover effects are discussed. Thereafter, the literature on the sovereign rating spillover effects through trade linkages and capital flow channels is explored. The literature review then concludes with a summary of studies that investigate credit rating regional spillovers to geographically proximate countries that share common characteristics.

4.3.1 Sovereign downgrades spillovers

Investigations on the spillover effects of SCR announcements were first explored in the late 1990s, when financial liberalisation and globalisation gathered momentum. A number of studies argue that the nature of credit rating announcement determines the spillover effect. Kaminsky and Schmukler (1999) were amongst the first to investigate financial markets spillovers from investors' herding behaviour when news about

international agreements, credit ratings, economy, policy, politics and capital controls is announced. They apply an event studies analysis on the 20 largest 1-day swings in stock prices in 9 Asian countries during the Asian crisis from 1997 to 1998 to determine whether cross-country spillover stock market volatility was a result of fundamentals used by CRAs in assigning SCRs. They find that the cross-country spillover effects result from market swings triggered by investor panic during the Asian crisis. Hence, they conclude that investors overreact to bad news and herding instincts drive the large market swings.

Additionally, Kaminsky and Schmukler (2001) examine whether financial markets spillovers to neighbouring emerging economies are reactions to changes in sovereign ratings and outlooks of one country in the region. They apply a combination of event studies and panel regression estimates on 16 emerging economies in East Asia, Eastern Europe, and Latin America between 1990 and 2000. They find significant direct cross-country contagion and spillover effects from sovereign rating to neighbouring countries. However, their findings suggest that financial markets in countries with lower ratings are more affected by rating announcements in higher rated countries, especially sovereign downgrades. Thus, investors in lower rated countries incorporate spillovers from new sovereign rating announcements in higher rated countries by adjusting their required returns to a new equilibrium.

Furthermore, Gande and Parsley (2005) analyse spillover effects on sovereign credit spreads from credit rating announcements of one country. They apply event studies to a data set of daily market-closing observations of the interest rate spreads of 34 countries matched to the United States government bond over the period from 1991 to 2000. They find statistically significant spillovers on sovereign credit spreads from negative ratings change of other countries while positive ratings change have no discernible impact. Their conclusion partially accords with Kaminsky and Schmukler (1999) whereby sovereign rating spillovers are asymmetric because investors are wary about the downside risk rather than upside potential. Hence, the spillovers across countries and regions are associated with negative ratings events not the reverse.

Notably, Ferreira and Gama (2007) extend Gande and Parsley (2005)'s findings by investigating sovereign debt rating information spillover not only across countries but also across markets. This is accomplished by examining S&P's credit rating and market outlook of 18 developing countries and 11 developed countries with publicly traded US dollar-denominated sovereign debt over the period 1989 to 2003. They concur with Gande and Parsley (2005) that rating changes in one country incorporate valuable information for the aggregate stock market returns of other countries. Hence, the evidence indicates that there are sovereign rating spillover effects from negative asymmetric reactions that are significantly heterogeneous both across countries and markets.

It can however be argued that a sovereign rating downgrade spillover effect possibly depends on the sensitivity of the type and nature of the assets being traded in each of the affected financial markets. Flores (2010) uses panel regressions to capture the immediate effects of rating announcements on sovereign spreads and event studies to investigate the behaviour of East Asia, Eastern Europe Latin America's domestic and foreign financial markets for the period 1997 to 2010. The results find that, in accordance with Gande and Parsley (2005) and Ferreira and Gama (2007), rating announcements affect both domestic and foreign markets. However, Flores further shows that sovereign rating announcement spillover effects are stronger in financial markets that are dominated by short-term investors that trade in short-term financial assets. Thus, Flores findings imply that the sovereign rating spillover effect is insignificant in long-term debt markets such as government bonds.

Afonso *et al.* (2011) apply a combination of Granger Causality and event studies to analyse the reaction of 24 European Union sovereign bond yield and credit default swap spreads following the 99000 credit rating announcements by Standard and Poor's, Moody's and Fitch between 1995 and 2010. Their results contrast with Kaminsky and Schmukler (2001) as they find significant spillover effects from sovereign downgrades of low credit rated countries to higher rated countries and bi-directional causality between

ratings and spreads. They thus conclude that negative sovereign rating events usually take markets by surprise and thus generates spillover effects that spread from lower rated countries to higher rated countries.

In contrast, Arezki *et al.* (2011) posit that the magnitude of spillover effects depends on the size of the downgraded economy and the rating category. Thus, they examine the spillover effects of sovereign rating news on the European financial markets during the period of 2007 to 2010 using a combination of event studies and the Vector Autoregression (VAR) approach. In accordance with the previous studies, they find that sovereign rating downgrades have statistically and economically significant spillover effects, both across countries and financial markets. However, they further find that the magnitude of the spillover effects depends on the type of announcements, the source country experiencing the downgrade, and the rating agency from which the announcement originates. They thus conclude that sovereign rating downgrades to speculative grade for relatively large economies have systemic spillover effects across neighbouring countries.

Thus in summary, the literature finds significant evidence of sovereign rating spillover effects from rating downgrades, while upgrades have an insignificant and limited spillover effect because investors are wary about the downside risk rather than upside potential. Thus, the findings suggest that the rating spillovers are asymmetric as investors overreact to bad news and herding instincts drive the large market swings. Additionally, spillovers depend on the rating grade assigned, the nature of the assets being traded, the source country, and the rating agency from which the announcement originates. However, if investors react to sovereign rating spillovers, then they should move capital across markets and countries borders through capital flow channels and market linkages.

4.3.2 Market linkages and capital flow

Another body of literature on sovereign rating spillovers suggests that the magnitude of the spillover effects depend on the trade linkages and capital flow channels shared

between countries. Hence, investors react to credit rating announcements by adjusting their portfolio capital across markets, which is determined by financial linkages between sovereigns (Luchtenberg and Vu, 2015). Thus, credit ratings change could spur financial instability due to shared banking regulations, derivative contracts and investment mandates in financially integrated environment (Kaminsky and Schmukler, 2001).

Ismailescu and Kazemi (2010) estimate panel regressions and event studies using 43 436 daily observations from 22 emerging economies during the period 2001 to 2008 to investigate the reaction of credit default swap spreads to credit rating announcements and the cross-border spillover effects in emerging economies. Similarly, Ballester and González-Urteaga (2015) apply a Generalized VAR (GVAR) approach to investigate the cross-border spillover effects of credit rating events for sovereign credit default swaps in Latin America's emerging economies during 2004 to 2014. Both studies find that positive ratings announcements have a higher magnitude of spillovers into other emerging derivative markets than negative announcements. In addition, sovereign rating upgrades and positive outlooks immediately spill over to other emerging countries as they have a greater impact on the credit swap markets through common creditor and competition in trade markets transmission mechanisms. However, Ismailescu and Kazemi (2010) conclude that the findings suggest that a credit upgrade in emerging economies conveys more information for default swaps than a credit downgrades whereas Ballester and González-Urteaga (2015) conclude that the impact of downgrades is significant in the medium term.

Bissoondoyal-Bheenick (2012) apply event studies on a sample of 17 Asia Pacific Economic Cooperation (APEC) countries for the period 1990 to 2001 to examine the spillover effects from sovereign ratings announced by both Standard and Poor's and Moody's for countries that are connected by trade and financial markets links. Contrary to the earlier study of Ismailescu and Kazemi (2010), Bissoondoyal-Bheenick find significant spillover effects in countries that are connected by financial markets links but insignificant spillovers amongst countries that share trade links. Hence, he concludes that financial linkages among countries are stronger than trade links.

There is however no consensus on how sovereign rating spillovers impact financial market interdependencies over different time frames. Thus, Claeys and Vašíček (2012) analyse bilateral linkages between 16 European Union sovereign bond markets over time by estimating the forecast-error variance decompositions VAR between 2000 and 2011. They find that rating spillovers are heterogeneous, gradually increasing with time due to financial and economic integration stimulated by capital account liberalisation, financial deregulation, financial innovation and the introduction of monetary unions. Thus, Claeys and Vašíček conclude that spillovers and contagion depends on the financial and economic integration between countries, which open channels of capital and cross-country information flow.

Similarly, Forbes (2012) observe increasing spillovers from negative credit rating events after applying correlation and extreme value analysis on a sample of 48 countries around the world between 1980 and 2011. However, contrary to Claeys and Vašíček (2012), Forbes finds that credit rating spillover effects are intensified by cross-country interdependences created by vulnerabilities from more leveraged banking systems, greater trade exposure, weaker macroeconomic fundamentals, and larger international portfolio investment liabilities. Hence, Forbes argues that countries that share interdependent vulnerabilities are more sensitive to cross-country spillovers.

Chen *et al.* (2016) use panel regression models to examine sovereign rating transmission mechanisms on all long term sovereign rating announcements for 103 countries from S&P between 1989 and 2012 produces spillover effects on the economic growth rates of other countries. They find that rating revisions have significant spillover effects on annual economic growth rates of other countries, which are transmitted through direct and indirect trade and financial linkages. They further argue that when a country is downgraded, its terms of trade are negatively affected, which allows other countries to benefit economically as the downgraded country becomes less competitive in the international market. Conversely, for countries that share bilateral trade relationships, a sovereign downgrade in one country has negative spillover effects to its

counterparties through a downturn in economic activities, which reduce income and imports by the downgraded country.

Thus in summary, investors adjust their portfolios by moving capital across countries and markets following a credit rating announcements. Hence, sovereign rating spillover effects depend on the capital flow channels, financial and trade linkages among countries. However, the direction of cross-country spillovers is still contentious. Thus, the role of sovereign ratings spillovers to financial asset comovements in regional bodies that share common characteristics is still debated.

4.3.3 Regional spillovers

In contrast to the studies discussed above, another body of literature argues that, even without direct financial linkages, countries in the same region share common characteristics and their geographic proximity make them prone to spillover effects. Hence, the geographic distance is inversely related to the spillover impact, whereby sovereign rating news have more pronounced effects in countries nearer to each other, than more distant countries.

Amongst the studies to pioneered this line of argument of sovereign rating regional spillover effects is Kim and Wu (2011), who argue that there are negative regional spillover effects when one country's credit rating improves because the upgraded country attracts the region's bank flows from neighbouring countries. Kim and Wu estimate multivariate panel regression models to examine the effect of SCR changes on international bank flows from the Group 7 (G7) to a selected 55 emerging countries between 1995 and 2008. They find evidence indicating that credit rating announcements have a strong regional rating spillover effect and significantly positive influences on international bank flows from developed markets. Their evidence suggests that foreign (local) currency ratings announcements are more influential for bank lending to investment-grade (non-investment-grade) borrowing countries. Conversely, excluding Asia and Eastern Europe, credit rating improvements in one emerging market region tend to reduce bank flows to other regions. Hence, these

findings suggest that public debt management strongly affect banking sector financing in emerging markets through financial flow from rich to poor countries.

Christopher *et al.* (2012) examine the transitory effects of SCRs on regional financial markets by estimating a combination of three-stage dynamic conditional correlation (DCC) and bivariate GARCH model using a sample of 19 emerging countries over the period from 1994 to 2007. They find that the response of stock and bond market to sovereign ratings within a region is heterogeneous, which accords with Kim and Wu (2011). Their results thus suggest that sovereign rating downgrades lead investors to shift funds from the downgraded market into neighbouring countries but there are also positive rating spillover effects from sovereign rating upgrades. Christopher *et al.* conclude that there are regional transmission channels through which both information, capital flows and the influence of negative information is concentrated in countries that have higher foreign currency debt ratings than the regional average.

Other studies have questioned whether credit rating announcements from the three international rating agencies generate the same magnitude of spillover effects. Thus, Alsakka and Gwilym (2013) investigate foreign exchange spillover reactions from SCR change by applying event studies to a set of 44 European and Central Asian countries rated by Moody's, S&P and Fitch during the pre-crisis period of 2000 to 2006 and during financial crisis between 2007 to 2010. They find strong exchange rate spillover effects (the strongest effects from Fitch ratings) to other countries' exchange rates in the region following rating downgrades from all three major agencies. They further observe that spillover effects from the second or third rating agency's announcements are more significant than from the first rating agency's announcements. Alsakka and Gwilym further argue that spillover signals from the second and third rating agency's announcements are stronger because of a cumulative confirmatory effect which they provide to the first mover rating announcements. Thus, they conclude that the market responds immediately and strongly to any rating announcement that confirms prior rating change from one or both international rating agencies.

Boninghausen and Zabel (2013) perform a counterfactual analysis with event studies to investigate sovereign bond spillovers from all credit rating announcements by Standard and Poor's, Moody's and Fitch across 73 developed and emerging debt markets between 1994 and 2011. Similarly, Corbet (2014) apply Vector autoregression models to investigate the spillover effects of unfavourable sovereign rating announcements on 10 European countries' financial markets between 2005 and 2012. Both studies find significant spillovers throughout regional financial markets from sovereign downgrades, which are associated with an increase in equity returns, cost of insuring debt through credit default swaps, and sovereign bond yields. Hence, Boninghausen and Zabel (2013) and Corbet (2014) conclude that credit default swaps, equity markets and government bonds provide the main financial inter-linkages for sovereign rating announcements cross-country spillovers.

However, Kalotychou *et al.* (2014) argue that spillover effects can be distinguished into two mechanisms: fast regional cross-border contagion effects and global common shock spillover effects. They apply a combination of event study and the standard multi-factor asset pricing approaches to examine the cross-border propagation of systemic risk from sovereign rating announcements to international sovereign debt market using credit default swap spreads for 67 sovereign borrowers in 5 regions (Asia and Pacific, Europe, Eastern Europe, Latin America and Middle East and North Africa) from 2002 to 2013. The results show that the degree to which different regions are affected by a rise in the global sovereign risk factor depends on economic fundamentals, and the global spillover of credit events works through the global risk factor such as credit crunch or bankruptcy. They thus conclude that the global risk and regional vulnerabilities are both influenced by investors' risk appetites, which also depends on economic fundamentals, especially the sovereign's level of government debt.

More recently, Drago and Gallo (2016) estimate regression models and event studies to analyse S&P sovereign rating spillover effects on the credit default swaps of 15 Economic and Monetary Union member states between 2004 and 2015. They find evidence of a spillover effect on public budget and financial markets of other countries

following downgrade announcements, which are transmitted through the international bank flows between regional member countries. They conclude that the economic and financial conditions of rated countries determine the size of the spillover effect. Thus in summary, the impact of SCR spillover effects depends on the level of foreign currency rating, investors' risk appetites, the economic condition of rated country and the number international rating agencies to confirm the credit rating announcements.

4.3.4 Conclusion

Hence the review of the literature finds that early studies argue that cross-country contagion and spillover effects are asymmetrical and significantly stronger during specific regional crisis episodes. Additionally, other studies argue that the impact of the spillover effect depends on the rating grade assigned, the nature of assets being traded, the source country and the rating agency from which the announcement originates. Although the evidence presented is mixed, most studies acknowledge that the magnitude of spillover effects depend on the trade linkages and capital flow channels shared between countries. However, more recent studies posit that even without direct financial linkages, countries in the same region share common characteristics and their geographic proximity make them prone to spillover effects. There is therefore an ongoing debate on the sovereign rating spillover effects in emerging markets.

Thus, this chapter uses an up-to-date sample of Africa's emerging markets and all credit rating announcements from the three international rating agencies to investigate the sovereign rating spillover effects. To date, no study has been conducted on SCR spillover impact on African markets, which are characterized by limited information, high risk assets, liquidity challenges, relatively few participants, lack of transparency, low institutional quality, and greater uncertainty. It is therefore hypothesised that if there is statistically significant changes in stock or bond returns in other countries following SCR announcements in one country, then there are sovereign credit rating spillover effects. Hence, sovereign rating changes in one country would affect capital market of other countries.

4.4 Data Description

To examine the SCR cross-country spillover effects, the analysis makes use of daily bond yield, daily stock returns and foreign currency long-term sovereign ratings announcements of 19 African countries that received a SCR by any or all of the three largest CRAs (Standard and Poor's, Moody's and Fitch) over the period of 1994 to 2014[25]. Following Gande and Parsley (2004), the long-term sovereign rating symbols used by the three international rating agencies are linearly transformed from ordinal rating scales into numbers corresponding to each rating grade. Furthermore, as recommended by Ferreira and Gama (2007) and Ismailescu and Kazemi (2010), positive (negative) changes in rating outlook and positive (negative) additions to watchlists are accounted for by adding 0.5 (-0.5) and 0.25 (-0.25) to one credit rating notch to consider these SCR announcements respectively.

The analysis focuses only on long-term foreign currency-denominated ratings because they are more liquid and have extensive rating information (Flores, 2010). In addition, the foreign currency-denominated daily S&P 10-year sovereign bond index, which track the performance of both local and sovereign bonds, and the United States dollar-denominated Africa-oriented S&P value-weighted stock index are used to measure bond and stock market performance respectively. The bond and stock market data was obtained from Bloomberg and Reuters, while the SCR and outlook change information was obtained from the three rating agencies' websites. The data is categorized into country specific data to explore the possible spillover effects from one country to another. Hence, the sample represents five geographically divided regions that could be more susceptible to the cross-border spillover effects of rating announcements (North Africa, West Africa, East Africa, Central Africa and Southern Africa). Amongst the 19 countries in the sample analysed, no country falls under the Central Africa region, hence the region is excluded. The number and distribution of the SCR actions between 1994 and 2014 is shown in Table 4.1 below.

[25] These include Burkina Faso, Benin, Botswana, Ivory Coast, Cameroon, Egypt, Ghana, Gambia, Kenya, Morocco, Mali, Malawi, Mauritius, Namibia, Nigeria, Rwanda, Senegal, South Africa, Tunisia, Uganda, and Zambia.

Table 4.1: Summary of SCR events

Fitch/S&P (Moody)	Downgrades	Fitch/S&P (Moody)	Upgrades
A (A2) to A- (A3)	1	A- (A3) to A (A2)	1
A- (A3) to BBB+ (Baa1)	1	BBB+ (Baa1) to A- (A3)	-
BBB+ (Baa1) to BBB (Baa2)	5	BBB (Baa2) to BBB+ (Baa1)	1
BBB (Baa2) to BBB- (Baa3)	4	BBB- (Baa3) to BBB (Baa2)	-
BBB- (Baa3) to BB+ (Ba1)	7	BB+ (Ba1) to BBB- (Baa3)	1
BB+ (Ba1) to BB (Ba2)	5	BB (Ba2) to BB+ (Ba1)	2
BB (Ba2) to BB-(Ba3)	5	BB-(Ba3) to BB (Ba2)	1
BB- (Ba3) to B+(B1)	3	B+(B1) to BB- (Ba3)	2
B+ (B1) to B (B2)	2	B (B2) to B+ (B1)	5
B (B2) to B- (B3)	2	B- (B3) to B (B2)	3
B- (B3) to CCC+ (Caa1)	1	CCC+ (Caa1) to B- (B3)	2
CCC+ (Caa1) to CCC (Caa2)	1		
	37		**18**
Fitch/S&P (Moody)	Negative Outlook	Fitch/S&P (Moody)	Positive Outlook
Positive to Stable	50	Negative to Stable	5
Stable to Negative	42	Stable to Positive	4
Under review (Watch)	21		
	113		**9**

4.5 Methodology

The analysis applies the Granger causality test (Granger, 1988) on long-term foreign currency rating upgrades and downgrades of rated countries' stock and bond returns to investigate the possible causal relationships among the factors. According to Granger (1988), the underlying principles of the test are; the cause happens prior to its effect and the cause has unique information about the future values of its effect. This test is thus appropriate to investigate the cross-country SCR spillover effects by examining the model hypothesis for identification of a causal effect of from one country on another variable. It is hypothesized that if a SCR in one country Granger causes stock or bond returns in other countries, then there are sovereign rating spillover effects. Hence, sovereign rating announcements in one country would affect capital markets of other countries. As proposed by Granger (1988), the analysis tests the hypothesis by examining the causal effects of the SCR announcements on the stock and bond markets of other countries and vice versa:

$$P(Y_{t+1} \in A|\Omega_t) \neq P\left(Y_{t+1} \in A\middle|\Omega_{-x(t)}\right) \quad (4.1)$$

Where P is the probability, A is the set of security returns, Ω_t is the sovereign rating information available at time *t* in the market, and $\Omega_{-x(t)}$ is the modified market where the SCR information Ω_t is excluded. The Granger causality test estimates the following three regression equations:

$$x_t = \beta_{10} + \sum_{i=1}^{n} \beta_{1i} y_{t-i} + \sum_{j=1}^{n} \beta_{1n+j} x_{t-i} + \sum_{k=1}^{n} \beta_{1n+k} z_{t-i} + \varepsilon_{1i} \quad (4.2)$$

$$y_t = \beta_{20} + \sum_{i=1}^{n} \beta_{2i} y_{t-i} + \sum_{j=1}^{n} \beta_{2n+j} x_{t-i} + \sum_{k=1}^{n} \beta_{2n+k} z_{t-i} + \varepsilon_{2i} \quad (4.3)$$

$$z_t = \beta_{30} + \sum_{i=1}^{n} \beta_{3i} y_{t-i} + \sum_{j=1}^{n} \beta_{3n+j} x_{t-i} + \sum_{k=1}^{n} \beta_{3n+k} z_{t-i} + \varepsilon_{3i} \quad (4.4)$$

Where n is the number of lags that adequately models the dynamic structure, ε_i are white noise error terms, x represents sovereign credit rating announcements, y represents stock returns, z represents bond returns, and β_i are constant coefficents. The F-statistic is therefore applied to test the significance of the Granger causality to determine whether the model satisfies best fit requirements.

Having examined the causal relationships among the factors, the analysis next uses impulse responses to assess the effect of SCR shocks on security returns, the interactions amongst the three variables (SCR, stocks and bond returns), and the response of one variable to an impulse in another variable in a system. The impulse response analysis quantifies the reaction of every single variable in the model on an exogenous shock to the model (Koop *et al.,* 1996) and the reaction is measured for every variable at certain times after credit rating announcements. It is hypothesized that if there is a reaction by one variable to an impulse in another variable then the latter causes the former. To estimate the degree and timing of SCR changes, the impulse

response function ψ_t at time t is specified as in Khalid and Kawai (2003) with the same specifications as follows:

$$\psi_t = \frac{\partial y_t}{\partial \varepsilon_t} + \frac{\partial x_t}{\partial \varepsilon_t} \tag{4.5}$$

Where x_t and y_t are stock and bond returns respectively, and ε_t is the impulse from SCR series as unit impulses.

The Granger causality test does not determine the relative strength of causality effects beyond the selected time span (Koop *et al.*, 1996). Hence, causality tests are unable to indicate the response of one variable (endogenous) to an impulse with another variables (exogenous) when shocking the residuals (Rajasekar *et al*., 2014). Thus, the impulse response function traces the effect of one unit shock to one of the variables on current and future values of all the endogenous variables in a system over various time horizons (Rahman and Shahbaz, 2013). Through impulse responses, the positive and negative relationship in relation with future periods can be specifically identified.

4.6 Empirical Results

The results of the group unit root test applied at level to the three series (10-year sovereign bond index, SCR and country stock index) are presented in Table 4.2 and show that the null hypothesis of the unit root at level form can be rejected. Hence, the mean, variance and autocorrelation structure of the residuals of the three series are first difference stationary, (I(1)), over time. Thus, the statistical properties are time invariant (Lee *et al.*, 2010), which is an underlying assumption in many time series data analysis techniques (Guendling *et al.*, 2005).

Table 4.2: Group Unit Root Test Results

Series (Sovereign credit rating, Country stock index and 10-year sovereign bond index)	t-Statistic	Probability
Null: Unit root (assumes common unit root process)		
Levin, Lin & Chu t	-3.76276	0.0001***
Null: Unit root (assumes individual unit root process)		
Im, Pesaran and Shin W-stat	-109.754	0.0000***
ADF - Fisher Chi-square	3805.28	0.0000***
PP - Fisher Chi-square	676.816	0.0000***

*** Indicate the significance at 1 percent level.

4.6.1 Granger causality test results

The next step of the analysis is to test the causality of credit rating spillover to securities returns of neighbouring countries using the Granger Causality test (Granger, 1988). Table 4.3 below presents the results of the North African regional Granger causality tests. As can be seen, the null hypothesis of no Granger causality running from the sovereign rating of one country to securities returns in other countries cannot be rejected at the 5 percent significance level. However, there is significant evidence to reject the hypothesis that there is no causality from SCR announcements in Egypt to the Tunisia Country Stock Index (CSI), which suggests that there is a unidirectional sovereign rating spillover effect from Egypt to Tunisia's stock index but not in reverse. These results reflect a close relationship between Egypt and Tunisia possibly because of the geographical proximity and similarities in their financial markets. Additionally, the countries commonly share a similar legal origin based on the francophone civil code. The unidirectional causality runs only from Egypt to Tunisia possibly because the two countries have the same credit rating, but Egypt's financial markets are much stronger and well established than Tunisia's. The Egyptian Exchange has 247 active counters and has been trading since 1883 compared to the Bourse de Tunis, which has 56 counters and has been trading since 1969. Furthermore, the Egyptian stock market capitalisation of US$70.03 billion is approximately 7 times more that Tunisia with a market capitalisation of US$9.32 billion at December 2015.

Table 4.3: North Africa Regional Pairwise Granger Causality Test

Lags	2		4		6	
Null Hypothesis	F-Statistic	Prob.	F-Statistic	Prob.	F-Statistic	Prob.
Egypt SCR→Morocco CSI	0.373	0.688	0.520	0.721	0.418	0.868
Egypt SCR→Morocco SBI	0.820	0.441	0.424	0.791	0.860	0.524
Egypt SCR→Morocco SCR	1.751	0.174	0.878	0.476	0.588	0.741
Egypt SCR→Tunisia CSI	0.137	0.872	0.297	0.880	2.798	0.010***
Egypt SCR→Tunisia SBI	0.748	0.473	0.397	0.811	0.740	0.617
Egypt SCR→Tunisia SCR	0.074	0.929	0.037	0.997	0.027	1.000
Morocco SCR→Egypt CSI	0.148	0.863	0.183	0.948	0.218	0.971
Morocco SCR→Egypt SBI	0.084	0.919	0.045	0.996	0.114	0.995
Morocco SCR→Tunisia CSI	1.886	0.152	1.049	0.380	1.260	0.273
Morocco SCR→Tunisia SBI	0.276	0.759	0.148	0.964	0.115	0.995
Morocco SCR→Tunisia SCR	0.047	0.954	0.023	0.999	0.016	1.000
Morocco SCR→Egypt SCR	0.534	0.587	0.266	0.900	0.178	0.983
Tunisia SCR→Egypt CSI	0.029	0.972	0.074	0.990	0.378	0.894
Tunisia SCR→Egypt SBI	0.390	0.677	0.269	0.898	0.132	0.992
Tunisia SCR→Egypt SCR	2.639	0.072	1.327	0.257	0.889	0.502
Tunisia SCR→Morocco CSI	2.284	0.102	1.273	0.278	1.255	0.275
Tunisia SCR→Morocco SBI	0.002	0.998	0.005	1.000	0.010	1.000
Tunisia SCR→Morocco SCR	0.483	0.617	0.242	0.914	0.162	0.987

→ represents does not Granger cause CSI represents Country Stock Index

*** represents significance at the 1 percent level SBI represents Sovereign Bond Index

The West African causality results are presented in Table 4.4, and shows that there is bi-directional Granger causality from sovereign rating changes between Benin, Burkina Faso, Nigeria and Ghana. These effects could possibly be attributed to economic integration between the members of the Economic Community of West African States (ECOWAS) through the West African Economic and Monetary Union (UEMOA) and the West African Monetary Zone (WAMZ). These sub-regional blocs are aimed at developing regional trade liberalization to creating a common market and coordinating macroeconomic policy convergence towards eventually adopting a common currency - the *Eco* (Harvey and Cushing, 2015). Furthermore, there is uni-directional Granger causality from a Nigerian and Senegalese sovereign rating announcements to the Ghanian stock market, but not in reverse. Thus, these results show that there is significant spillover effects from some countries to others in the West African region, which further suggests that there is financial integration (Claeys and Vašíček, 2012) facilitated by the CFA franc common currency.

Table 4.4: West Africa Regional Pairwise Granger Causality Tests

Lags	2		4		6	
Null Hypothesis	F-Statistic	Prob.	F-Statistic	Prob.	F-Statistic	Prob.
Benin SCR→Burkina Faso CSI	0.232	0.793	0.102	0.982	0.085	0.998
Benin SCR→Burkina Faso SBI	0.091	0.913	3.989	0.003**	2.835	0.009***
Benin SCR→Burkina Faso SCR	0.000	1.000	0.000	1.000	0.000	1.000
Benin SCR→Ghana CSI	0.047	0.954	0.029	0.998	0.038	1.000
Benin SCR→Ghana SBI	0.010	0.990	0.015	1.000	0.110	0.995
Benin SCR→Ghana SCR	0.000	1.000	0.000	1.000	0.000	1.000
Benin SCR→Nigeria CSI	0.115	0.891	0.172	0.953	0.135	0.992
Benin SCR→Nigeria SBI	0.434	0.648	0.317	0.867	0.287	0.944
Benin SCR→Nigeria SCR	6.769	0.001**	3.402	0.009**	2.280	0.034**
Benin SCR→Senegal SBI	0.093	0.911	0.077	0.989	0.081	0.998
Benin SCR→Senegal SCI	0.007	0.993	0.030	0.998	0.040	1.000
Benin SCR→SENEGAL_SCR	0.000	1.000	0.000	1.000	0.000	1.000
Burkina Faso SCR→Benin CSI	0.008	0.992	0.535	0.710	0.771	0.593
Burkina Faso SCR→Benin SBI	0.106	0.900	0.200	0.939	1.861	0.084
Burkina Faso SCR→Benin SCR	11.016	0.000**	5.586	0.000**	3.778	0.001***
Burkina Faso SCR→Ghana CSI	0.036	0.965	0.029	0.998	0.027	1.000
Burkina Faso SCR→Ghana SBI	0.192	0.826	0.090	0.986	0.081	0.998
Burkina Faso SCR→Ghana SCR	0.000	1.000	0.000	1.000	0.000	1.000
Burkina Faso SCR→Nigeria SBI	0.176	0.839	0.106	0.981	0.306	0.934
Burkina Faso SCR→Nigeria SCI	0.068	0.934	0.032	0.998	0.043	1.000
Burkina Faso SCR→Nigeria SCR	4.670	0.009**	2.344	0.053	1.568	0.152
Burkina Faso SCR→Senegal CSI	0.342	0.710	0.162	0.958	0.121	0.994
Burkina Faso SCR→Senegal SBI	1.072	0.342	1.589	0.174	1.078	0.373
Burkina Faso SCR→Senegal SCR	0.001	0.999	0.000	1.000	0.000	1.000
Ghana SCR→Benin CSI	0.321	0.726	2.207	0.066	1.482	0.180
Ghana SCR→Benin SBI	0.051	0.951	0.055	0.994	0.133	0.992
Ghana SCR→Benin SCR	7.599	0.001**	3.835	0.004**	2.581	0.017**
Ghana SCR→Burkina Faso CSI	0.043	0.958	1.332	0.255	0.889	0.502
Ghana SCR→Burkina Faso SBI	0.019	0.982	0.148	0.964	0.280	0.947
Ghana SCR→Burkina Faso SCR	36.942	0.000**	18.993	0.000**	13.030	0.000
Ghana SCR→Nigeria CSI	0.046	0.956	0.099	0.983	0.078	0.998
Ghana SCR→Nigeria SBI	0.007	0.993	0.415	0.798	0.328	0.922
Ghana SCR→Nigeria SCR	4.236	0.015**	2.125	0.075	1.422	0.202
Ghana SCR→Senegal CSI	0.286	0.751	0.156	0.960	0.134	0.992
Ghana SCR→Senegal SBI	0.065	0.937	0.034	0.998	0.037	1.000
Ghana SCR→Senegal SCR	0.000	1.000	0.000	1.000	0.000	1.000
Nigeria SCR→Benin CSI	0.164	0.848	0.087	0.986	0.058	0.999
Nigeria SCR→Benin SBI	0.038	0.963	0.099	0.983	0.047	1.000
Nigeria SCR→Benin SCR	0.183	0.832	0.092	0.985	0.061	0.999
Nigeria SCR→Burkina Faso CSI	0.032	0.969	0.497	0.738	0.401	0.879
Nigeria SCR→Burkina Faso SBI	2.852	0.058	2.040	0.086	1.581	0.148
Nigeria SCR→Burkina Faso SCR	0.003	0.997	0.001	1.000	0.001	1.000
Nigeria SCR→Ghana CSI	0.012	0.988	0.776	0.541	2.525	0.019**
Nigeria SCR→Ghana SBI	0.580	0.560	0.505	0.732	0.339	0.917
Nigeria SCR→Ghana SCR	0.032	0.969	3.727	0.005**	2.482	0.021**
Nigeria SCR→Senegal CSI	0.399	0.671	0.221	0.927	1.587	0.147
Nigeria SCR→Senegal SBI	0.033	0.968	0.099	0.983	0.068	0.999
Nigeria SCR→Senegal SCR	0.001	0.999	0.000	1.000	0.000	1.000
Senegal SCR→Benin CSI	0.038	0.962	0.051	0.995	0.044	1.000
Senegal SCR→Benin SBI	0.053	0.948	0.180	0.949	0.249	0.960
Senegal SCR→Benin SCR	0.727	0.484	0.364	0.834	0.243	0.962

Senegal SCR→Burkina Faso CSI	0.100	0.905	0.067	0.992	0.878	0.510
Senegal SCR→Burkina Faso SBI	0.144	0.866	1.355	0.247	1.468	0.185
Senegal SCR→Burkina Faso SCR	2.167	0.115	1.086	0.362	0.725	0.629
Senegal SCR→Ghana CSI	0.898	0.408	0.615	0.652	2.264	0.035**
Senegal SCR→Ghana SBI	0.445	0.641	0.575	0.681	0.833	0.544
Senegal SCR→Ghana SCR	2.390	0.092	1.198	0.310	0.800	0.569
Senegal SCR→Nigeria CSI	0.073	0.930	0.806	0.521	0.572	0.753
Senegal SCR→Nigeria SBI	0.569	0.566	0.278	0.892	0.200	0.977
Senegal SCR→Nigeria SCR	1.192	0.304	0.597	0.665	0.398	0.881

→ represents does not Granger cause CSI represents Country Stock Index

*** and ** represent significance at the 1 and 5 percent level respectively

SBI represents Sovereign Bond Index

The East African causality tests in Table 4.5 below show that there is uni-directional Granger causality from a Malawian SCR to a Ugandan SCR, a Rwandan SCR to a Kenyan SCR, a Ugandan SCR to a Kenyan SCR and a Ugandan SCR to a Rwandan SCR. The inter-linkage between the region's countries could possibly be a result of the political and economic integration through the East African Community (EAC), which is a potential precursor to the establishment of the East African Federation (Davoodi *et al.*, 2013), a proposed federation of its members into a single sovereign state (Ogola *et al.*, 2015). The EAC already launched the region's common market for goods, labour, and capital with the goal of creating a common currency towards a full political federation within the next 10 years. This suggests that sovereign ratings in these countries have spillover effects leading to changes in sovereign rating of neighbouring countries in the East African region. Further, the results show that sovereign rating announcements in Kenya, Malawi, Mauritius, Rwanda, Zambia spills over to the Ugandan bond markets. However, sovereign rating changes in Kenya, Rwanda and Zambia spill over to Mauritius and Malawi stock markets. However, the different spillover directions could be possibly be explained by the economic linkages amongst the East African countries through trade on the common market protocols, customs unions and cross-border banking. Due to country specific challenges and barriers, regional intergration may benefit countries differently.

Table 4.5: East Africa Regional Pairwise Granger Causality Tests

Lags	2		4		6	
Null Hypothesis	F-Statistic	Prob.	F-Statistic	Prob.	F-Statistic	Prob.
Kenya SCR→Malawi SBI	1.066	0.344	0.628	0.643	0.493	0.814
Kenya SCR→Malawi CSI	0.047	0.954	0.129	0.972	0.096	0.997
Kenya SCR→Malawi SCR	0.001	0.999	0.001	1.000	0.000	1.000
Kenya SCR→Mauritius SBI	0.020	0.980	0.017	0.999	0.516	0.797
Kenya SCR→Mauritius CSI	3.092	0.046**	2.340	0.053	3.471	0.002***
Kenya SCR→Mauritius SCR	0.020	0.981	0.010	1.000	0.007	1.000
Kenya SCR→Rwanda SBI	0.017	0.984	0.009	1.000	0.007	1.000
Kenya SCR→Rwanda CSI	0.929	0.395	0.603	0.660	0.445	0.849
Kenya SCR→Rwanda SCR	0.007	0.993	0.004	1.000	0.002	1.000
Kenya SCR→Uganda SBI	15.317	0.000**	7.976	0.000**	5.286	0.000***
Kenya SCR→Uganda CSI	0.025	0.975	0.041	0.997	0.055	0.999
Kenya SCR→Uganda SCR	0.001	0.999	0.000	1.000	0.000	1.000
Kenya SCR→Zambia SBI	0.941	0.390	1.235	0.294	1.873	0.082
Kenya SCR→Zambia CSI	0.019	0.981	0.503	0.733	1.344	0.234
Kenya SCR→Zambia SCR	2.742	0.065	1.374	0.240	0.917	0.481
Malawi SCR→Kenya SBI	1.568	0.209	1.012	0.400	0.896	0.497
Malawi SCR→Kenya CSI	0.257	0.773	0.176	0.951	1.254	0.275
Malawi SCR→Kenya SCR	2.190	0.112	1.097	0.356	0.732	0.624
Malawi SCR→Mauritius SBI	0.742	0.476	0.407	0.803	0.303	0.936
Malawi SCR→Mauritius CSI	0.006	0.994	0.071	0.991	0.081	0.998
Malawi SCR→Mauritius SCR	0.006	0.994	0.003	1.000	0.002	1.000
Malawi SCR→Rwanda SBI	0.004	0.996	0.003	1.000	0.003	1.000
Malawi SCR→Rwanda CSI	0.427	0.653	0.229	0.923	0.181	0.982
Malawi SCR→Rwanda SCR	1.369	0.254	0.685	0.602	0.458	0.840
Malawi SCR→Uganda SBI	11.499	0.000**	6.014	0.000**	4.683	0.000***
Malawi SCR→Uganda CSI	0.002	0.998	0.447	0.775	0.564	0.759
Malawi SCR→Uganda SCR	5.128	0.006**	2.574	0.036**	1.723	0.111
Malawi SCR→Zambia SBI	0.255	0.775	0.201	0.938	0.369	0.899
Malawi SCR→Zambia CSI	0.170	0.844	0.855	0.490	0.568	0.756
Malawi SCR→Zambia SCR	0.933	0.394	0.467	0.760	0.311	0.932
Mauritius SCR→Kenya SBI	0.259	0.772	0.160	0.958	0.104	0.996
Mauritius SCR→Kenya CSI	0.027	0.973	0.063	0.993	0.055	0.999
Mauritius SCR→Kenya SCR	0.145	0.865	0.073	0.990	0.048	1.000
Mauritius SCR→Malawi SBI	0.205	0.815	0.117	0.976	0.085	0.998
Mauritius SCR→Malawi CSI	0.375	0.687	0.187	0.946	0.154	0.988
Mauritius SCR→Malawi SCR	0.342	0.710	0.171	0.953	0.114	0.995
Mauritius SCR→Rwanda SBI	0.022	0.979	0.012	1.000	0.009	1.000
Mauritius SCR→Rwanda CSI	0.124	0.884	0.156	0.961	0.134	0.992
Mauritius SCR→Rwanda SCR	0.176	0.839	0.088	0.986	0.059	0.999
Mauritius SCR→Uganda SBI	5.188	0.006**	2.705	0.029**	1.796	0.096*
Mauritius SCR→Uganda CSI	0.027	0.973	0.097	0.984	0.069	0.999
Mauritius SCR→Uganda SCR	0.214	0.807	0.107	0.980	0.072	0.999
Mauritius SCR→Zambia SBI	0.416	0.660	0.342	0.849	0.219	0.971
Mauritius SCR→Zambia CSI	0.015	0.985	1.666	0.155	1.262	0.272
Mauritius SCR→Zambia SCR	0.091	0.913	0.045	0.996	0.030	1.000
Rwanda SCR→Kenya SBI	1.231	0.292	0.472	0.757	0.352	0.909
Rwanda SCR→Kenya CSI	0.075	0.928	0.609	0.656	0.469	0.832
Rwanda SCR→Kenya SCR	9.809	0.000**	4.941	0.001**	3.318	0.003***
Rwanda SCR→Malawi SBI	0.558	0.573	0.279	0.892	0.173	0.984
Rwanda SCR→Malawi CSI	4.354	0.013**	2.202	0.066	1.949	0.069*
Rwanda SCR→Malawi SCR	0.281	0.755	0.141	0.967	0.094	0.997
Rwanda SCR→Mauritius SBI	0.184	0.832	0.560	0.692	0.508	0.803

Rwanda SCR→Mauritius CSI	0.516	0.597	0.257	0.906	0.445	0.849
Rwanda SCR→Mauritius SCR	0.017	0.983	0.009	1.000	0.006	1.000
Rwanda SCR→Uganda SBI	13.777	0.000**	7.251	0.000**	4.804	0.000**
Rwanda SCR→Uganda CSI	0.005	0.995	0.772	0.543	0.880	0.509
Rwanda SCR→Uganda SCR	0.000	1.000	0.000	1.000	0.000	1.000
Rwanda SCR→Zambia SBI	2.299	0.101	1.677	0.152	1.335	0.238
Rwanda SCR→Zambia CSI	0.070	0.933	0.031	0.998	0.165	0.986
Rwanda SCR→Zambia SCR	2.139	0.118	1.071	0.369	0.715	0.638
Uganda SCR→Kenya SBI	0.383	0.682	0.155	0.961	0.126	0.993
Uganda SCR→Kenya CSI	1.495	0.224	0.785	0.535	0.687	0.660
Uganda SCR→Kenya SCR	3.115	0.045**	1.561	0.182	1.043	0.395
Uganda SCR→Malawi SBI	0.591	0.554	1.467	0.209	0.983	0.435
Uganda SCR→Malawi CSI	0.121	0.886	0.065	0.992	0.054	0.999
Uganda SCR→Malawi SCR	0.000	1.000	0.000	1.000	0.000	1.000
Uganda SCR→Mauritius SBI	0.323	0.724	0.401	0.808	1.120	0.348
Uganda SCR→Mauritius CSI	0.425	0.654	0.192	0.943	0.142	0.991
Uganda SCR→Mauritius SCR	0.010	0.990	0.005	1.000	0.003	1.000
Uganda SCR→Rwanda SBI	2.685	0.068	1.344	0.251	0.895	0.497
Uganda SCR→Rwanda CSI	0.527	0.590	0.287	0.887	0.193	0.979
Uganda SCR→Rwanda SCR	4.947	0.007**	2.483	0.042**	1.662	0.126
Uganda SCR→Zambia SBI	0.294	0.745	0.459	0.766	0.415	0.870
Uganda SCR→Zambia CSI	0.067	0.935	16.792	0.000**	11.404	0.000***
Uganda SCR→Zambia SCR	1.392	0.249	0.696	0.594	0.465	0.835
Zambia SCR→Kenya SBI	0.088	0.916	0.033	0.998	0.025	1.000
Zambia SCR→Kenya CSI	0.000	1.000	0.088	0.986	0.061	0.999
Zambia SCR→Kenya SCR	0.000	1.000	0.000	1.000	0.000	1.000
Zambia SCR→Malawi SBI	4.985	0.007**	2.529	0.039**	1.655	0.128
Zambia SCR→Malawi CSI	0.012	0.988	0.016	1.000	0.474	0.828
Zambia SCR→Malawi SCR	0.000	1.000	0.000	1.000	0.000	1.000
Zambia SCR→Mauritius SBI	0.480	0.619	0.650	0.627	0.456	0.841
Zambia SCR→Mauritius CSI	3.213	0.040**	1.620	0.166	1.104	0.357
Zambia SCR→Mauritius SCR	0.046	0.956	0.023	0.999	0.015	1.000
Zambia SCR→Rwanda SBI	0.002	0.998	0.002	1.000	0.001	1.000
Zambia SCR→Rwanda CSI	1.668	0.189	0.899	0.464	0.607	0.725
Zambia SCR→Rwanda SCR	0.007	0.993	0.004	1.000	0.002	1.000
Zambia SCR→Uganda SBI	8.990	0.000**	4.658	0.001**	3.072	0.005***
Zambia SCR→Uganda CSI	0.095	0.909	0.047	0.996	0.035	1.000
Zambia SCR→Uganda SCR	0.047	0.954	0.023	0.999	0.016	1.000

→ represents does not Granger cause CSI represents Country Stock Index

***, **, * represent significance at the 1, 5, 10 percent level respectively

SBI represents Sovereign Bond Index

With regards to the Southern Africa, the causality test results presented in Table 4.6 below show that there is uni-directional causality from a Botswana SCR to the South Africa SBI, a Namibian SCR to the South African SBI, and a Botswana SCR to a Namibian SCR, which indicate that there are credit rating spillovers between these markets. These findings could be a result of the close linkage between the Botswana and Namibian economies to the South African economy. In addition, the Namibian dollar and Botswana pula are pegged to the South African rand, and thus their inflation and

interest rates also move closely in line with South Africa (Muchapondwa and Stage, 2013).

Table 4.6: Southern Africa Regional Pairwise Granger Causality Tests

Lags	2		4		6	
Null Hypothesis	F-Statistic	Prob.	F-Statistic	Prob.	F-Statistic	Prob.
Botswana SCR→Namibia CSI	2.094	0.123	1.314	0.262	0.917	0.481
Botswana SCR→Namibia SBI	0.498	0.608	2.077	0.081	1.893	0.078*
Botswana SCR→Namibia SCR	4.208	0.015**	2.111	0.077	1.412	0.206
Botswana SCR→South Africa CSI	0.112	0.894	0.123	0.974	0.190	0.980
Botswana SCR→South Africa SBI	6.962	0.001**	3.537	0.007**	2.405	0.025**
Botswana SCR→South Africa SCR	1.003	0.367	0.512	0.727	0.349	0.911
Namibia SCR→Botswana CSI	0.858	0.424	0.503	0.734	0.440	0.853
Namibia SCR→Botswana SBI	0.020	0.980	0.014	1.000	0.012	1.000
Namibia SCR→Botswana SCR	0.000	1.000	0.000	1.000	0.000	1.000
Namibia SCR→South Africa CSI	0.873	0.418	0.961	0.428	1.053	0.389
Namibia SCR→South Africa SBI	11.694	0.000**	6.121	0.000**	4.172	0.000***
Namibia SCR→South Africa SCR	0.728	0.483	0.372	0.829	0.254	0.958
South Africa SCR→Botswana CSI	0.657	0.519	0.212	0.932	0.329	0.922
South Africa SCR→Botswana SBI	1.179	0.308	0.631	0.640	0.441	0.852
South Africa SCR→Botswana SCR	0.245	0.783	0.123	0.974	0.082	0.998
South Africa SCR→Namibia CSI	0.080	0.923	0.066	0.992	0.053	0.999
South Africa SCR→Namibia SBI	0.755	0.470	0.977	0.419	1.688	0.120
South Africa SCR→Namibia SCR	0.424	0.655	0.212	0.932	0.142	0.991

→ represents does not Granger cause CSI represents Country Stock Index

***, **, * represent significance at the 1, 5, 10 percent level respectively

SBI represents Sovereign Bond Index

Table 4.7 below presents results of an ordered probit model employed to test the robustness in the Granger Causality test. As can be seen, the results show that coefficients are positive but not significant, therefore an increase in the predicting parameter would lead to an increase in the predicted probabilities.

Table 4.7: Probit Regression Results

LR χ^2	22.09			Pseudo R^2	0.044
Prob. > χ^2	0.001			Log likelihood	23.84
Parameters	Coef.	Std. Err.	Prob.	95% Conf. interval	
SCR	0.273	0.179	0.038	0.002	0.021
CSI	0.409	0.193	0.128	0.078	0.086
SBI	0.015	0.647	0.017	0.022	0.772

CSI represents Country Stock Index
SBI represents Sovereign Bond Index

4.6.2 Impulse responses

The graphical results of the stock and bond indices impulse responses to Cholesky's one standard deviation sovereign rating shock are presented in the Appendices. The results indicate that when a sovereign rating is shocked by one standard deviation, the regional stock and bond markets generally respond by less than 1 percent and this effect fades away within four days of a sovereign rating announcement. Thus, the regional sovereign rating spillover impact is very small and its effects are quickly absorbed into stock and bond markets prices.

The cross-country impulse responses from a sovereign rating shock in one country to the sovereign ratings in other countries in the region are also marginal but persists for more than 10 periods. These effects could possibly be attributed to regional financial and economic integration (Braun and Raddatz, 2007) associated with capital account liberalization (Eichengreen *et al.*, 2011), financial deregulation, and financial innovation (Causevic, 2003); as well as with monetary unions (Bayar *et al.*, 2013) such as the CFA franc in West and Central Africa, the dinar in North Africa and the rand[26] indexed currencies in Southern and Eastern Africa. Thus, the sovereign rating shock originating from the any of the countries in the same region is transmitted to all other countries' credit ratings. As suggested by Claeys and Vašíček (2012), the bilateral linkages between these countries open the channels of capital and cross-country information flows that determine sovereign rating spillovers and contagion. Hence, the results show that Drago and Gallo (2016)'s finding that a spillover effect on financial markets

[26] It is legal tender in the Common Monetary Area

following credit rating announcements transmitted through the international bank flows between regional member countries also applies to countries in Africa.

4.7 Conclusion

This chapter examined the spillover effects of long-term foreign currency SCR changes on financial markets of neighbouring countries in 19 African countries grouped into five geographical regions during the period 1994 to 2014. The results of the Granger Causality tests find significant evidence of sovereign rating spillover effects in capital markets trading long-term securities such as stocks. Thus, investors consider regional countries' credit rating profiles as a whole rather than on an individual country basis. Furthermore, it can be concluded that in accordance with Christopher *et al.* (2012), there are regional transmission channels through which both information and capital flows. Thus, investors shift funds from downgraded lower sovereign rated countries to higher rated countries, which generate spillover effects in the region's neighbouring countries.

Impulse response analysis further shows that the regional sovereign rating spillover impacts are marginal and are quickly absorbed into stock and bond markets prices. However, the cross-country impulse responses - from a sovereign rating shock in one country to the sovereign ratings in other countries in the same region - are also marginal but persist over longer time periods.

Thus, there are five implications arising from these results. First, the regional bilateral linkages between countries serve as channels of capital and SCR information flow. Second, the regional sovereign ratings are susceptible to member countries' unfavourable macro-economic conditions arising from varied economic policies, financial resources, infrastructure, institutional strength, and political stability. Third, the disparities in the levels of economic development of African states negatively affects the objectives of regional economic integration. Lastly, the success of the common market areas depends on the degree to which member countries align their national policies with regional policies so as to avoid conflicting priorities. Hence, the results of the

analysis suggest that it is imperative for regional countries to pursue developmental macroeconomic policies that will enhance cooperation and integration, and to avoid negative ratings that will have regional spillover effects.

APPENDICES: IMPULSE RESPONSES

Appendix 4A: North Africa Region

Period	Response of Egypt SBI to: Egypt SCR	Morocco SCR	Tunisia SCR	Response of Egypt CSI to: Egypt SCR	Morocco SCR	Tunisia SCR	Response of Egypt SCR to: Egypt SCR	Morocco SCR	Tunisia SCR
1	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	16.830%	0.000%	0.000%
	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	-0.161%	0.000%	0.000%
2	-0.001%	-0.001%	-0.001%	-0.010%	-0.007%	-0.001%	16.791%	0.002%	0.005%
	-0.004%	-0.004%	-0.004%	-0.012%	-0.012%	-0.012%	-0.279%	-0.228%	-0.228%
3	0.000%	0.000%	0.000%	0.000%	0.000%	0.001%	16.757%	-0.009%	0.047%
	0.000%	0.000%	0.000%	-0.001%	-0.001%	-0.001%	-0.278%	-0.227%	-0.228%
4	0.000%	0.000%	0.000%	0.001%	0.000%	0.000%	16.727%	-0.018%	0.089%
	0.000%	0.000%	0.000%	-0.001%	-0.001%	-0.001%	-0.279%	-0.227%	-0.230%
5	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	16.695%	-0.028%	0.128%
	0.000%	0.000%	0.000%	-0.001%	0.000%	-0.001%	-0.279%	-0.228%	-0.232%
6	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	16.663%	-0.038%	0.168%
	0.000%	0.000%	0.000%	-0.001%	0.000%	-0.001%	-0.281%	-0.228%	-0.236%
7	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	16.631%	-0.048%	0.208%
	0.000%	0.000%	0.000%	-0.001%	0.000%	-0.001%	-0.283%	-0.229%	-0.241%
8	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	16.599%	-0.058%	0.247%
	0.000%	0.000%	0.000%	-0.001%	0.000%	-0.001%	-0.285%	-0.230%	-0.246%
9	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	16.568%	-0.068%	0.286%
	0.000%	0.000%	0.000%	-0.001%	0.000%	-0.001%	-0.288%	-0.231%	-0.253%
10	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	16.536%	-0.078%	0.325%
	0.000%	0.000%	0.000%	-0.001%	0.000%	-0.001%	-0.291%	-0.233%	-0.260%

Period	Response of Morocco SBI to: Egypt SCR	Morocco SCR	Tunisia SCR	Response of Morocco CSI to: Egypt SCR	Morocco SCR	Tunisia SCR	Response of Morocco SCR to: Egypt SCR	Morocco SCR	Tunisia SCR
1	0.000%	0.000%	0.000%	-0.002%	0.000%	0.000%	0.000%	17.623%	0.000%
	-0.002%	0.000%	0.000%	-0.010%	0.000%	0.000%	-0.238%	-0.168%	0.000%
2	0.000%	0.000%	0.000%	0.000%	0.002%	-0.016%	-0.002%	17.597%	-0.007%
	-0.002%	-0.002%	-0.002%	-0.010%	-0.010%	-0.010%	-0.337%	-0.292%	-0.239%
3	0.000%	0.000%	0.000%	0.000%	0.000%	0.002%	0.016%	17.577%	-0.019%
	0.000%	0.000%	0.000%	-0.001%	-0.001%	-0.001%	-0.337%	-0.292%	-0.239%
4	0.000%	0.000%	0.000%	0.000%	-0.001%	0.002%	0.035%	17.560%	-0.025%
	0.000%	0.000%	0.000%	-0.001%	-0.001%	-0.001%	-0.337%	-0.292%	-0.241%
5	0.000%	0.000%	0.000%	0.000%	0.000%	0.001%	0.056%	17.540%	-0.027%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.001%	-0.338%	-0.292%	-0.244%
6	0.000%	0.000%	0.000%	0.000%	0.000%	0.001%	0.076%	17.521%	-0.029%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.001%	-0.339%	-0.293%	-0.248%
7	0.000%	0.000%	0.000%	0.000%	0.000%	0.001%	0.096%	17.501%	-0.031%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.001%	-0.341%	-0.293%	-0.253%
8	0.000%	0.000%	0.000%	0.000%	0.000%	0.001%	0.117%	17.482%	-0.034%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.001%	-0.344%	-0.294%	-0.259%
9	0.000%	0.000%	0.000%	0.000%	0.000%	0.001%	0.137%	17.462%	-0.036%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.001%	-0.346%	-0.295%	-0.266%

10	0.000%	0.000%	0.000%	0.000%	0.000%	0.001%	0.157%	17.443%	-0.038%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.001%	-0.349%	-0.297%	-0.274%

	Response of Tunisia SBI to:			Response of Tunisia CSI to:			Response of Tunisia SCR to:		
Period	Egypt SCR	Morocco SCR	Tunisia SCR	Egypt SCR	Morocco SCR	Tunisia SCR	Egypt SCR	Morocco SCR	Tunisia SCR
1	-0.018%	0.024%	0.000%	0.000%	0.002%	0.000%	0.003%	-0.013%	19.147%
	-0.076%	-0.076%	0.000%	-0.011%	-0.011%	0.000%	-0.259%	-0.259%	-0.183%
2	-0.005%	-0.016%	0.000%	0.003%	-0.004%	-0.008%	0.002%	-0.014%	19.102%
	-0.076%	-0.076%	-0.076%	-0.011%	-0.011%	-0.011%	-0.366%	-0.366%	-0.317%
3	-0.002%	0.000%	0.002%	0.000%	0.000%	0.000%	0.009%	-0.021%	19.042%
	-0.005%	-0.004%	-0.007%	-0.002%	-0.002%	-0.002%	-0.365%	-0.365%	-0.317%
4	-0.002%	0.000%	-0.005%	0.001%	0.000%	0.000%	0.015%	-0.025%	18.986%
	-0.005%	-0.004%	-0.006%	-0.001%	0.000%	-0.001%	-0.365%	-0.364%	-0.318%
5	-0.003%	0.000%	-0.002%	0.001%	-0.001%	-0.001%	0.023%	-0.030%	18.930%
	-0.004%	-0.003%	-0.006%	-0.001%	0.000%	-0.001%	-0.365%	-0.364%	-0.320%
6	-0.003%	0.000%	-0.001%	0.001%	-0.001%	-0.001%	0.030%	-0.034%	18.875%
	-0.004%	-0.003%	-0.006%	-0.001%	0.000%	-0.001%	-0.366%	-0.363%	-0.323%
7	-0.003%	0.000%	-0.002%	0.001%	-0.001%	-0.001%	0.037%	-0.038%	18.820%
	-0.004%	-0.003%	-0.006%	-0.001%	0.000%	-0.001%	-0.367%	-0.363%	-0.327%
8	-0.002%	0.000%	-0.002%	0.001%	-0.001%	-0.001%	0.045%	-0.042%	18.765%
	-0.004%	-0.003%	-0.005%	-0.001%	0.000%	-0.001%	-0.369%	-0.363%	-0.332%
9	-0.002%	0.000%	-0.002%	0.001%	-0.001%	-0.001%	0.052%	-0.047%	18.711%
	-0.004%	-0.003%	-0.005%	-0.001%	0.000%	-0.001%	-0.371%	-0.364%	-0.337%
10	-0.002%	0.000%	-0.002%	0.001%	-0.001%	-0.001%	0.059%	-0.051%	18.656%
	-0.004%	-0.003%	-0.005%	-0.001%	0.000%	-0.001%	-0.374%	-0.364%	-0.344%

Appendix 4B: West Africa Region

Period	Response of Benin SBI to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR	Response of Benin CSI to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR
1	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
2	0.015%	-0.018%	-0.014%	-0.013%	-0.013%	-0.006%	-0.005%	-0.006%	0.005%	0.000%
	-0.053%	-0.039%	-0.039%	-0.039%	-0.039%	-0.014%	-0.010%	-0.010%	-0.010%	-0.010%
3	-0.002%	0.000%	-0.001%	0.002%	0.001%	-0.001%	-0.001%	0.004%	0.000%	-0.001%
	-0.008%	-0.008%	-0.007%	-0.006%	-0.004%	-0.002%	-0.002%	-0.002%	-0.002%	-0.001%
4	-0.001%	0.002%	0.000%	0.001%	0.005%	-0.001%	-0.001%	0.003%	0.001%	0.002%
	-0.013%	-0.010%	-0.010%	-0.009%	-0.009%	-0.002%	-0.002%	-0.002%	-0.002%	-0.002%
5	0.001%	0.002%	-0.003%	0.000%	0.000%	-0.002%	-0.001%	0.002%	0.001%	-0.001%
	-0.004%	-0.004%	-0.004%	-0.002%	-0.002%	-0.001%	-0.001%	-0.001%	-0.001%	0.000%
6	0.000%	0.002%	-0.003%	0.000%	-0.001%	-0.002%	-0.001%	0.002%	0.001%	-0.001%
	-0.005%	-0.004%	-0.004%	-0.002%	-0.002%	-0.001%	-0.001%	-0.001%	-0.001%	0.000%
7	0.000%	0.002%	-0.002%	0.000%	0.000%	-0.002%	-0.001%	0.002%	0.001%	0.000%
	-0.004%	-0.004%	-0.004%	-0.002%	-0.001%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
8	0.000%	0.002%	-0.002%	0.000%	0.001%	-0.002%	-0.001%	0.002%	0.001%	0.000%
	-0.004%	-0.004%	-0.004%	-0.002%	-0.001%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
9	0.000%	0.002%	-0.002%	0.000%	0.000%	-0.002%	-0.001%	0.002%	0.001%	0.000%
	-0.004%	-0.004%	-0.003%	-0.002%	-0.001%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
10	0.000%	0.002%	-0.002%	0.000%	0.000%	-0.002%	-0.001%	0.002%	0.001%	0.000%
	-0.004%	-0.004%	-0.003%	-0.002%	-0.001%	-0.001%	-0.001%	-0.001%	0.000%	0.000%

Period	Response of Benin SCR to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR	Response of Burkina Faso SBI to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR
1	16.494%	0.000%	0.000%	0.000%	0.000%	-0.031%	0.000%	0.000%	0.000%	0.000%
	-0.158%	0.000%	0.000%	0.000%	0.000%	-0.028%	0.000%	0.000%	0.000%	0.000%
2	16.385%	0.015%	0.025%	0.018%	0.013%	-0.006%	0.005%	0.006%	-0.065%	-0.014%
	-0.341%	-0.223%	-0.223%	-0.223%	-0.223%	-0.039%	-0.028%	-0.028%	-0.028%	-0.028%
3	16.268%	0.104%	0.039%	0.014%	0.021%	0.006%	-0.005%	0.004%	0.010%	0.002%
	-0.341%	-0.225%	-0.224%	-0.223%	-0.223%	-0.008%	-0.006%	-0.006%	-0.005%	-0.005%
4	16.144%	0.180%	0.046%	-0.002%	0.011%	0.000%	-0.005%	0.003%	0.005%	0.001%
	-0.342%	-0.230%	-0.227%	-0.222%	-0.222%	-0.005%	-0.004%	-0.004%	-0.003%	-0.003%
5	16.026%	0.261%	0.058%	-0.013%	0.006%	0.000%	-0.003%	0.003%	-0.002%	-0.001%
	-0.346%	-0.238%	-0.233%	-0.222%	-0.221%	-0.003%	-0.003%	-0.003%	-0.002%	-0.001%
6	15.909%	0.340%	0.071%	-0.021%	0.004%	0.001%	-0.004%	0.003%	0.000%	0.000%
	-0.352%	-0.250%	-0.242%	-0.223%	-0.221%	-0.003%	-0.003%	-0.003%	-0.001%	-0.001%
7	15.792%	0.417%	0.084%	-0.030%	0.001%	0.001%	-0.004%	0.003%	0.000%	0.000%
	-0.360%	-0.263%	-0.252%	-0.225%	-0.221%	-0.003%	-0.003%	-0.003%	-0.001%	-0.001%
8	15.676%	0.492%	0.098%	-0.039%	-0.003%	0.000%	-0.004%	0.003%	0.000%	0.000%
	-0.371%	-0.279%	-0.265%	-0.227%	-0.222%	-0.003%	-0.003%	-0.003%	-0.001%	-0.001%
9	15.561%	0.566%	0.114%	-0.048%	-0.006%	0.000%	-0.004%	0.003%	0.000%	0.000%
	-0.382%	-0.296%	-0.278%	-0.229%	-0.223%	-0.003%	-0.003%	-0.003%	-0.001%	-0.001%
10	15.447%	0.638%	0.130%	-0.057%	-0.010%	0.001%	-0.003%	0.003%	0.000%	0.000%
	-0.395%	-0.315%	-0.293%	-0.233%	-0.224%	-0.003%	-0.003%	-0.002%	-0.001%	-0.001%

Period	Response of Burkina Faso CSI to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR	Response of Burkina Faso SCR to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR
1	-0.006%	0.000%	0.000%	0.000%	0.000%	-0.003%	12.156%	0.000%	0.000%	0.000%
	-0.010%	0.000%	0.000%	0.000%	0.000%	-0.164%	-0.116%	0.000%	0.000%	0.000%
2	-0.001%	-0.004%	0.001%	0.000%	-0.005%	-0.021%	12.000%	0.009%	-0.005%	-0.026%
	-0.014%	-0.010%	-0.010%	-0.010%	-0.010%	-0.276%	-0.201%	-0.165%	-0.165%	-0.165%
3	-0.001%	-0.001%	0.001%	0.000%	0.002%	-0.032%	11.837%	0.181%	0.011%	-0.020%
	-0.003%	-0.002%	-0.002%	-0.002%	-0.002%	-0.274%	-0.200%	-0.164%	-0.163%	-0.163%
4	-0.001%	-0.001%	0.001%	0.001%	0.000%	-0.042%	11.679%	0.348%	0.009%	-0.017%
	-0.002%	-0.002%	-0.002%	-0.001%	-0.001%	-0.273%	-0.201%	-0.165%	-0.162%	-0.162%
5	-0.001%	-0.001%	0.001%	0.000%	0.000%	-0.055%	11.521%	0.509%	0.008%	-0.017%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.273%	-0.205%	-0.169%	-0.161%	-0.160%
6	-0.001%	-0.001%	0.001%	0.000%	0.000%	-0.068%	11.365%	0.669%	0.008%	-0.016%
	-0.001%	-0.001%	-0.001%	0.000%	0.000%	-0.276%	-0.210%	-0.174%	-0.161%	-0.159%
7	-0.001%	-0.001%	0.001%	0.000%	0.000%	-0.079%	11.212%	0.827%	0.008%	-0.013%
	-0.001%	-0.001%	-0.001%	0.000%	0.000%	-0.280%	-0.218%	-0.182%	-0.161%	-0.158%
8	-0.001%	-0.001%	0.001%	0.000%	0.000%	-0.090%	11.060%	0.982%	0.008%	-0.010%
	-0.001%	-0.001%	-0.001%	0.000%	0.000%	-0.285%	-0.227%	-0.190%	-0.162%	-0.158%
9	-0.001%	-0.001%	0.001%	0.000%	0.000%	-0.101%	10.910%	1.135%	0.008%	-0.008%
	-0.001%	-0.001%	-0.001%	0.000%	0.000%	-0.291%	-0.237%	-0.199%	-0.163%	-0.158%
10	-0.001%	-0.001%	0.001%	0.000%	0.000%	-0.112%	10.763%	1.285%	0.007%	-0.005%
	-0.001%	-0.001%	-0.001%	0.000%	0.000%	-0.299%	-0.247%	-0.209%	-0.164%	-0.158%

Period	Response of Ghana SBI to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR	Response of Ghana CSI to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR
1	0.002%	0.011%	0.000%	0.000%	0.000%	0.000%	0.010%	0.000%	0.000%	0.000%
	-0.013%	-0.013%	0.000%	0.000%	0.000%	-0.010%	-0.010%	0.000%	0.000%	0.000%
2	0.003%	-0.013%	0.000%	0.013%	-0.014%	-0.003%	-0.002%	-0.003%	0.000%	-0.014%
	-0.018%	-0.014%	-0.013%	-0.013%	-0.013%	-0.013%	-0.010%	-0.010%	-0.010%	-0.010%
3	0.000%	-0.003%	0.003%	-0.003%	0.003%	0.000%	-0.002%	0.002%	0.000%	0.001%
	-0.004%	-0.003%	-0.003%	-0.003%	-0.003%	-0.002%	-0.002%	-0.002%	-0.001%	-0.001%
4	0.001%	-0.003%	0.003%	0.000%	-0.001%	0.000%	-0.001%	0.001%	0.001%	0.001%
	-0.002%	-0.002%	-0.001%	-0.001%	-0.001%	-0.002%	-0.002%	-0.002%	-0.001%	-0.001%
5	0.001%	-0.003%	0.002%	0.000%	0.000%	0.000%	-0.001%	0.001%	0.000%	0.000%
	-0.002%	-0.002%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	0.000%
6	0.001%	-0.003%	0.002%	0.000%	0.000%	0.000%	-0.001%	0.001%	0.000%	0.000%
	-0.002%	-0.002%	-0.001%	-0.001%	0.000%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
7	0.001%	-0.003%	0.002%	0.000%	0.000%	0.000%	-0.001%	0.001%	0.000%	0.000%
	-0.001%	-0.002%	-0.001%	-0.001%	0.000%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
8	0.001%	-0.003%	0.002%	0.000%	0.000%	0.000%	-0.001%	0.001%	0.000%	0.000%
	-0.001%	-0.001%	-0.001%	-0.001%	0.000%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
9	0.001%	-0.003%	0.002%	0.000%	0.000%	0.000%	-0.001%	0.001%	0.000%	0.000%
	-0.001%	-0.001%	-0.001%	-0.001%	0.000%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
10	0.001%	-0.003%	0.002%	0.000%	0.000%	0.000%	-0.001%	0.001%	0.000%	0.000%
	-0.001%	-0.001%	-0.001%	-0.001%	0.000%	-0.001%	-0.001%	-0.001%	0.000%	0.000%

Period	Response of Ghana SCR to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR	Response of Nigeria SBI to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR
1	0.018%	-0.013%	12.985%	0.000%	0.000%	-0.004%	-0.005%	0.004%	0.000%	0.000%
	-0.175%	-0.175%	-0.124%	0.000%	0.000%	-0.008%	-0.008%	-0.008%	0.000%	0.000%
2	0.007%	-0.008%	12.957%	-0.021%	-0.005%	0.010%	0.001%	-0.001%	0.003%	-0.006%
	-0.296%	-0.248%	-0.215%	-0.176%	-0.176%	-0.011%	-0.008%	-0.008%	-0.008%	-0.008%
3	0.009%	-0.007%	12.941%	-0.022%	0.015%	0.000%	-0.003%	0.002%	0.001%	0.000%
	-0.297%	-0.249%	-0.216%	-0.176%	-0.176%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
4	0.011%	-0.002%	12.929%	-0.027%	0.032%	0.001%	-0.002%	0.002%	0.001%	-0.001%
	-0.299%	-0.253%	-0.219%	-0.177%	-0.177%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
5	0.017%	-0.005%	12.913%	-0.030%	0.048%	0.000%	-0.002%	0.002%	0.000%	0.000%
	-0.303%	-0.258%	-0.224%	-0.178%	-0.177%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
6	0.023%	-0.007%	12.898%	-0.033%	0.064%	0.000%	-0.002%	0.002%	0.000%	0.000%
	-0.309%	-0.266%	-0.230%	-0.180%	-0.178%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
7	0.028%	-0.010%	12.882%	-0.036%	0.081%	0.000%	-0.002%	0.002%	0.000%	0.000%
	-0.317%	-0.275%	-0.238%	-0.182%	-0.179%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
8	0.033%	-0.012%	12.867%	-0.039%	0.097%	0.000%	-0.002%	0.002%	0.000%	0.000%
	-0.325%	-0.285%	-0.247%	-0.185%	-0.181%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
9	0.038%	-0.014%	12.852%	-0.042%	0.114%	0.000%	-0.002%	0.002%	0.000%	0.000%
	-0.335%	-0.297%	-0.257%	-0.188%	-0.183%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
10	0.043%	-0.016%	12.837%	-0.046%	0.130%	0.000%	-0.002%	0.002%	0.000%	0.000%
	-0.346%	-0.309%	-0.269%	-0.191%	-0.185%	-0.001%	-0.001%	-0.001%	0.000%	0.000%

Period	Response of Nigeria CSI to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR	Response of Nigeria SCR to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR
1	0.005%	-0.001%	-0.001%	0.000%	0.000%	0.011%	-0.003%	-0.037%	14.853%	0.000%
	-0.010%	-0.010%	-0.010%	0.000%	0.000%	-0.201%	-0.201%	-0.201%	-0.142%	0.000%
2	0.007%	0.000%	-0.001%	0.015%	0.003%	-0.008%	-0.014%	-0.050%	14.832%	-0.025%
	-0.014%	-0.010%	-0.010%	-0.010%	-0.010%	-0.339%	-0.284%	-0.284%	-0.246%	-0.201%
3	0.004%	-0.003%	0.000%	-0.001%	-0.001%	0.033%	-0.029%	-0.043%	14.792%	-0.017%
	-0.002%	-0.002%	-0.002%	-0.001%	-0.001%	-0.340%	-0.285%	-0.285%	-0.246%	-0.202%
4	0.003%	-0.002%	0.000%	-0.002%	0.001%	0.096%	-0.015%	-0.037%	14.751%	-0.021%
	-0.002%	-0.002%	-0.002%	-0.001%	-0.001%	-0.342%	-0.289%	-0.287%	-0.247%	-0.202%
5	0.003%	-0.002%	0.000%	-0.001%	0.000%	0.149%	-0.016%	-0.036%	14.710%	-0.020%
	-0.001%	-0.001%	-0.001%	-0.001%	0.000%	-0.346%	-0.295%	-0.291%	-0.247%	-0.202%
6	0.003%	-0.002%	0.000%	-0.001%	0.000%	0.203%	-0.017%	-0.034%	14.669%	-0.021%
	-0.001%	-0.001%	-0.001%	-0.001%	0.000%	-0.353%	-0.303%	-0.297%	-0.248%	-0.203%
7	0.003%	-0.002%	0.000%	-0.001%	0.000%	0.256%	-0.017%	-0.032%	14.629%	-0.021%
	-0.001%	-0.001%	-0.001%	-0.001%	0.000%	-0.360%	-0.313%	-0.305%	-0.250%	-0.204%
8	0.003%	-0.002%	0.000%	-0.001%	0.000%	0.309%	-0.017%	-0.030%	14.588%	-0.021%
	-0.001%	-0.001%	-0.001%	-0.001%	0.000%	-0.370%	-0.324%	-0.314%	-0.252%	-0.206%
9	0.003%	-0.002%	0.000%	-0.001%	0.000%	0.361%	-0.017%	-0.028%	14.548%	-0.021%
	-0.001%	-0.001%	-0.001%	-0.001%	0.000%	-0.381%	-0.337%	-0.324%	-0.254%	-0.207%
10	0.003%	-0.002%	0.000%	-0.001%	0.000%	0.412%	-0.016%	-0.025%	14.508%	-0.021%
	-0.001%	-0.001%	-0.001%	-0.001%	0.000%	-0.393%	-0.351%	-0.335%	-0.257%	-0.209%

Period	Response of Senegal SBI to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR	Response of Senegal CSI to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR
1	-0.012%	0.012%	-0.001%	0.006%	0.000%	-0.005%	-0.003%	-0.002%	-0.002%	0.000%
	-0.044%	-0.044%	-0.044%	-0.044%	0.000%	-0.010%	-0.010%	-0.010%	-0.010%	0.000%
2	0.018%	-0.055%	-0.015%	0.003%	0.000%	0.005%	0.000%	0.000%	-0.003%	-0.025%
	-0.060%	-0.045%	-0.045%	-0.044%	-0.045%	-0.013%	-0.010%	-0.010%	-0.010%	-0.010%
3	-0.005%	0.009%	-0.002%	0.004%	0.003%	0.004%	-0.002%	0.000%	0.001%	0.003%
	-0.009%	-0.008%	-0.007%	-0.006%	-0.005%	-0.003%	-0.002%	-0.002%	-0.002%	-0.002%
4	-0.004%	0.007%	-0.004%	0.003%	-0.001%	0.002%	-0.002%	0.000%	-0.001%	0.003%
	-0.007%	-0.007%	-0.006%	-0.004%	-0.004%	-0.002%	-0.002%	-0.002%	-0.001%	-0.001%
5	-0.003%	0.005%	-0.004%	0.001%	0.000%	0.003%	-0.002%	0.000%	-0.001%	0.000%
	-0.006%	-0.006%	-0.005%	-0.003%	-0.002%	-0.001%	-0.001%	-0.001%	-0.001%	0.000%
6	-0.003%	0.005%	-0.004%	0.001%	0.000%	0.003%	-0.002%	0.000%	-0.001%	0.000%
	-0.006%	-0.006%	-0.005%	-0.002%	-0.002%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
7	-0.003%	0.005%	-0.004%	0.001%	0.001%	0.003%	-0.002%	0.000%	-0.001%	0.000%
	-0.006%	-0.006%	-0.005%	-0.002%	-0.002%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
8	-0.003%	0.005%	-0.004%	0.001%	0.000%	0.003%	-0.002%	0.000%	-0.001%	0.000%
	-0.006%	-0.006%	-0.005%	-0.002%	-0.002%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
9	-0.003%	0.004%	-0.003%	0.001%	0.000%	0.003%	-0.002%	0.000%	-0.001%	0.000%
	-0.006%	-0.006%	-0.005%	-0.002%	-0.002%	-0.001%	-0.001%	-0.001%	0.000%	0.000%
10	-0.003%	0.004%	-0.003%	0.001%	0.000%	0.003%	-0.001%	0.000%	-0.001%	0.000%
	-0.006%	-0.005%	-0.005%	-0.002%	-0.002%	-0.001%	-0.001%	-0.001%	0.000%	0.000%

Period	Response of Senegal SCR to: Benin SCR	B-Faso SCR	Ghana SCR	Nigeria SCR	Senegal SCR
1	0.003%	0.002%	-0.013%	-0.020%	13.541%
	-0.183%	-0.183%	-0.183%	-0.183%	-0.129%
2	-0.004%	0.001%	-0.003%	-0.008%	13.537%
	-0.310%	-0.260%	-0.260%	-0.259%	-0.225%
3	-0.002%	0.005%	0.001%	-0.014%	13.512%
	-0.311%	-0.261%	-0.260%	-0.260%	-0.225%
4	-0.006%	0.011%	0.002%	-0.016%	13.500%
	-0.313%	-0.264%	-0.263%	-0.260%	-0.225%
5	-0.007%	0.011%	0.000%	-0.016%	13.495%
	-0.318%	-0.270%	-0.267%	-0.261%	-0.226%
6	-0.008%	0.012%	-0.001%	-0.016%	13.488%
	-0.324%	-0.278%	-0.273%	-0.262%	-0.227%
7	-0.008%	0.013%	-0.001%	-0.015%	13.480%
	-0.332%	-0.288%	-0.281%	-0.264%	-0.228%
8	-0.008%	0.014%	-0.002%	-0.015%	13.473%
	-0.341%	-0.299%	-0.289%	-0.266%	-0.229%
9	-0.009%	0.015%	-0.003%	-0.015%	13.465%
	-0.352%	-0.311%	-0.299%	-0.268%	-0.231%
10	-0.009%	0.016%	-0.004%	-0.014%	13.458%
	-0.363%	-0.324%	-0.310%	-0.271%	-0.233%

Appendix 4C: East Africa Region

Period	Response of Kenya SBI to: Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR	Response of Kenya CSI to: Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR
1	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
2	-0.001%	0.172%	0.001%	-0.035%	0.000%	0.012%	0.003%	0.003%	-0.002%	0.020%
	-0.155%	-0.155%	-0.155%	-0.155%	-0.154%	-0.015%	-0.015%	-0.015%	-0.015%	-0.015%
3	-0.003%	-0.016%	0.013%	-0.017%	0.003%	-0.004%	-0.001%	0.000%	0.002%	-0.003%
	-0.014%	-0.012%	-0.011%	-0.016%	-0.014%	-0.003%	-0.003%	-0.002%	-0.003%	-0.003%
4	-0.002%	-0.013%	0.009%	-0.007%	0.010%	-0.002%	0.001%	0.000%	0.002%	-0.001%
	-0.012%	-0.011%	-0.009%	-0.014%	-0.013%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
5	-0.002%	-0.010%	0.009%	-0.008%	0.013%	-0.002%	0.000%	0.000%	0.002%	-0.001%
	-0.010%	-0.008%	-0.007%	-0.011%	-0.009%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
6	-0.002%	-0.010%	0.010%	-0.009%	0.013%	-0.002%	0.000%	0.000%	0.002%	-0.001%
	-0.010%	-0.008%	-0.007%	-0.011%	-0.009%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
7	-0.002%	-0.010%	0.010%	-0.010%	0.012%	-0.002%	0.000%	0.000%	0.002%	-0.001%
	-0.010%	-0.008%	-0.007%	-0.011%	-0.009%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
8	-0.002%	-0.010%	0.010%	-0.009%	0.012%	-0.002%	0.000%	0.000%	0.002%	-0.001%
	-0.010%	-0.008%	-0.007%	-0.011%	-0.009%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
9	-0.002%	-0.010%	0.009%	-0.009%	0.012%	-0.002%	0.000%	0.000%	0.002%	-0.001%
	-0.010%	-0.008%	-0.007%	-0.011%	-0.009%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
10	-0.002%	-0.010%	0.009%	-0.009%	0.012%	-0.002%	0.000%	0.000%	0.002%	-0.001%
	-0.010%	-0.008%	-0.007%	-0.011%	-0.009%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%

Period	Response of Malawi SBI to Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR	Response of Kenya SCR to: Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR
1	0.000%	0.000%	0.000%	0.000%	0.000%	13.547%	0.000%	0.000%	0.000%	0.000%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.129%	0.000%	0.000%	0.000%	0.000%
2	-0.005%	-0.008%	0.000%	-0.001%	-0.003%	13.493%	-0.012%	0.000%	-0.008%	-0.004%
	-0.015%	-0.015%	-0.015%	-0.015%	-0.015%	-0.224%	-0.184%	-0.184%	-0.184%	-0.184%
3	0.002%	0.003%	-0.001%	0.000%	0.002%	13.435%	-0.013%	0.000%	0.041%	-0.008%
	-0.004%	-0.004%	-0.004%	-0.004%	-0.004%	-0.224%	-0.183%	-0.183%	-0.184%	-0.183%
4	0.001%	-0.001%	0.000%	-0.001%	0.000%	13.379%	-0.016%	0.004%	0.079%	-0.008%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.224%	-0.183%	-0.183%	-0.185%	-0.184%
5	0.001%	0.000%	-0.001%	0.000%	0.000%	13.324%	-0.013%	0.003%	0.132%	-0.009%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.225%	-0.184%	-0.183%	-0.187%	-0.185%
6	0.001%	0.000%	-0.001%	-0.001%	0.000%	13.270%	-0.011%	0.002%	0.184%	-0.009%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.226%	-0.185%	-0.184%	-0.190%	-0.186%
7	0.001%	0.000%	-0.001%	-0.001%	0.000%	13.216%	-0.009%	0.001%	0.234%	-0.009%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.229%	-0.186%	-0.185%	-0.194%	-0.189%
8	0.001%	0.000%	-0.001%	-0.001%	0.000%	13.163%	-0.007%	0.001%	0.284%	-0.009%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.232%	-0.188%	-0.187%	-0.198%	-0.192%
9	0.001%	0.000%	-0.001%	-0.001%	0.000%	13.109%	-0.005%	0.000%	0.334%	-0.009%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.235%	-0.191%	-0.188%	-0.204%	-0.195%
10	0.001%	0.000%	-0.001%	-0.001%	0.000%	13.056%	-0.002%	0.000%	0.384%	-0.009%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.239%	-0.193%	-0.191%	-0.210%	-0.199%

Period	Response of Malawi CSI to: Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR	Response of Malawi SCR to: Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR
1	0.001%	0.000%	0.000%	0.000%	0.000%	-0.013%	10.084%	0.000%	0.000%	0.000%
	-0.010%	0.000%	0.000%	0.000%	0.000%	-0.136%	-0.096%	0.000%	0.000%	0.000%
2	0.002%	0.010%	-0.009%	0.028%	-0.003%	-0.024%	10.078%	0.001%	-0.002%	-0.007%
	-0.010%	-0.010%	-0.010%	-0.010%	-0.010%	-0.193%	-0.167%	-0.137%	-0.137%	-0.137%
3	0.001%	-0.001%	0.001%	-0.004%	0.000%	-0.035%	10.071%	0.007%	0.012%	-0.012%
	-0.002%	-0.002%	-0.002%	-0.002%	-0.002%	-0.193%	-0.167%	-0.137%	-0.137%	-0.137%
4	0.001%	-0.001%	0.001%	-0.005%	-0.001%	-0.046%	10.067%	0.012%	0.027%	-0.017%
	-0.001%	-0.001%	-0.001%	-0.002%	-0.001%	-0.194%	-0.168%	-0.137%	-0.138%	-0.138%
5	0.001%	0.001%	0.000%	0.000%	0.000%	-0.056%	10.060%	0.018%	0.042%	-0.021%
	-0.001%	-0.001%	0.000%	-0.001%	-0.001%	-0.195%	-0.168%	-0.138%	-0.140%	-0.139%
6	0.001%	0.001%	0.000%	-0.001%	0.000%	-0.067%	10.055%	0.023%	0.058%	-0.025%
	-0.001%	0.000%	0.000%	-0.001%	-0.001%	-0.196%	-0.169%	-0.139%	-0.143%	-0.141%
7	0.001%	0.000%	0.000%	-0.001%	0.000%	-0.077%	10.049%	0.028%	0.073%	-0.029%
	-0.001%	0.000%	0.000%	-0.001%	-0.001%	-0.198%	-0.171%	-0.140%	-0.146%	-0.143%
8	0.001%	0.000%	0.000%	-0.001%	0.000%	-0.087%	10.043%	0.034%	0.088%	-0.034%
	-0.001%	0.000%	0.000%	-0.001%	0.000%	-0.200%	-0.172%	-0.142%	-0.150%	-0.145%
9	0.001%	0.000%	0.000%	-0.001%	0.000%	-0.097%	10.036%	0.039%	0.102%	-0.038%
	-0.001%	0.000%	0.000%	-0.001%	0.000%	-0.203%	-0.174%	-0.143%	-0.155%	-0.149%
10	0.001%	0.000%	0.000%	-0.001%	0.000%	-0.107%	10.030%	0.045%	0.117%	-0.042%
	-0.001%	0.000%	0.000%	-0.001%	0.000%	-0.206%	-0.176%	-0.145%	-0.160%	-0.152%

Period	Response of Mauritius SBI to: Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR	Response of Mauritius CSI Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR
1	0.000%	-0.003%	0.000%	0.000%	0.000%	-0.010%	-0.006%	0.000%	0.000%	0.000%
	-0.004%	-0.004%	0.000%	0.000%	0.000%	-0.010%	-0.010%	0.000%	0.000%	0.000%
2	0.000%	0.005%	-0.001%	0.002%	0.003%	-0.006%	0.000%	-0.002%	0.005%	0.000%
	-0.004%	-0.004%	-0.004%	-0.004%	-0.004%	-0.010%	-0.010%	-0.010%	-0.010%	-0.010%
3	0.000%	-0.001%	0.000%	0.000%	-0.001%	-0.003%	0.001%	0.000%	0.002%	0.000%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
4	0.000%	0.000%	0.000%	0.000%	0.000%	-0.003%	0.001%	0.000%	0.002%	0.000%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
5	0.000%	0.000%	0.000%	0.000%	0.000%	-0.003%	0.001%	0.000%	0.002%	-0.001%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
6	0.000%	0.000%	0.000%	0.000%	0.000%	-0.003%	0.001%	0.000%	0.002%	-0.001%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
7	0.000%	0.000%	0.000%	0.000%	0.000%	-0.003%	0.001%	0.000%	0.002%	-0.001%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
8	0.000%	0.000%	0.000%	0.000%	0.000%	-0.003%	0.001%	0.000%	0.002%	-0.001%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
9	0.000%	0.000%	0.000%	0.000%	0.000%	-0.003%	0.001%	0.000%	0.002%	-0.001%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
10	0.000%	0.000%	0.000%	0.000%	0.000%	-0.003%	0.001%	0.000%	0.002%	-0.001%
	0.000%	0.000%	0.000%	0.000%	0.000%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%

Period	Response of Mauritius SCR to: Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR	Response of Rwanda SBI to: Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR
1	0.002%	0.132%	20.345%	0.000%	0.000%	-0.061%	-0.066%	-0.041%	0.000%	0.000%
	-0.275%	-0.275%	-0.194%	0.000%	0.000%	-0.547%	-0.547%	-0.546%	0.000%	0.000%
2	-0.012%	0.132%	20.313%	-0.030%	0.001%	-0.049%	-0.047%	-0.018%	0.021%	1.283%
	-0.389%	-0.389%	-0.337%	-0.276%	-0.276%	-0.551%	-0.552%	-0.552%	-0.548%	-0.548%
3	-0.015%	0.128%	20.279%	-0.028%	-0.010%	-0.021%	-0.014%	0.015%	0.050%	-0.162%
	-0.389%	-0.389%	-0.337%	-0.277%	-0.276%	-0.076%	-0.073%	-0.071%	-0.080%	-0.076%
4	-0.014%	0.128%	20.244%	-0.029%	-0.012%	-0.012%	-0.009%	0.011%	0.031%	-0.024%
	-0.390%	-0.389%	-0.337%	-0.279%	-0.277%	-0.041%	-0.037%	-0.032%	-0.049%	-0.043%
5	-0.012%	0.127%	20.209%	-0.028%	-0.012%	-0.029%	-0.005%	0.005%	0.055%	-0.022%
	-0.391%	-0.390%	-0.338%	-0.282%	-0.279%	-0.034%	-0.027%	-0.024%	-0.039%	-0.032%
6	-0.011%	0.127%	20.175%	-0.028%	-0.012%	-0.023%	-0.004%	0.006%	0.053%	-0.023%
	-0.394%	-0.391%	-0.339%	-0.287%	-0.283%	-0.034%	-0.026%	-0.023%	-0.038%	-0.031%
7	-0.009%	0.126%	20.140%	-0.027%	-0.012%	-0.024%	-0.005%	0.006%	0.051%	-0.024%
	-0.397%	-0.393%	-0.341%	-0.294%	-0.287%	-0.033%	-0.025%	-0.023%	-0.037%	-0.030%
8	-0.008%	0.125%	20.106%	-0.027%	-0.012%	-0.024%	-0.005%	0.006%	0.051%	-0.023%
	-0.401%	-0.395%	-0.343%	-0.301%	-0.292%	-0.033%	-0.025%	-0.023%	-0.037%	-0.030%
9	-0.007%	0.125%	20.071%	-0.026%	-0.012%	-0.024%	-0.005%	0.006%	0.051%	-0.023%
	-0.406%	-0.397%	-0.345%	-0.310%	-0.298%	-0.033%	-0.025%	-0.023%	-0.037%	-0.030%
10	-0.005%	0.124%	20.037%	-0.025%	-0.012%	-0.024%	-0.005%	0.006%	0.051%	-0.023%
	-0.412%	-0.401%	-0.348%	-0.320%	-0.304%	-0.033%	-0.025%	-0.023%	-0.037%	-0.030%

Period	Response of Rwanda CSI to: Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR	Response of Rwanda SCR: Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR
1	0.009%	-0.006%	0.019%	0.000%	0.000%	-0.022%	0.007%	0.016%	11.572%	0.000%
	-0.049%	-0.049%	-0.049%	0.000%	0.000%	-0.156%	-0.156%	-0.156%	-0.111%	0.000%
2	0.018%	0.010%	-0.008%	-0.005%	-0.022%	-0.020%	0.011%	0.016%	11.555%	0.000%
	-0.051%	-0.051%	-0.051%	-0.049%	-0.049%	-0.222%	-0.222%	-0.222%	-0.192%	-0.157%
3	-0.003%	-0.002%	0.001%	0.000%	0.007%	-0.020%	0.010%	0.017%	11.531%	0.031%
	-0.015%	-0.015%	-0.015%	-0.015%	-0.015%	-0.221%	-0.221%	-0.221%	-0.192%	-0.157%
4	0.004%	0.000%	0.002%	-0.003%	0.003%	-0.020%	0.007%	0.018%	11.506%	0.056%
	-0.004%	-0.004%	-0.003%	-0.004%	-0.004%	-0.222%	-0.221%	-0.221%	-0.193%	-0.158%
5	0.001%	0.000%	0.000%	0.000%	-0.002%	-0.020%	0.005%	0.019%	11.483%	0.083%
	-0.003%	-0.003%	-0.002%	-0.003%	-0.003%	-0.223%	-0.222%	-0.221%	-0.195%	-0.159%
6	0.002%	0.000%	0.000%	0.000%	0.000%	-0.020%	0.003%	0.020%	11.459%	0.109%
	-0.003%	-0.002%	-0.002%	-0.003%	-0.002%	-0.224%	-0.222%	-0.222%	-0.197%	-0.161%
7	0.002%	0.000%	0.000%	-0.001%	0.000%	-0.020%	0.000%	0.021%	11.435%	0.135%
	-0.002%	-0.002%	-0.002%	-0.003%	-0.002%	-0.226%	-0.223%	-0.222%	-0.200%	-0.163%
8	0.002%	0.000%	0.000%	-0.001%	0.000%	-0.020%	-0.002%	0.022%	11.411%	0.161%
	-0.002%	-0.002%	-0.002%	-0.003%	-0.002%	-0.228%	-0.224%	-0.223%	-0.203%	-0.166%
9	0.002%	0.000%	0.000%	-0.001%	0.000%	-0.020%	-0.004%	0.022%	11.387%	0.187%
	-0.002%	-0.002%	-0.002%	-0.003%	-0.002%	-0.231%	-0.226%	-0.224%	-0.207%	-0.169%
10	0.002%	0.000%	0.000%	-0.001%	0.000%	-0.020%	-0.006%	0.023%	11.363%	0.212%
	-0.002%	-0.002%	-0.002%	-0.003%	-0.002%	-0.234%	-0.228%	-0.226%	-0.212%	-0.173%

Period	Response of Uganda SBI to: Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR	Response of Uganda CSI to: Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR
1	0.002%	0.020%	0.010%	0.007%	0.000%	-0.001%	0.000%	-0.001%	-0.002%	0.000%
	-0.052%	-0.052%	-0.052%	-0.052%	0.000%	-0.012%	-0.012%	-0.012%	-0.012%	0.000%
2	0.005%	0.008%	0.013%	0.016%	0.006%	-0.002%	0.000%	0.001%	-0.001%	-0.005%
	-0.052%	-0.052%	-0.052%	-0.052%	-0.052%	-0.012%	-0.012%	-0.012%	-0.012%	-0.012%
3	0.004%	-0.002%	0.005%	-0.005%	0.000%	0.000%	-0.001%	0.000%	0.000%	0.002%
	-0.005%	-0.005%	-0.003%	-0.005%	-0.004%	-0.002%	-0.002%	-0.002%	-0.002%	-0.002%
4	0.005%	-0.001%	0.004%	-0.003%	0.001%	0.001%	0.000%	0.000%	0.000%	0.001%
	-0.005%	-0.004%	-0.004%	-0.006%	-0.005%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
5	0.007%	0.002%	0.003%	0.000%	0.001%	0.000%	-0.001%	0.000%	-0.001%	0.001%
	-0.004%	-0.003%	-0.003%	-0.004%	-0.003%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%
6	0.006%	0.001%	0.003%	0.000%	0.001%	0.000%	0.000%	0.000%	-0.001%	0.001%
	-0.004%	-0.003%	-0.002%	-0.004%	-0.003%	-0.001%	-0.001%	0.000%	-0.001%	-0.001%
7	0.006%	0.001%	0.004%	-0.001%	0.001%	0.000%	0.000%	0.000%	-0.001%	0.001%
	-0.004%	-0.003%	-0.002%	-0.004%	-0.003%	-0.001%	-0.001%	0.000%	-0.001%	-0.001%
8	0.006%	0.001%	0.003%	0.000%	0.001%	0.000%	0.000%	0.000%	-0.001%	0.001%
	-0.004%	-0.003%	-0.002%	-0.004%	-0.003%	-0.001%	-0.001%	0.000%	-0.001%	-0.001%
9	0.006%	0.001%	0.003%	0.000%	0.001%	0.000%	0.000%	0.000%	-0.001%	0.001%
	-0.004%	-0.003%	-0.002%	-0.004%	-0.003%	-0.001%	-0.001%	0.000%	-0.001%	-0.001%
10	0.006%	0.001%	0.003%	0.000%	0.001%	0.000%	0.000%	0.000%	-0.001%	0.001%
	-0.004%	-0.003%	-0.002%	-0.004%	-0.003%	-0.001%	-0.001%	0.000%	-0.001%	-0.001%

Period	Response of Uganda SCR: Kenya SCR	Malawi SCR	Mauritius SCR	Rwanda SCR	Uganda SCR
1	-0.002%	0.006%	0.002%	-0.001%	12.282%
	-0.166%	-0.166%	-0.166%	-0.166%	-0.117%
2	-0.006%	0.008%	-0.002%	0.003%	12.257%
	-0.235%	-0.235%	-0.235%	-0.235%	-0.204%
3	-0.007%	0.040%	-0.002%	-0.001%	12.233%
	-0.235%	-0.235%	-0.235%	-0.235%	-0.203%
4	-0.009%	0.063%	-0.002%	-0.007%	12.203%
	-0.235%	-0.235%	-0.234%	-0.236%	-0.204%
5	-0.008%	0.091%	-0.003%	-0.010%	12.180%
	-0.236%	-0.235%	-0.235%	-0.237%	-0.205%
6	-0.007%	0.119%	-0.003%	-0.014%	12.155%
	-0.237%	-0.236%	-0.235%	-0.239%	-0.206%
7	-0.007%	0.146%	-0.003%	-0.018%	12.131%
	-0.239%	-0.236%	-0.236%	-0.241%	-0.208%
8	-0.007%	0.173%	-0.004%	-0.021%	12.107%
	-0.242%	-0.238%	-0.237%	-0.244%	-0.210%
9	-0.007%	0.200%	-0.004%	-0.024%	12.082%
	-0.245%	-0.239%	-0.238%	-0.248%	-0.213%
10	-0.007%	0.227%	-0.004%	-0.028%	12.058%
	-0.248%	-0.241%	-0.239%	-0.252%	-0.217%

Appendix 4D: Southern Africa Region

Period	Response of Botswana SBI to: Botswana SCR	Namibia SCR	S-Africa SCR	Response of Botswana CSI to: Botswana SCR	Namibia SCR	S-Africa SCR	Response of Botswana SCR to: Botswana SCR	Namibia SCR	S-Africa SCR
1	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	24.386%	0.000%	0.000%
	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	-0.233%	0.000%	0.000%
2	0.009%	0.011%	0.073%	-0.014%	-0.001%	-0.001%	24.364%	0.006%	0.015%
	-0.111%	-0.111%	-0.111%	-0.009%	-0.009%	-0.009%	-0.404%	-0.330%	-0.330%
3	-0.007%	-0.002%	0.016%	0.002%	0.000%	0.000%	24.370%	0.001%	0.039%
	-0.008%	-0.007%	-0.008%	-0.001%	-0.001%	-0.001%	-0.404%	-0.330%	-0.330%
4	-0.006%	0.000%	0.008%	0.000%	0.000%	0.000%	24.383%	-0.002%	0.066%
	-0.008%	-0.008%	-0.009%	-0.001%	-0.001%	-0.001%	-0.406%	-0.332%	-0.333%
5	-0.004%	0.000%	0.012%	0.000%	0.000%	0.000%	24.372%	-0.003%	0.080%
	-0.005%	-0.005%	-0.007%	0.000%	0.000%	-0.001%	-0.408%	-0.334%	-0.337%
6	-0.004%	0.000%	0.012%	0.000%	0.000%	0.000%	24.358%	-0.004%	0.095%
	-0.005%	-0.005%	-0.007%	0.000%	0.000%	0.000%	-0.410%	-0.336%	-0.341%
7	-0.004%	0.000%	0.012%	0.000%	0.000%	0.000%	24.346%	-0.004%	0.110%
	-0.005%	-0.005%	-0.007%	0.000%	0.000%	0.000%	-0.413%	-0.340%	-0.347%
8	-0.004%	0.000%	0.012%	0.000%	0.000%	0.000%	24.333%	-0.005%	0.124%
	-0.005%	-0.005%	-0.007%	0.000%	0.000%	0.000%	-0.416%	-0.343%	-0.353%
9	-0.004%	0.000%	0.012%	0.000%	0.000%	0.000%	24.321%	-0.006%	0.138%
	-0.005%	-0.005%	-0.007%	0.000%	0.000%	0.000%	-0.420%	-0.348%	-0.361%
10	-0.004%	0.000%	0.012%	0.000%	0.000%	0.000%	24.309%	-0.007%	0.153%
	-0.005%	-0.005%	-0.007%	0.000%	0.000%	0.000%	-0.424%	-0.353%	-0.369%

Period	Response of Namibia SBI to: Botswana SCR	Namibia SCR	S-Africa SCR	Response of Namibia CSI to: Botswana SCR	Namibia SCR	S-Africa SCR	Response of Namibia SCR to: Botswana SCR	Namibia SCR	S-Africa SCR
1	0.003%	0.000%	0.000%	0.024%	0.000%	0.000%	0.010%	18.958%	0.000%
	-0.012%	0.000%	0.000%	-0.017%	0.000%	0.000%	-0.256%	-0.181%	0.000%
2	0.012%	-0.013%	0.014%	0.036%	0.011%	0.003%	0.013%	18.919%	-0.003%
	-0.012%	-0.012%	-0.012%	-0.017%	-0.017%	-0.017%	-0.362%	-0.314%	-0.257%
3	0.001%	0.001%	0.000%	0.001%	0.000%	0.000%	0.045%	18.883%	-0.003%
	-0.001%	-0.001%	-0.001%	-0.002%	-0.001%	-0.002%	-0.362%	-0.314%	-0.257%
4	0.000%	-0.001%	0.000%	-0.001%	-0.001%	0.000%	0.074%	18.852%	-0.006%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.362%	-0.314%	-0.258%
5	0.000%	0.000%	0.000%	0.001%	-0.001%	0.000%	0.108%	18.816%	-0.002%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.363%	-0.315%	-0.260%
6	0.000%	0.000%	0.000%	0.001%	-0.001%	0.000%	0.142%	18.781%	0.001%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.364%	-0.316%	-0.263%
7	0.000%	0.000%	0.000%	0.000%	-0.001%	0.000%	0.177%	18.746%	0.005%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.365%	-0.317%	-0.267%
8	0.000%	0.000%	0.000%	0.000%	-0.001%	0.000%	0.211%	18.711%	0.009%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.367%	-0.319%	-0.272%
9	0.000%	0.000%	0.000%	0.000%	-0.001%	0.000%	0.245%	18.676%	0.012%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.369%	-0.322%	-0.278%
10	0.000%	0.000%	0.000%	0.000%	-0.001%	0.000%	0.279%	18.641%	0.016%
	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.001%	-0.371%	-0.324%	-0.284%

Period	Response of S-Africa SBI to: Botswana SCR	Namibia SCR	S-Africa SCR	Response of S-Africa CSI to: Botswana SCR	Namibia SCR	S-Africa SCR	Response of S-Africa SCR to: Botswana SCR	Namibia SCR	S-Africa SCR
1	0.0100%	0.0113%	0.0000%	-0.0092%	0.0101%	0.0000%	-0.0053%	0.0017%	16.5831%
	-0.0820%	-0.0820%	0.0000%	-0.0140%	-0.0140%	0.0000%	-0.2240%	-0.2240%	-0.1590%
2	0.0117%	0.0090%	0.0101%	0.0043%	-0.0113%	0.0170%	-0.0062%	0.0033%	16.4964%
	-0.0830%	-0.0830%	-0.0830%	-0.0140%	-0.0140%	-0.0140%	-0.3160%	-0.3160%	-0.2740%
3	-0.0039%	0.0094%	-0.0022%	0.0017%	-0.0012%	-0.0012%	0.0059%	0.0072%	16.4220%
	-0.0062%	-0.0053%	-0.0062%	-0.0014%	-0.0012%	-0.0011%	-0.3150%	-0.3150%	-0.2730%
4	-0.0010%	0.0142%	-0.0057%	0.0014%	0.0001%	-0.0021%	0.0225%	0.0072%	16.3537%
	-0.0056%	-0.0048%	-0.0061%	-0.0012%	-0.0012%	-0.0013%	-0.3150%	-0.3140%	-0.2730%
5	-0.0004%	0.0126%	-0.0032%	0.0008%	-0.0007%	-0.0012%	0.0308%	0.0094%	16.2817%
	-0.0041%	-0.0039%	-0.0053%	-0.0007%	-0.0006%	-0.0008%	-0.3140%	-0.3140%	-0.2740%
6	-0.0011%	0.0122%	-0.0030%	0.0007%	-0.0008%	-0.0011%	0.0388%	0.0112%	16.2101%
	-0.0040%	-0.0039%	-0.0052%	-0.0007%	-0.0006%	-0.0008%	-0.3140%	-0.3140%	-0.2750%
7	-0.0009%	0.0123%	-0.0031%	0.0008%	-0.0008%	-0.0012%	0.0470%	0.0131%	16.1387%
	-0.0040%	-0.0039%	-0.0052%	-0.0006%	-0.0006%	-0.0008%	-0.3150%	-0.3140%	-0.2770%
8	-0.0009%	0.0123%	-0.0031%	0.0008%	-0.0007%	-0.0012%	0.0552%	0.0151%	16.0676%
	-0.0040%	-0.0039%	-0.0052%	-0.0006%	-0.0006%	-0.0008%	-0.3150%	-0.3150%	-0.2800%
9	-0.0009%	0.0122%	-0.0031%	0.0008%	-0.0008%	-0.0012%	0.0633%	0.0170%	15.9969%
	-0.0040%	-0.0039%	-0.0052%	-0.0006%	-0.0006%	-0.0008%	-0.3160%	-0.3160%	-0.2830%
10	-0.0008%	0.0122%	-0.0030%	0.0008%	-0.0008%	-0.0011%	0.0714%	0.0189%	15.9264%
	-0.0040%	-0.0039%	-0.0051%	-0.0006%	-0.0006%	-0.0008%	-0.3180%	-0.3170%	-0.2870%

CHAPTER 5

DO SOVEREIGN CREDIT RATINGS POSITIVELY AFFECT CAPITAL MARKET EFFICIENCY IN AFRICA?

5.1 Summary abstract

This chapter investigates the effect of long-term foreign currency sovereign credit rating announcements on long-term foreign currency denominated bonds and stocks in 19 African countries over the period of 1994 to 2014. The results of Ljung–Box Q autocorrelation, runs and variance ratio tests find that sovereign credit ratings do not significantly impact bond market efficiency. In contrast, stock markets show evidence of weak form efficiency implying that long-term sovereign credit ratings positively affect equities market efficiency in Africa.

5.2 Introduction

A SCR is one of the major external forces that influence financial markets by imposing discipline on governments and other market participants (Duygun *et al.*, 2016). Bolton *et al.* (2012) claim that the monitoring indicators assigned by CRAs reduce governments' monopoly in structuring policies, regulations and controls that stifle innovation and productivity. In addition, Ekins and Calabria (2012) report that CRAs contribute to market efficiency by providing accurate, clear and reliable assessments of the solvency of participants in the financial markets.

Other studies argue that the informational effects of rating agencies on financial markets is irrelevant in developed markets because they are efficient (Fama, 1965; Fama, 1970; Ojah and Karemera,1999; Norden and Weber, 2004; Hooper *et al*., 2008). Furthermore, Gande and Parsley (2014) add that the significant decline in the reputation of CRAs following the global financial crisis suggests that their role in influencing financial market efficiency is diminishing. On the other hand, Kiff *et al.* (2010) argue that credit ratings hinder financial market efficiency because security issuers may use ratings to increase

information asymmetry through ‘rating shopping’ from agencies that assign high ratings in order to reduce borrowing costs. However, the correct function of credit ratings is to enhance transparency and efficiency in financial markets by reducing the information asymmetry between borrowers and lenders (Gande and Parsley, 2014).

The theory of market efficiency was pioneered by Fama (1965), whose efficient market hypothesis (EMH) assert that it is impossible for investors to outperform financial markets because security prices reflect all available relevant information. Consistent with the EMH, Samuelson (1973) developed the random walk hypothesis (RWH) from Cootner (1966)’s idea of the random character of stock market prices, which argues that security prices fluctuate randomly and cannot be predicted. However, Grossman and Stiglitz (1980), Lo and MacKinlay (1988), Stein (1989) and Campbell *et al*. (1996) subsequently provide empirical evidence that financial markets are not efficient and that the random walk model is not consistent with the stochastic behaviour of security returns.

Malkiel (2003) argues that investors are subject to waves of optimism and pessimism created by credit ratings, which cause security prices to deviate systematically from their fundamental values. It can thus be argued that financial markets cannot be perfectly efficient as there would thus be no incentive for investors to hire financial analysts to actively optimise their security portfolios (Shleifer, 2000; Shleifer, 2004; Birru, 2012; Majumder, 2012; Hirshleifer *et al.*, 2013). Furthermore, the increasing sophistication of information databases (Zuo, 2016) and empirical techniques suggests that investors are confident that it is possible to fundamentally forecast future security prices (So, 2013). Therefore, abnormal returns arise from the departures of security prices from efficiency (Ikram and Nugroho, 2014). Thus, Ikram and Nugroho argue that if credit ratings enhance financial market efficiency then inefficient markets should become more efficient in the long-term following credit rating announcements.

The information function of CRAs constitutes due diligence, which enhances investor confidence and allow borrowers to have broader access to funds thereby impacts

information efficiency (Sewell, 2011). While studies on market efficiency have been widely conducted in both developed and emerging markets, investigation on the efficiency of African markets. However, most studies find that African stock markets are weak form efficient (Muragu, 1990; Mlambo and Biekpe, 2007; Ajao and Osayuwu, 2012), and are thus comparable with emerging stock markets in Asia and Latin America, depending on the type of information being incorporated.

Although the literature on African financial market efficiency has been growing, studies that test the effects of SCR announcements on financial markets efficiency are rare. Thus, this chapter contributes to the African financial market efficiency literature in three ways. First, by being amongst the first empirical analysis to explore how credit rating announcements enhance the efficiency of stock and bond prices. Second, by applying a combination of three weak form efficiency tests instead of the more common approach of utilising just one or two tests. Lastly, by measuring the efficiency of both the capital markets rather than just focusing on the efficiency of equities markets. Thus, it explores the following two sub-questions. First, does the levels of market efficiency change following sovereign credit announcements? Second, does the presence of sovereign credit ratings have an effect on market efficiency?

Following Mlambo and Biekpe (2007) and Ajao and Osayuwu (2012), this paper applies Ljung–Box Q, Runs and the variance ratio tests (Lo and MacKinlay, 1988; Ntim *et al.,* 2011) to examine if African bond and stock prices remain weak form inefficient after SCR announcements; and the Engle-Granger Cointegration (Engle and Granger, 1987) and Granger causality (Granger, 1988) tests to investigate SCRs effect on semi-strong market efficiency.

5.3 Literature Review

The empirical analyses on the efficiency of financial markets gained momentum in the 1960s with studies in support of the EMH and the RWH indicating that security prices always fully reflect available information. No investor or analyst could outperform the market by using the same information that is already available to all investors, except by

chance (Fama *et al.*, 1969). Critics however present the momentum effect observed in the security returns of some countries (such as seasonal effects, asset bubbles and credit bubbles) to argue against financial markets efficiency (Shiller, 2003).

Thus, this literature review proceeds as follows. First, the literature that analyses credit rating impacts on market efficiency using cross-regional data is explored, followed by studies on developed countries and emerging markets. The literature review then concludes with an analysis of studies exploring the sovereign rating information efficiency of African financial markets.

5.3.1 Cross-Regional Studies

Generally, cross-regional studies report mixed findings on the effect of credit ratings on efficiency at different times and market conditions. Notably, Norden and Weber (2004) analyse the efficiency of financial markets in responding to rating announcements made by the three international rating agencies during the period from 2000 to 2002. Applying the event study method to 60,827 credit default swap spreads of 90 firms from Europe, the United States and Asia, and on the Stoxx 50, S&P500 and Topix 100 indices, they find that financial markets anticipate all credit rating actions starting approximately two to three months before the announcement date. Thus, they conclude that financial markets are weak form efficient. However, they further observe that rating reviews are still associated with significant abnormal reactions, which implies evidence against the semi-strong form efficiency.

Additionally, Pukthuanthong-Le *et al*. (2007) measure the weak form sovereign rating information efficiency of the debt and equity markets in 34 emerging and developed countries over the period of 1990 to 2000. They find that market efficiency depends on the cost of relevant information and argue that if the marginal benefit of collecting and processing relevant information (such as credit ratings) exceeds its marginal cost to an investor, then the market will be information efficient because prices will incorporate all publicly available information. It can however be assumed that, in an efficient market, the adjustment of security prices to sovereign rating actions happens quickly to disallow

arbitrage opportunities. Thus, Hooper *et al*. (2008) investigate the speed of security prices adjustment to rating announcements among 42 countries listed on Datastream Global Market Indices, the S&P or the IFC over the nine-year period from 1995 to 2003. Their panel regression models reveal that the speed of security price adjustments to rating announcements is insignificant on the announcement day, which indicates that markets are thus absorbing new tradable information in weak efficient form.

Contrary to other cross-regional studies, Lee *et al.* (2010) argue that security returns are weak form inefficient. They employ panel data stationarity tests that incorporate multiple structural breaks to investigate whether the efficient market hypothesis holds in stock markets in 32 developed and 26 developing countries over the period from 1999 to 2007. They find that stock returns are stationary processes in both developed and developing countries. Since nonstationarity is a necessary condition for market efficiency, they conclude that security returns are inconsistent with the efficient market hypothesis, which implies that there are profitable arbitrage opportunities among stock markets.

Safari and Ariff (2015) examine the FTSE Bond indices for a sample of 94 rating announcements from nine developing countries between 1998 and 2013. They report that inefficiency and instability of capital markets are economic consequences of emotionally driven information whereby investors overreact when they are uncertain on how to incorporate announcement information into their expectations of future security performance. Therefore, Safari and Ariff argue that fund managers are paid to beat benchmarks above their peers to maintain funds inflows. Hence, the contracts between investors and their fund managers are a critical point of friction that encourages them to look for momentums, which are usually divorced from the real fundamentals, eventually creating bubbles and mispricings. Safari and Ariff then conclude that, in accordance with Lee *et al.* (2010), developing financial markets are weak form inefficient.

The majority of cross-country studies thus find that financial markets anticipate credit rating actions prior to their announcement dates, and conclude that financial markets

are weak form efficient. In contrast, some cross-country studies find that security returns are stationary processes in both developed and developing countries, which implies that security returns are weak form inefficient. These studies thus argue that if financial markets were efficient, there would be no rational reason why investors hire fund managers and pay them to exploit arbitrage opportunities. However, studies on developed markets imply that the investing public is confident in their financial system because the channels of information dissemination are assumed to be well-established and efficient. Thus, the information provision role of credit ratings is irrelevant because there would be neither information asymmetries nor arbitrage opportunities.

5.3.2 Developed Countries' Studies

Fama (1965) is acknowledged as among the key contributors to the theory of financial market efficiency. Applying serial correlation tests on the U.S. DJIA index returns over the time period 1957 to 1962, he finds evidence in support of the random walk in stock market prices. Fama thus challenges the proponents of both technical and fundamental analyses, empirically proving that the markets are efficient because security prices adjust very rapidly to new information. Fama (1970) further reports that markets are in equilibrium when current prices at any point in time fully reflect all available information. Therefore, institutions such as rating agencies that are created to provide expert information to financial markets are irrelevant.

In the North American region, Pinches and Singleton (1978) investigate the efficiency equilibrium market models using 207 companies listed on the CRSP U.S. total market index between 1950 and 1972. Later on, Goh and Ederington (1993) apply event studies to examine the reaction of the Wall Street Journal Index returns to Moody's bond rating changes during the period from 1984 to 1986. Similar to Fama (1970), both studies find that financial markets are efficient when in equilibrium and that financial market participants are rational, well-informed and have the ability to determine the quality of the borrowers in the market without the aid of credit rating information. Hence, ratings are irrelevant in security pricing because all fundamentals are quickly incorporated into capital market prices as markets are information efficient.

However, other studies on the North American markets suggest that markets routinely depart from efficiency and random walk. Katz (1974) is acknowledged as amongst the first to discover security markets inefficiency in the context of sovereign rating information by testing the semi-strong efficiency hypothesis. In support of Katz (1974), Danos *et al.* (1984) and Ederington *et al*. (1987) assert that bond rating agencies possess expert judgement and are specialists at processing information related to firm's financial condition at low cost than the benefit. Similarly, Lo and MacKinlay (1988) apply volatility-based specification test to examine the random walk hypothesis on NYSE-AMEX market return indices between 1962 and 1985. Their tests reject the random walk hypothesis, which imply that security price formation is inefficient. Thus, credit ratings play a pivotal role in disseminating information and reducing uncertainty.

Reisen and von Maltzan (1998) conduct an event study on a sample of U.S. stock markets measured by International Finance Corporation (IFC) Global indices to test the information efficiency during the period 1987 and 1996. Brooks *et al.* (2004) also apply the event study method on The MSCI World Index over the period from 1973 to 2001 to test the weak form efficiency. The results of both studies show that financial markets are weak form informationally inefficient. Both studies thus conclude that public announcements such as credit ratings act as an equalizer in the capital markets by reducing the ability of investors to outperform each other by making better judgements about creditworthiness. Brooks *et al.* (2004) however questions the inconsistent financial market reactions, which cannot be solely attributed to informational events, superior judgements and expert knowledge conveyed in information published in credit rating reports.

Thus, Kim *et al.* (2011) follow on Brooks *et al.* (2004) and examine the efficiency of the U.S. markets by using two autocorrelation test statistics (the variance ratio and portmanteau) to test the predictability of the DJIA index from 1900 to 2009. They find evidence that time varying returns are highly predictable with a moderate degree of uncertainty because stock market volatility is driven by changing market conditions and

economic fundamentals. This implies that a publicly available prudent credit rating system can aid in counteracting the effects of rumours and speculation, which increase efficiency and public confidence in a financial system.

With regards to Japanese and European markets, Naraya and Smyth (2007) provide evidence in support of the random walk hypothesis in G7 stock market indices from 1960 to 2003 using unit root test that allows two structural breaks in the returns series. Furthermore, they find insignificant evidence in support of mean reversion in security returns. However, unlike other countries that follow a random walk, they find mixed evidence in Japan, which shows that stock prices are stationary. They argue that the ratings can increase rather than reduce information asymmetry when market participants misinterpret and mischaracterize them by creating faulty assumptions and flawed decisions.

In contrast, some studies on European markets counter that financial markets are neither completely efficient nor inefficient. Dockery and Kavussanos (1996) investigate the weak form efficiency on the Athens stock market between 1988 and 1994 using regression models and Wald statistical tests. Contrary to studies that find evidence in support of the random walk hypothesis in G7 countries, Dockery and Kavussanos' results significantly reject the random walk hypothesis, which is a necessary condition for a financial market to be called efficient. Similarly, Steiner and Heinke (2001) analyse the Eurobond market over the period from 1985 to 1996 by means of univariate tests and cross-sectional regressions. They also find the Eurobond market to be significantly weak form inefficient, which concurs with Dockery and Kavussanos (1996). Both studies thus conclude that financial markets are informationally inefficient and security prices move systematically over time. Hence, credit rating reports convey information that is not entirely available to all market participants.

Thus in summary, there is little consensus on the effects that credit rating announcements have on the efficiency of financial markets in developed countries. While the majority of the studies show that developed markets are generally weak form

efficient, the effects of credit ratings on financial markets efficiency are significant. Thus, credit ratings play an important efficiency role by disseminating information and reducing uncertainty, which improves public confidence in a financial system. However, as explored below, empirical studies undertaken on developing countries argue that markets are generally inefficient and weak form efficient at best; possibly due to their relatively small, under developed and illiquid states, and thus credit rating information could have a significant impact.

5.3.3 Studies on Developing Countries

In contrast to the studies discussed above, the majority of the literature on developing countries finds that financial markets are largely inefficient and institutions such as rating agencies possess information that is not available in the public domain. Thus, investors rely primarily on credit rating announcements to determine asset values.

With regards to Asian markets, Griffin and Sanvicente (1982) are acknowledged as among the first to investigate financial market information efficiency in the context of sovereign rating announcements in Asian markets (excluding Japan). Applying an event study method to monthly data from 1970 to 1980, they find that financial markets are efficient and thus they argue that the role of credit ratings in shaping market efficiency is largely insignificant. They however note that the efficiency observed in both developed and developing markets could be a result of the increased regulatory oversight by the Securities and Exchange Commissions which aims to promote transparency and efficiency following the security market crashes.

In contrast, Subasi (2008) examines the behaviour of Asian market indices returns around the time of sovereign bond rating changes by Moody's and Fitch between 1995 and 2007. The analysis rejects the market efficiency and random walk hypotheses, which implies that CRAs are specialists at generating, obtaining and processing issuers' default risk information that was not previously in the financial markets. Thus, Subasi concludes that indices of thinly traded markets may not represent the true underlying index value, which creates a bias towards rejecting the efficiency and random walk

tests.

In the case of Arab countries, Islam and Khaled (2005) adopt heteroskedasticity-robust tests to examine the efficiency of the relatively small Asian stock markets (Dhaka and Muscat Stock Exchanges) between 1990 and 2001. Their findings concur with Subasi (2008) as they also significantly reject weak form market efficiency and the random walk hypothesis in the small Gulf markets. They thus conclude in accordance with Subasi (2008) that the infrequent trading on the Gulf markets could have significantly influenced their results. Nonetheless, Islam and Khaled argue that market participants constantly look for sovereign creditworthiness signals through the fiscal health and economic prospects of a country.

Similarly, Abraham *et al.* (2002) test the random walk behaviour and weak form efficiency of the three major Gulf stock markets (Bahrain, Kuwait and Saudi Arabia) using the variance ratio and runs tests over the period 1992 to 1998 while Abdmoulah (2010) examines 11 Arab stock markets for the period 2009 to 2011 using GARCH-M (1,1) model with state-space time-varying parameters. Both studies observe weak form inefficiency in all the stock markets and a high sensitivity to the past market shocks such as contemporaneous crises. This contrasts with more stable and mature markets in developed countries. Abdmoulah however cites the ineffectiveness of liberalisation and reforms undertaken to intensify efforts to expand, deepen, improve liquidity, transparency and reduce consentrated trading in these markets. Thus, Abdmoulah conclude that credit ratings enhance long-term investment culture that effectively develop market efficiency.

With regards to the efficiency of Latin American and Caribbean emerging markets, Urrutia (1995) uses variance ratio tests on four Latin American (Agentina, Brazil, Mexico and Chile) emerging markets from 1975 to 1991. Similarly, Ojah and Karemera (1999) also test the random walk by applying multiple variance ratio and autoregressive fractional integrated moving average tests on the same countries from 1987 to 1997. Both studies reject the random walk while generally accepting weak form efficiency.

They suggest that the rejection of random walk and acceptance of weak form efficiency is because Latin American index returns are expressed in local currencies and that domestic investors may not be able to detect patterns in stock returns to realise the abnormal returns trends. This implies that there is an inconsistent credit rating impact on market efficiency between domestic and international investors. Hence, domestic investors may not be able to design profitable trading strategies leveraged on credit rating information like their international counterparts using comparable index adjustments.

Conversely, Grieb and Reyes (1999) examine the random walk properties of the Brazilian and Mexican stock markets from 1988 to 1995 using variance ratio test. They find that market returns are mean reverting in Mexico whilst they are not in Brazil. They also report that only Brazil has a tendency towards exhibiting a random walk. More recently, Robinson and Bangwayo-Skeete (2015) use event studies on six emerging markets in the Commonwealth Caribbean over the period from 2001 to 2015 to test the semi-strong form market efficiency. In accordance with Ojah and Karemera (1999), they find that security markets in the region are generally weak form efficient. Robinson and Bangwayo-Skeete however observe semi-strong form inefficiency as the markets do not generally react to sovereign debt restructurings and credit ratings reviews because investors fundamentally anticipate these events. Grieb and Reyes (1999) attribute the mixed findings in studies on the Latin American region possibly to the cross-sectional variations in the degree of infrequent trading in these emerging financial markets. Ojah and Karemera (1999) further suggest that the markets could have become efficient possibly because of strengthened regulatory frameworks following the structural breaks caused by financial crises.

Finally, Majumder (2012) develops a rational model of asset pricing to examine the weak form efficiency of the BRIC and U.S. markets between 2001 to 2011. He finds that in less efficient markets, security prices are more emotionally driven and incorporate a high degree of market sentiments. Thus, fund managers and analysts constantly seek security price momentums, which are usually divorced from the real

fundamentals. He therefore argues that financial markets, in both developed and large emerging economies, cease to be efficient when driven by emotions because investor sentiment dominate decision-making.

Thus these studies show that, with only a few exceptions, most emerging financial markets are largely inefficient and that the informational role of credit rating institutions in shaping market efficiency is significant. However, the literature below, analysing market efficiency using cross-regional data, argues that the effect of credit ratings on market efficiency depends on the cost of accessing the credit rating information.

5.3.4 Studies on Africa

Magnusson and Wydick (2002) adopt autocorrelation functions and the Box-Pierce Q-statistics to test whether the eight largest[27] African stock markets meet the weak form stock market efficiency criterion over a 24-month period from 1998 to 2000. They find that African markets are generally weak form efficient, comparable to other emerging financial markets in Asia and Latin America. Magnusson and Wydick conclude that the weak form efficiency observed in African markets could thus largely be a result of the internationalization of financial markets, which improves transparency and efficiency so as to deter market manipulation. Hence, increasing the level of transparency in emerging financial markets reduces uncertainty about the issuers' credit risks.

Appiah-Kusi and Menyah (2003) address the variable measurement and econometric problems in most market efficiency studies that assume linearity in expected returns and also fail to account for thin trading by applying EGARCH-M to model index returns of 11 African stock markets from 1990 to 1994. In contrast to Magnusson and Wydick (2002), Appiah-Kusi and Menyah reject weak form efficiency in Botswana, Ghana, Ivory Coast, Nigeria and Swaziland South Africa; whilst Egypt, Kenya, Mauritius and Morocco and Zimbabwe are found to be weak form efficient. They argue that despite prior evidence to the contrary, age and market size are not important factors in determining efficiency.

[27] Based on market capitalisation, the countries are; Botswana, Cote d'Ivoire, Ghana, Kenya, Mauritius, Nigeria, South Africa and Zimbabwe.

Their findings show that the two largest and oldest markets in Africa (Nigeria and South Africa) are amongst the inefficient markets whereas some smaller and newer financial markets such as Mauritius show evidence of weak form efficiency. They thus conclude that weak form efficiency is not directly related to market age, number of firms, trade volume, market capitalisation, nor transaction costs as market participants do not exploit potentially profitable opportunities because the transaction costs that arise will outweigh any potential gains.

Jefferis and Smith (2005) test the evolving efficiency of all 29 Africa's stock markets for the period 1990 to 2001. Adopting the GARCH approach with time-varying parameters, they find that in contrast to Magnusson and Wydick (2002) and Appiah-Kusi and Menyah (2003), only the Johannesburg stock market (JSE) is weak form efficient, while Morocco, Egypt and Nigeria are below weak form efficient, and the other 25 African stock markets show no tendency towards weak form efficiency. Additionally, Simons and Laryea (2006) employ both parametric (autocorrelation, variance ratio autoregressive tests) and non-parametric tests (Kolmogrov-Smirnov goodness of fit and runs tests) to explore the efficiency of four African stock markets (Egypt, Ghana, Mauritius and South Africa) between 1990 and 2003. Their results find that only the South African stock market is weak form efficient, whereas Ghana, Mauritius and Egypt are inefficient. Contrary to Appiah-Kusi and Menyah (2003), both Jefferis and Smith (2005) and Simons and Laryea (2006) conclude that market imperfections, low disclosure requirements, thin and nonsynchronous trading and high cost of capital to investors cause the inefficiencies in African markets.

Mlambo and Biekpe (2007) further investigate the weak form efficiency of 10 African stock markets using the runs test for serial dependency from 1998 to 2005. Partially similar to Jefferis and Smith's (2005) findings, they report that not all securities on each exchange are efficient. Thus, a significant number of securities in each market show evidence of generally weak form market efficiency while the remainder rejects the random walk hypothesis. Ajao and Osayuwu (2012) apply the Box-Ljung statistic and runs tests on the 200 securities traded on the Nigerian Stock Exchange (NSE) from

2001 to 2010 to test the weak form efficiency. Similar to Mlambo and Biekpe (2007), Ajao and Osayuwu also find a significant number of securities showing evidence of weak form market efficiency. Both studies thus conclude that not all securities are weak form efficient even when the financial markets overally show weak form efficiency tendencies.

The literature on the informational efficiency of African financial markets is still relatively thin and the conclusions are highly fragmented. A number of studies present evidence that the more established financial markets with large number of securities and high capitalization levels are usually weak form efficient because information about them is widely available on the market. In contrast, other studies argue that age and market size are irrelevant in determining market efficiency, as large and old markets remain weak form inefficient whilst some smaller and newer markets show evidence of weak form efficiency. However other literature posits that no financial market has all its securities completely weak form efficient or inefficient and instead most markets have a combination of both efficient and inefficient securities.

5.3.5 Conclusion

Thus in summary, the majority of studies that analyse the efficiency of financial markets in Africa find that the responses to rating announcements made by the three international rating agencies tends to adhere to weak form efficiency as they anticipate credit rating actions prior to their announcement dates. There is however disagreements on why there are significant abnormal reactions associated with the announcements of credit rating changes. Hence, other studies on emerging markets argue that markets are inefficient and unstable following credit rating announcement because investors overreact to the uncertainty of how to incorporate the announcements information into their expectations of future security performance. The general consensus is therefore that security price formation is inefficient and credit ratings play a pivotal role in disseminating information and reducing uncertainty. Thus, the role of credit ratings in shaping market efficiency is still an area of ongoing debate and studies dedicated to the effects of SCRs on African financial market efficiency are still rare and inconclusive.

5.4 Data and Methodology

Africa's financial markets are relatively under-developed and thus suffer from illiquidity, thin trading and information asymmetry (Kenny and Moss, 1998; Patel, 2014; Ravi and Hong, 2014). Hence, securities traded in African financial markets are classified as high yield to compensate investors for perceived high risk (Smith and Dyakova, 2014). Since 1994 a total of 30 African countries have received SCRs from the three international CRAs; the information which, in accordance with Ikram and Nugroho (2014), could positively affect the efficiency of financial markets. This section provides a summary of the data and methodology used in exploring how credit ratings affect financial market efficiency in Africa.

5.4.1 Data

The analysis of the credit rating effect on market efficiency makes use of the foreign currency long-term sovereign ratings announcements of 19 African countries[28] that have both operational stock and debt markets, and have received a SCR by any or all of the three largest CRAs (Standard and Poor's, Moody's and Fitch) over the period of 1994 to 2014[29]. As suggested by Flores (2010), only long-term foreign currency-denominated ratings are used because they are more liquid and have extensive rating information. In accordance with Ismailescu and Kazemi (2010), to create a series, the long-term sovereign rating symbols used by the three international rating agencies are linearly transformed from ordinal rating scales into numbers corresponding to each rating grade. The positive (negative) changes in rating outlook and positive (negative) additions to watchlists are accounted for by adding 0.5 (-0.5) and 0.25 (-0.25) to one credit rating notch respectively.

In addition, the daily foreign currency-denominated S&P 10-year sovereign bond index, which track the performance of both local and sovereign bonds, and the daily United

[28] There are a total of 30 African countries with a SCRs from the big three international CRAs, but only 19 of them have considerably active debt and stock markets.

[29] These include Burkina Faso, Benin, Botswana, Ivory Coast, Cameroon, Egypt, Ghana, Gambia, Kenya, Morocco, Mali, Malawi, Mauritius, Namibia, Nigeria, Rwanda, Senegal, South Africa, Tunisia, Uganda, and Zambia.

States dollar-denominated Africa-oriented S&P value-weighted stock indices for each of the 19 countries are used to measure bond and stock market performance respectively. The daily bond and stock market data was obtained from Bloomberg and Reuters, while the SCR and outlook change information was obtained from the three rating agencies' websites. It is envisaged that the lengthy sampling period increases the power of random walk test and reduce the problem of non-trading bias which might arise from thin or infrequent trading in some African financial markets. The daily bond and stock index return series are converted into logarithmic returns to make them analytically more tractable and to improve the normally of their distributions. As suggested by Freud and Pagan (2000), logarithmic transformation removes most of linear dependence between successive daily returns, which is more appropriate for the application of market efficiency tests.

5.4.2 Methodology

This chapter performs several tests to examine the efficiency of African financial markets in the context of SCR information. First, following Mlambo and Biekpe (2007) and Ajao and Osayuwu (2012), the Ljung–Box Q autocorrelation function (ACF) test (Box *et al.*, 1994) is used to test if the successive security returns are independent. It is hypothesized that if African financial markets are weak form efficient in incorporating new information published by CRAs, then the autocorrelation coefficients should be significantly different from zero. Thus, the following two regression models are estimated:

$$x_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} y_{t-i} + \sum_{j=1}^{m} \beta_{2j} x_{t-j} + \sum_{k=1}^{l} \beta_{3k} z_{t-k} + \varepsilon_{1t} \quad (5.1)$$

$$y_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} y_{t-i} + \sum_{j=1}^{m} \alpha_{2j} x_{t-j} + \sum_{k=1}^{l} \alpha_{3k} z_{t-k} + \varepsilon_{2t} \quad (5.2)$$

Where $n, m \; and \; l$ are the number of lags that adequately model the equations, ε_t are white noise error terms, z represents sovereign credit ratings, x represents stock

returns, y represents bond returns, and $\beta_i \, and \, \alpha_i$ are constant coefficents. The correlation between time t and $t-k$ security returns are examined using the test statistic of autocorrelation specified as follows:

$$\rho_k = \frac{\sum_{t=1}^{T-k}(x_t - \bar{x})\,(x_{t-k} - \bar{x})}{\sum_{t=1}^{T}(x_t - \bar{x})^2} \tag{5.3}$$

Where ρ_k is serial correlation coefficient of lag k, T is the sample size, k is the lag length, x is the security return at time t, and $\bar{x}$ is the sample mean of the security returns. The Ljung-Box Q-statistic is then used to test the joint null hypothesis that all autocorrelations are equal to zero as follows:

$$Q_{LB} = n(n+2)\sum_{t=1}^{m}\frac{\hat{\rho}^2(t)}{n-t} \sim \chi^2 \tag{5.4}$$

Where Q_{LB} is asymptotically distributed as a chi−square, ρ_k is the serial correlation of lag k, n is the number of observations, and m is the degrees of freedom and the maximum lag considered (as suggested by Tsay (2005), that $m \approx Ln(T)$ to improve performance power of the test).

Second, the runs test (Wald and Wolfowitz, 1940) is used to examine if successive security returns are independent and randomly distributed. It is hypothesized that if the stock and bond returns are random then the observed number of runs in the series should be close to the expected number of runs. The runs test implies that the elements of a sequence are mutually independent over time if the number of runs is not significantly higher or lower than expected. Thus, the security returns are categorized into three types of runs: an upward run, where prices go up; a flat run, where returns do not change; and a downward run, where prices go down. The expected number of runs m is estimated as follows:

$$m = \frac{T(T+1) - \sum_{i=1}^{3} n_i^2}{T} \tag{5.5}$$

Where T is the sample size, i is the signs of plus, minus, or no change, n_i is the total number of changes in each category of signs. The standard deviation (σ_m) of runs is defined by:

$$\sigma_m = \sqrt{\frac{\sum_{i=1}^{3} n_i^2 \left(\sum_{i=1}^{3} n_i^2 + T(T+1)\right) - 2T\left(\sum_{i=1}^{3} n_i^3 - T^3\right.}{T^2(T-1)}} \tag{5.6}$$

The standard normal Z-statistic is then used to conduct a run test, which is given by:

$$Z = \frac{(R \pm 0.5) - m}{\sigma_m} \tag{5.7}$$

Where R is the number of observed runs, m is the expected number of runs, and 0.5 denotes the correction factor for continuity adjustment. The positive serial correlation indicates a positive dependence of stock price, which accordingly violates the random walk theory.

Third, after examining the randomness and independence of successive security returns, it is necessary to ascertain weak form market efficiency by examining the random walk hypothesis using the variance ratio test (Lo and MacKinlay, 1988; Ntim *et al.,* 2011). As suggested by Lo and MacKinlay (1988) the variance ratio test analyses two independent variance coefficients in each sovereign security returns. If the multiple variance ratios are significantly close to zero, then African markets can be deemed to be efficient. If the return series follow a random walk, the variance of its q-differences would be q times the variance of its first differences. With a sample size of $nq + 1$ and observations ($p_0, p_1, p_2, \ldots, p_{nq}$), the variance ratio of q-difference $VR(q)$ is defined as:

$$VR(q) = \frac{Var(p_t - p_{t-p})}{Var(p_t - p_{t-1})} = \frac{\sigma^2(q)}{\sigma^2(1)} \quad (5.8)$$

With

$$\sigma^2(q) = \frac{1}{m}\sum_{t=q}^{nq}\left(P_t - P_{t-q} - q\hat{\mu}\right)^2 \quad (5.9)$$

$$\sigma^2(1) = \frac{1}{nq-1}\sum_{t=1}^{nq}\left(P_t - P_{t-q} - \hat{\mu}\right)^2 \quad (5.10)$$

$$m = q(nq - q + 1)\left(1 - \frac{q}{nq}\right);\ \ \mu = \frac{1}{nq}\left(P_{nq} - P_0\right)$$

Where $\sigma^2(q)$ is the scaled variance of the q −difference, $\sigma^2(1)$ is the variance of the first difference, and P_t is the closing price.

Fourth, having found evidence of weak form efficiency, which is a necessary condition for semi-strong informational efficiency, the analysis next uses the Engle-Granger cointegration test (Engle and Granger, 1987) to establish if there is evidence of the semi-strong form efficiency on African financial markets. If there is no cointegration between the credit rating and security returns series, it implies that there are comovements between them, which indicate that the series can be used to predict each other thus violating the semi-strong form efficiency hypothesis. Since the population parameters are unknown and returns are not normally distributed, to test the significance of the cointegration hypothesis, t-statistics are calculated (as in studies by Ikram and Nugroho, 2014; Cooke and Bailey, 2015). The time-series t-test of Serra (2002) is applied as follows:

$$t_{\hat{\beta}} = \frac{\hat{\beta}_t - \beta_0}{SE(\hat{\beta}_t)} \quad (5.11)$$

Where t_β is the student t-test at $\propto$ significance level, and β_0 is an estimate constant which match the actual unknown parameter value β_t, and $SE(\hat{\beta}_t)$ is the standard error of

the estimator $\hat{\beta}_t$ for β_t.

Lastly, to further analyse the semi-strong form of market efficiency, as applied in Mabakeng and Sheefeni (2014), a Granger causality test (Granger, 1988) is conducted to verify the results of the cointegration test. The Granger causality examines whether lagged values of the SCRs help to predict stock and bond return series by testing the following hypothesis for identification of a causal effects:

$$P(Y_{t+1} \in A|\Omega_t) \neq P\left(Y_{t+1} \in A\middle|\Omega_{-x(t)}\right) \tag{5.12}$$

Where P is the probability, A is the set of security returns, Ω_t is the sovereign rating information available at time *t* in the market, and $\Omega_{-x(t)}$ is the modified market where the SCR information Ω_t is excluded. The Granger causality test estimates the three regression equations:

$$x_t = \beta_{10} + \sum_{i=1}^{n} \beta_{1i} y_{t-i} + \sum_{j=1}^{n} \beta_{1n+j} x_{t-i} + \sum_{k=1}^{n} \beta_{1n+k} z_{t-i} + \varepsilon_{1i} \tag{5.13}$$

$$y_t = \beta_{20} + \sum_{i=1}^{n} \beta_{2i} y_{t-i} + \sum_{j=1}^{n} \beta_{2n+j} x_{t-i} + \sum_{k=1}^{n} \beta_{2n+k} z_{t-i} + \varepsilon_{2i} \tag{5.14}$$

$$z_t = \beta_{30} + \sum_{i=1}^{n} \beta_{3i} y_{t-i} + \sum_{j=1}^{n} \beta_{3n+j} x_{t-i} + \sum_{k=1}^{n} \beta_{3n+k} z_{t-i} + \varepsilon_{3i} \tag{5.15}$$

Where n is the number of lags that adequately model the dynamic structure, ε_i are white noise error terms, x represents SCR, y represents stock returns, z represents bond returns, and β_i are constant coefficents. The significance of the Granger causality from one series to another is determined by the p-values and test statistics.

5.5 Empirical Results

To estimate the regression equations for the efficiency tests, a sufficient number of lags are determined by the lag length selection criteria. The results of the lag selection

criteria presented in Table 5.1 show that either 2 or 7 lags adequately model the regression equations. Ng and Perron (2001) mathematically prove that the lag selection of AIC is more preferable for parsimony and predictive model strength. Thus, model over-identification is better than under-identification (Howard, 2013). Hence, all the analyses in this chapter apply 7 lags as suggested by three criteria (the LR, FRE and the AIC) as compared to 2 lags selected by two criteria (SC and HQ).

Table 5.1: Lag Length Selection Criteria Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	4795	6899	7.150	-1.031	-1.031	-1.031
1	3927	6895	4.290	-8.451	-8.450	-8.450
2	3929	363.4	4.270	-8.455	**-8.452***	**-8.454***
3	3929	7.306	4.270	-8.454	-8.451	-8.453
4	3929	15.30	4.270	-8.454	-8.450	-8.453
5	3929	3.566	4.270	-8.454	-8.449	-8.453
6	3929	30.16	4.270	-8.454	-8.449	-8.453
7	2994	**36.97***	**4.270***	**-8.455***	-8.448	-8.453
8	3002	15.12	4.270	-8.455	-8.447	-8.452
9	3930	2.372	4.270	-8.454	-8.446	-8.452
10	3930	2.139	4.270	-8.454	-8.445	-8.451

* represents sufficient number of lags

Having selected the appropriate number of lags, Table 5.2 below presents results of the Ljung–Box Q autocorrelation test. As can be seen from the results, the null hypothesis of no autocorrelation cannot be rejected for the bond returns model, which shows that bond returns are independent of each other. These results contrast with other emerging markets studies such as Katz (1974), Khurana and Raman (2003), and May (2010), which suggest that bond prices are not weak form efficient. Thus, successive bond prices are not predictable and the historical bond returns cannot be used to predict future returns. Hence, the effect of SCRs on bond market efficiency is significant. This result could be because most of Africa's bond markets are still relatively small and undeveloped (Mu *et al.*, 2013).

The results of the stock returns model shows in contrast that the null hypothesis of no autocorrelation cannot be rejected for the first 10 periods after a SCR change but can

be rejected thereafter. This result suggests that stock returns become significantly weak form inefficient 10 days after a SCR announcement. The result accords with Nam *et al.* (2006) who argue that the positive and negative autocorrelation at higher order lags in both stocks and bonds suggests that the security returns are predictable at long horizons because their returns are mean reverting in the long-term, which is the general evidence against weak form market efficiency. These results are consistent with the previous findings on African markets by Magnusson and Wydick (2002), Mlambo and Biekpe (2007) and Ajao and Osayuwu (2012) who conclude that not all securities in the financial markets are weak form efficient even when the financial markets overally show weak form tendencies.

Table 5.2: Ljung–Box Q Autocorrelation Test Results

Lags	Bond returns				Stock returns			
	AC	PAC	Q-Stat	Prob*	AC	PAC	Q-Stat	Prob*
1	0.000	0.000	0.000	0.996	0.000	0.000	0.000	0.984
2	0.000	0.000	0.000	0.996	0.000	0.000	0.001	0.999
3	0.000	0.000	0.000	0.996	0.000	0.000	0.002	0.999
4	0.000	0.000	0.000	0.996	0.000	0.000	0.017	0.999
5	0.000	0.000	0.000	0.996	0.000	0.000	0.020	0.999
6	0.000	0.000	0.000	0.996	0.000	0.000	0.031	0.999
7	0.000	0.000	0.017	0.996	-0.001	-0.001	0.069	0.999
8	-0.005	-0.005	2.257	0.972	-0.006	-0.006	3.593	0.892
9	0.002	0.002	2.704	0.975	0.006	0.006	6.450	0.694
10	-0.002	-0.002	3.071	0.980	-0.001	-0.001	6.504	0.771
11	-0.001	-0.001	3.144	0.989	0.022	0.022	51.110	0.000***
12	0.001	0.001	3.224	0.994	0.022	0.022	94.898	0.000***
13	-0.001	-0.001	3.398	0.996	-0.003	-0.003	95.860	0.000***
14	0.002	0.002	3.936	0.996	0.013	0.013	111.090	0.000***
15	0.002	0.002	4.159	0.997	0.142	0.142	1987.800	0.000***
16	0.002	0.002	4.456	0.998	-0.083	-0.084	2628.800	0.000***
17	0.000	0.000	4.463	0.999	0.001	0.002	2628.900	0.000***
18	0.001	0.001	4.574	0.999	-0.011	-0.011	2640.900	0.000***
19	0.000	0.000	4.577	0.999	0.016	0.017	2664.400	0.000***
20	-0.003	-0.003	5.362	0.999	0.002	0.001	2664.800	0.000***

*** represents significance at 1 percent level

The results of the runs tests are presented in Table 5.3 below and show that the null hypothesis that the order of the bond and stock returns is random can be rejected at the 1 percent significance level. Hence, there is evidence that the order of the data is not

random as both the stock and bond returns series reject the null hypothesis of randomness of security returns. Contrary to the random walk theory, past price movements and trends may thus be used to predict current or future security price changes. As hypothesized above, if SCRs have a positive impact on financial market efficiency, Africa's bond and stock returns should be random following the announcements. It can therefore be argued that SCRs do not impact efficiency since African financial markets remain inefficient in the weak form. These results thus accord with previous studies on emerging markets by Abraham *et al.* (2002), Abdmoulah (2010) and Hong *et al.* (2012) who also reject weak form efficiency.

Whilst studies such as Knoke (1975), Knoke (1977), Ali (1989) argue that models with non-autocorrelated residuals are synonymous with random series and vice-versa, the findings from the Ljung–Box Q autocorrelation in Table 5.2 and runs test in Table 5.3 suggest otherwise. The results of the Ljung–Box Q autocorrelations suggest that bond returns are weak form efficient and stock returns are significantly weak form efficient up to 10 days after a SCR announcement, whereas the runs test shows that there is no significant influence from SCR announcement on weak form efficiency as both bond and stock market returns remain non-random. The contradictory results of the autocorrelation and runs tests find support for Lo and MacKinlay (1988) who argue that a model with uncorrelated residuals does not necessarily indicate that the data is generated from a random process. However, in time series regression models the runs test is more robust and is thus recommended for testing if a data set is from a random process (Ley and Paindaveine, 2013).

Table 5.3: Runs Test

Runs	Stock returns	Bond returns
R1	33380	40166
R2	0.000***	0.000***

*** represents significance at 1 percent level

The results show conflicting insights into the independence and randomness where the Ljung–Box Q autocorretion test suggests that the bond returns are weak form efficient

and stock prices are weak efficient at lower lags whereas the runs test finds inefficient returns over both short and long-term. Thus, the next test for weak form efficiency is the variance ratio. Table 5.4 below present results of the joint and individual variance ratio test with heteroskedasticity robust standard error estimates, which is regarded by Kim and Kim (2010) as a stronger random walk test. As can be seen, the p-values for both SCRs and bond returns are less than 0.05 and thus the null hypothesis that the bond and SCR series are a martingale can be rejected, which implies that bond returns and SCRs have no equal variances at the 1 percent significance level. However, there is insufficient evidence to reject the null hypothesis that the stock returns are a martingale and thus, the stock returns have equal variances at the 1 percent significance level. The findings imply that bond prices are neither random nor independent, and hence weak form efficiency can be rejected, whereas stock prices show weak form efficiency. Thus, it is possible to predict bond prices whereas trading strategies that use past announcements such as credit rating changes are unlikely to be profitable on African stock markets.

These empirical findings accord with Ojah and Karemera (1999), Grieb and Reyes (1999) and Simons and Laryea (2006) who report that emerging stock markets exhibit evidence of a random walk. However, the findings partially contradict the results of both the autocorrelation and the runs tests. This could have arisen for the following reasons. First, the analysis of weak form efficiency in the variance ratio technique allows for conditional heteroskedasticity in the disturbance term (Lo and MacKinlay, 1988), making it a more robust weak form efficiency test (Kim and Kim, 2010). Second, the autocorrelation and runs tests are designed to test the random walk and weak form efficiency by providing a mean (Knoke, 1975 and 1977) whereas the variance ratio method tests the random walk and weak form efficiency against stationary alternatives, based on linear increments in all sampling intervals (Ntim *et al.*, 2011). Lastly, the autocorrelation and runs tests measure the long-run effects of changes on the path of real returns whereas variance ratio uses overlapping data in computing the variance of long-horizon returns (Charles and Darne, 2009). Although the use of overlapping data and the provision for both heteroskedasticity and homoskedasticity improves the power

of the variance ratio test, it is nearly impossible to analyse the exact sampling distribution of the variance ratio test statistics in a finite sample (Cecchetti and Lam, 1994), creating significant bias and right skewness (Tse *et al.*, 2002). In addition, the variance ratios are asymptotic tests because their sampling distributions are approximated by their limiting distributions (Charles and Darne, 2009). Hence, these deficiencies may give rise to negative distortions in significance of asymptotic approximations.

Table 5.4: Variance ratio test results

	Bond returns		Stock returns		Soveign Credit ratings	
Joint Tests	Value	Prob.	Value	Prob.	Value	Prob.
Max |z| (at period 2)	4.271	0.0001**	2.232	0.0984	5.106	0.0000**

Individual test

	Bond returns			Stock returns			Sovereign Credit Ratings		
Period	Var. Ratio	z-Statistic	Prob.	Var. Ratio	z-Statistic	Prob.	Var. Ratio	z-Statistic	Prob.
2	0.461	-4.271	0.0000***	0.436	-2.232	0.0256**	0.500	-5.106	0.0000***
4	0.228	-4.077	0.0000***	0.210	-2.065	0.0388**	0.250	-5.106	0.0000***
8	0.115	-3.999	0.0001***	0.107	-1.988	0.0468**	0.125	-5.106	0.0000***
16	0.057	-3.975	0.0001***	0.058	-1.948	0.0514**	0.062	-5.103	0.0000***

***, **, * represent significance at the 1, 5, and 10 percent levels respectively

Table 5.5 below provides a summary of the three weak form efficiency tests results. As can be seen, the tests generally agree that African bond prices remain inefficient whereas the stock prices are weak form efficient. This accords with previous studies on emerging markets by Abraham *et al.* (2002), Abdmoulah (2010) and Hong *et al.* (2012) and Smith and Dyakova (2014) who also find that bond markets in emerging and developing countries are less competitive than stock markets which are generally weak form efficient.

Table 5.5: Summary of weak form efficiency tests results

Autocorrelation test	Bond prices are efficient Stock prices are efficient
Runs test	Bond prices are inefficient Stock prices are inefficient
Variance ratio test	Bond prices are inefficient Stock prices are efficient

Having found evidence of weak form efficiency from the Ljung–Box Q autocorrelation and the joint variance ratio tests, which is a necessary condition for semi-strong informational efficiency, the next step is to conduct cointegration tests using the Engle-Granger and the Johansen tests to establish if there is evidence of cointegration between the credit rating and security returns series. The results presented in Table 5.6 show that the null hypothesis of no cointegration between the credit ratings and security returns series can be rejected by both the Engle-Granger tau-statistic (t-statistic) and the Johansen trace statisic at the 1 percent level. Thus, the results of the cointegration test imply that there are comovements between credit ratings and security returns. Hence, these findings suggest that the series can be used to predict each other, which violates the semi-strong form efficiency hypothesis.

The intermediate results used in constructing the test statistics in the Engle-Granger cointegration test present long-run residual variances for all the three series below are 0.05, which indicates that there are no serial dependences in standard errors of the sample mean. In addition, there are three stochastic trends with the bond and stock returns lagging one and 30 periods respectively. This may also suggest that all three series are cointegrated. Hence, it can be concluded that the stock and bond returns series violate the semi-strong market efficiency form, which implies that SCR information does not affect market efficiency as security prices in African markets do not instantly reflect all publicly available information. These results also accord with the majority of studies in both developed and emerging markets (Katz, 1974; Norden and Weber, 2004; Robinson and Bangwayo-Skeete, 2015) that also find evidence against the semi-strong efficiency form.

Table 5.6: Cointegration Tests results

Engle-Granger			Johansen		
Dependent	tau-statistic	Prob.	Hypothesisized No. of CE (s)	Trace Statisic	Prob.
BOND	-227.8591	0.0000***	None	29.797	0.0002***
SCRC	-305.1602	0.0000***	At most 1	15.4947	0.0084***
STOCK	-48.84684	0.0000***	At most 2	602.27	0.0219***

Intermediate Results:

	BOND	SCRC	STOCK
Rho - 1	-1.101118	-1.000004	-1.00296
Rho S.E.	0.004832	0.003277	0.020533
Residual variance	0.011569	0.048136	0.000141
Long-run residual variance	0.011866	0.048136	0.000052
Number of lags	1	0	30
Number of observations	93121	93123	93063
Number of stochastic trends**	3	3	3

*** represents significance at 1 percent

In addition to the cointegration test, a Granger causality test is conducted to further analyse and verify the rejection of semi-strong market efficiency form. Table 5.7 presents the results of testing whether lagged values of the SCRs help to predict stock and bond return series. The results show that the p-values associated with the F-statistics are insignificant for all the pairs associated with SCRs changes. Therefore, the null hypothesis that SCRs do not Granger cause either the bond or stock returns can not be rejected. These results also accord with Katz (1974), Norden and Weber (2004) and Robinson and Bangwayo-Skeete (2015) and therefore confirm the earlier findings from the Engle-Granger Cointegration test that also reject the semi-strong form efficiency. Thus, it can be inferred that the SCR information does not affect market efficiency as security prices in African markets do not instantly reflect all publicly available information.

Table 5.7: Pairwise Granger Causality Tests Results

Null Hypothesis:	F-Statistic	Prob.
SCRC does not Granger Cause BOND	0.02180	0,9784
BOND does not Granger Cause SCRC	0.04227	0.9586
STOCK does not Granger Cause BOND	14.0936	0,0000***
BOND does not Granger Cause STOCK	0.12615	0.8815
STOCK does not Granger Cause SCRC	0.35312	0.7025
SCRC does not Granger Cause STOCK	0.13675	0.8722

*** represents significance at 1 percent

5.6 Conclusion

This chapter investigated the effect of foreign currency long-term SCR announcements on financial market efficiency in 19 African countries that have both operational stock and debt markets over the period of 1994 to 2014. The results of the Ljung–Box Q autocorrelation, runs and variance ratio tests of weak form efficiency find significant evidence of weak form efficiency in stock markets whereas the bond markets are generally weak form inefficient. Thus, SCRs do not impact bond markets efficiency since African bond markets remain inefficient in the weak form. In contrast, stock markets show evidence of weak form efficiency implying that long-term SCRs positively affect equities market efficiency in Africa. However, the Engle-Granger Cointegration and Granger Causality tests of market efficiency do not find significant evidence that SCRs impact African financial markets in semi-strong efficiency form.

There are therefore two implications arising from these results. First, SCRs determine the ‘best times’ that investors choose to buy or sell their bonds in African markets because their pricing patterns are weak form inefficient. Thus, bonds are either overvalued or undervalued as investors underreact or overeact to SCRs when determining an appropriate risk adjusted rate of return. Second, the bond markets in emerging and developing countries are less competitive than stock markets which are generally weak form efficient. Hence, credit ratings are more influential and useful for providing credit risk evaluations in African bond markets than in stock markets.

CHAPTER 6

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

Since the 2008 Global Financial crisis, the wave of very low to negative interest rates in developed economies such as Japan, Europe and United States (Hannoun, 2015), has left investors with very few choices in investment options. On the other hand, although emerging markets currently offer potential investment growth and higher returns, large corporations and other institutional investors with surplus financial resources are skeptical of investing in these markets because of high risk (Smith and Dyakova, 2014). Most emerging financial markets are relatively under-developed and thus suffer from illiquidity, thin trading and information asymmetry (Kenny and Moss, 1998; Patel, 2014; Ravi and Hong, 2014), which exposes them to manipulations by a few participants.

Thus, CRAs have become an important source of information on the creditworthiness of emerging markets' debt issuers for international investors (Agarwal *et al.*, 2015). As investors grapple with the uncertainties inherent in investment options, CRAs have wider access to crucial information needed to sift through the growing number of securities being issued in financial markets. Thus, countries and corporates that maintain positive macroeconomic indicators retain high credit ratings on their debt and borrow cheaply, which makes their financial securities attractive to investors.

However, CRAs have suffered from a number of shortcomings. First, the conflict of interests created by their issuer-pay model whereby the issuing sovereign pays for their credit rating, has compromised their credibility (Bayar, 2014). Second, credit rating methodologies are highly subjective and include key variables that are permeated by ideologically conditioned judgements and biases (Gaillard, 2014). Third, regulators create artificial demand for ratings by imposing credit ratings as part of compliance

requirements for countries and corporates to issue financial market securities (Ekins and Calabria, 2012). These credit ratings are usually from a few approved international credit rating firms. Thus, the artificial demand for credit ratings compromise the quality of ratings whilst elevating the importance of ratings but this is not based on market forces, and does not reflect the economic value of their output. Lastly, CRAs were offering favourable credit ratings to insolvent borrowers and approving extremely risky securitised mortgage-related obligations that were at the centre of the 2008 debt crisis, which could not have been marketed or sold without their high investment-grade approvals (Bolton *et al.*, 2012).

Thus, the objectivity of CRAs and the impact of their announcements on financial markets have been the subject of ongoing debate. Some studies find that SCRs effectively summarize and supplement the information contained in macroeconomic indicators (Ferri *et al.*, 1999; Elkhoury, 2008; Alsakka and Gwilym, 2013; Gande and Parsley, 2004, 2014; Duygun *et al.*, 2016). Other studies argue however that credit ratings simply tell the market what it already knows (Fama, 1965; Matolcsy and Lianto, 1995; Hirshleifer *et al.*, 2013; Bissoondoyal-Bheenick and Brooks, 2015). Nevertheless, rating announcements continue to have an impact on financial markets despite resistance, especially from downgraded borrowers who contend that CRAs fail to appreciate their economy, business and operating environment (Ntswane, 2014; Mohapatra, 2016; Sensoy, 2016).

Since liberalization, Africa's financial market systems have failed to broaden and deepen to be seamlessly integrated into the global financial system (Mu *et al*., 2013). In addition, information asymmetry, which is a common characteristic associated with African financial markets, has been exacerbated by low disclosure requirements, which create further imperfections and inefficiencies (Patel, 2014; Ravi and Hong, 2014). Despite these limitations, the investment appetite for Africa's financial assets has expanded the demand for CRAs sovereign creditworthiness information (Songwe, 2014).

Hence, this thesis empirically investigated the effects of the information provided by CRAs on African financial markets to determine whether SCRs contain material information that influences the secondary market securities pricing model and debt markets' interest rates. In particular, this thesis has sought to answer four primary research questions: (i) do SCR announcements influence excess bond and equity returns in Africa; (ii) what is the net effect of SCRs on bond and equity markets in Africa; (iii) what are the effects of SCR spillovers on neighbouring countries' financial markets, and; (iv) do SCRs affect financial market efficiency?

6.2 Summary of Findings

This section presents the findings from the investigation on the effects of the foreign currency long-term SCRs information on African financial markets. First, a summary of the findings on whether SCRs impact excess bonds and equities returns is presented, followed by the findings on the net effect of credit ratings on African bond and equity markets. Thereafter, the findings on whether there are credit ratings spillover effects to neighbouring countries' financial markets and lastly, the findings on the impact of credit ratings on the efficiency of African financial markets are reported.

6.2.1 Excess Market Returns

The importance of SCRs for investors has been a subject of ongoing debate. Some studies argue that SCRs announcements bridge the information gap between investors and issuers of securities, and hence their impact on financial markets is significant (Alsakka and Ap Gwilym, 2013; Rhee, 2015; Almeida *et al.*, 2017). In contrast, other studies report that SCRs have no impact on financial markets because they are a mere repetition of information that is already known (Matolcsy and Lianto, 1995; Ferreira and Gama, 2007; Michaelides *et al.*, 2015). Hence, this study investigates the effect of sovereign rating announcements on excess bond and equity returns. The analysis finds that the African financial markets are weakly sensitive to SCR announcements. This finding implies that there is no significant evidence of excess returns influenced by credit rating announcements. The finding accords with the literature (Andrianaivo and Yartey, 2010; Patel, 2014) which posit that most of the African countries' SCRs are sub-

investment (junk) grade and consequently suffer from illiquidity challenges. Hence, the announcements of SCR announcements do not significantly change the African financial market because they are already perceived to be risky markets, which attract mostly passive and long-term investors. These results indicate that both foreign and domestic investors in African financial markets are resilient when investing in low growth economies that have uncertainties such as sub-investment grade credit ratings, inefficient public enterprises, political turmoils, corruption scandals.

6.2.2 Net Effect on Bonds and Equity Prices

It is widely accepted that stocks and bonds do not move in the same direction because rising stock prices are associated with rising bond yields and falling bond prices (Stivers and Sun, 2002) as investors commonly sell bonds to raise money to buy stocks and sell stocks to raise money to buy bonds, which thus affects the prices of both asset classes (Maslov and Roehner, 2004). Hence, stocks and bond prices move in opposite directions because of their inverse responses to macroeconomic fundamentals (Ncube and Brixiov, 2015). On the other hand, SCR downgrades (upgrades) announcements are generally viewed as bad (good) news by market participants (Galil and Soffer, 2011), and thus it is expected that bonds and stocks react negatively (positively) to SCR downgrade (upgrade) related announcements. Therefore, an empirical analysis was conducted to assess whether SCR announcements have the same effect on both African bond and equity markets.

The empirical estimation finds evidence of unidirectional causality running from stocks to bonds and from credit ratings to bonds, but not in reverse. Thus, implying that investors prefer to buy stocks first and later sell them to buy bonds when a country's credit rating profile changes. Therefore, unfavourable SCR announcements cause bondholders to raise their required returns and drives bond prices down, which leads investors to then transfer funds from stocks to buy cheaper bonds. Furthermore, there is a significant moderately positive relationship between Africa's stock and bond markets; and a weakly significant positive association between SCR announcements and bond and stock market movements. These findings thus imply that sovereign rating

announcements therefore do not have the same implications for both stockholders and bondholders as shown by the weak association between SCRs and stock returns.

6.2.3 Rating spillovers

Studies on the spillover effects of SCR announcements on neighbouring and regional countries are still inconclusive and very scant when considering African markets. Thus, estimation was conducted to determine whether SCR announcements have spillover effects on the bond and equity markets in neighbouring countries. The findings show that the regional sovereign rating spillover impacts are marginal and are quickly absorbed into stock and bond markets prices. These findings thus imply that investors consider regional countries' credit rating profiles as a whole rather than on an individual country basis. Investors therefore shift funds from downgraded lower sovereign rated countries to higher rated countries, which generate spillover effects in the region's neighbouring countries. However, the cross-country shocks - from a sovereign rating shock in one country to the sovereign ratings in other countries in the same region - are also marginal but persist over longer time periods. These findings thus suggest that the investment environment in regional countries is interconnected, which allows cross-country information flows and credit rating spillovers. As suggested by Sun *et al.* (2010), macroeconomic fundamentals are shared across countries through trade and financial linkages, which are some of the key potential interconnection and transmission channels that expose countries to common shocks.

6.2.4 *Market efficiency*

There are few studies that test the impact of SCRs on financial market efficiency. Thus, the final estimation in this thesis explored how credit rating announcements enhances the efficiency of Africa's bond and equity prices. The analysis finds that stock markets are weak form efficient whereas the bond markets are generally weak form inefficient. These findings imply that SCR information does not enhance bond market efficiency since African bond markets remain inefficient in the weak form. In contrast, SCRs positively affect equity market efficiency in the long-term.

With regards to the inefficiency in African bond markets, the findings suggest that bonds are usually overvalued or undervalued as investors underreact or overreact to SCR announcements when determining an appropriate risk adjusted rate of return. Hence, it is implied that the timing of buying or selling bonds is significantly influenced by the SCRs. It can therefore be inferred that the weak form inefficient pricing patterns of bonds means that the 'best times' to sell (buy) would be just before a rating downgrade (upgrade). Credit ratings are therefore more influential and useful for providing credit risk evaluations in African bond markets than in stock markets. Hence, there are significant portfolio shifts in bondholders following sovereign rating announcements.

With regards to the stock markets in Africa, the findings show that they are more competitive than the bond markets since they are generally weak form efficient. This implies that macroeconomic indicators considered in SCR announcements would have been discounted into equities prices before such announcements are made. Therefore, SCRs do not generate abnormal stock returns because there are no significant portfolio restructuring in stocks following the announcements. In contrast to bonds whose value may largely be determined by the probability of default of the issuing sovereign, stock market investors are generally able to achieve the market rate of return from indexed stocks. Consequently, it can be deduced that if investment decisions are based on sovereign creditworthiness of security issuers, then in African markets, stocks are a more preferable investment option than bonds.

Thus in summary, the results of the empirical analysis show that SCR announcements only have a relatively weak effect on bond and equity returns in African financial markets. With regards to the net effects of SCR downgrade and upgrade announcements on bond and equity returns, announcements in sovereign ratings do not have the same implications for both stockholders and bondholders. A sovereign rating downgrade (upgrade) causes bondholders to raise (lower) their required returns and drives bond prices down (up), which leads investors to then transfer funds from stocks (bonds) to buy cheaper bonds (stocks). With regards to spillover effects, credit ratings announcements significantly spill over into neighbouring financial markets. Lastly, SCRs

positively affect the weak form efficiency of African stock markets to a greater extent than bond markets, which remains generally weak form inefficient following SCRs.

6.3 Policy implications

The empirical findings in this study lead to the following policy implications and recommendations.

6.3.1 Sovereign Domestic Policy

International investors around the world rely on credit ratings for information to guide their investment decisions (Hooper *et al.*, 2008). Some asset managers are restricted by their investment policy statements to invest only in countries or corporates that have a certain credit rating grade from one (or more) of the three international ratings agencies (Ellul *et al.,* 2011). It is widely accepted that sovereign credit rated governments are transparent and prudent (Gande and Parsley, 2014), thus their debt levels and cost of debt are significantly reduced (Elkhoury, 2008). The net benefit of reduced debt is passed to businesses and households. The lower-working class to middle class that relies on credit significantly benefit from reduced cost of borrowing (Beegle *et al.*, 2016). Governments should therefore seek to improve their credit rating profiles to reduce cost of borrowing.

The empirical analyses described in this thesis show that the operations of CRAs appear to be less important in the operation of stocks and bond markets in Africa. Governments should however appreciate the long-term information exchange between investors and borrowers, and the consequential nature of credit ratings in Africa's nascent financial markets to proactively manage the risks of negative ratings. As donor funding to most African countries is decreasing (Joffe, 2015), more states are opting for issuing sovereign bonds to finance fiscal deficits and other infrastructure development initiatives (Collier, 2014). This has led to a significant growth in financial markets as they become a more important source of current and future funding (Yartey, 2009).

With regard to fiscal policy, most African governments need to borrow in order to fund

both their budgets and developmental expenses (Loxley and Sackey, 2008; Omotola and Saliu, 2009; Powell and Bird, 2010). On average, according to *Tradingeconomics*[30] and *Countryeconomy*[31] data, government debt in most sovereign credit rated African countries stands between 20 to 50 percent of GDP, with around 30 percent being held by foreign investors who usually preclude asset managers from investing in sub-investment grade economies. As SCRs impact government expenditure and taxation in Africa, an unfavourable announcements in credit rating can have a negative effect on the cost of servicing national debt. Subsequently, government spending in key sectors such as education, human settlement, health, sanitation and other infrastructural development is negatively impacted, which leads to a budget deficit if governments continue to borrow to finance its expenditure (Johnson and Kriz, 2005; Elkhoury, 2008; Stallmann *et al.*, 2012). Furthermore, as foreign investment makes up a significant portion of financing in most African goverments' spending needs (Arslanalp and Tsuda, 2014), unfavourable SCR announcements could lead to a withdrawal of these funds, which could significantly alter the nature of the fiscal policy.[32] Sovereign governments in Africa should therefore aim to reduce and maintain low levels of national debt to ensure that sovereign debt accumulation does not negatively impact long-term economic growth. In addition, it is recommended that foreign currency denominated national debt should be kept at minimum levels in order to reduce government exposure to foreign exchange risk, which is highly volatile in most African countries (Oseni, 2016).

Empirical studies show that credit ratings directly impact monetary policy through changes in interest rates (Brooks *et al.*, 2011; Ellul *et al.*, 2011; Crosta, 2014) and exchange rates (Abad *et al*., 2012; Alsakka and Gwilym, 2013; Agarwal *et al*., 2015). Thus, sovereign credit downgrades result in an increase in interest rates, which is part of a deflationary monetary policy (SARB, 2016). In addition, as countries' SCR move from the investment grade into the sub-investment grade, their interest rates curve

[30] https://tradingeconomics.com

[31] https://countryeconomy.com

[32] For example, according to *Tradingeconomics* data, South Africa lost an estimated US$8billion to US$13billion due to forced selling by foreign investors following a SCR downgrade announcement in 2017; Namibia and Botswana also lost an estimated US$2.73billion following a SCR downgrade in 2017; and foreign investors withdraw an estimated US$0.65billion from Gabon and Mauritius after a negative SCR announcement in 2012 and 2015 respectively.

steepens from a linear to an exponential trend. This further increases the cost of servicing debt for both corporates and households, and consequently reduces aggregate demand by lowering consumption and investment. Households discretionary income decrease while borrowing cost increases and for firms, the opportunity cost of investment rises while higher interest rates also reduce aggregate demand by lowering net exports. It is therefore recommended that countries should maintain prudent domestic policies to avoid sovereign downgrades, which negatively affect financial markets and hamper economic development. In addition, while most African governments usually issue sovereign debt at the cheapest maturity (IMF, 2015), it is recommended that governments should rather construct their own favourable yield curves and term structures of interest rates on both foreign currency and domestic debt to enable their financial markets to develop and become competitive.

6.3.2 Regional and Foreign Policy

The findings show that there are linkages between regional stocks and bond returns, which decline as emerging countries become more creditworthy. In addition, the significant spillover effects from SCR announcements in one country to neighbouring financial markets show that regional markets are interlinked. With the growth of globalisation (Causevic, 2003), the channels of information flow expose countries to the vulnerabilities in other neighbouring sovereigns' poor policy choices and outcomes. It is therefore recommended that countries in the same region should aim to maintain or improve their macroeconomic environment to avert unfavourable SCRs that would affect the objectives of regional economic integration to the disadvantage of all other regional countries' credit ratings. However, despite the ongoing attempts by regional associations of African countries[33] to foster both internal and inter-regional trade, together with regulatory uniformity for Africa's economic development and diversification, the regional groups have failed to tackle cross-border externalities and their costs because of the sharp differences in policy preferences across member

[33] These include the Arab Maghreb Union (AMU), Common Market for Eastern and Southern Africa (COMESA), Community of Sahel-Saharan States (CEN-SAD), East African Community (EAC), Economic Community of Central African States (ECCAS), Economic Community of West African States (ECOWAS), Intergovernmental Authority for Development (IGAD) and the Southern African Development Community (SADC)

countries (Mapuva and Muyengwa-Mapuva, 2014). Furthermore, the overlapping and concurrent membership by member states has often divided countries efforts towards the regional integration goals as each member state prioritise on identifying its own economic opportunities at the expense of collective economic interests (AfDB, 2014).

With regards to regional and foreign policy, there are five implications arising from the findings in this thesis. First, the regional bilateral linkages between countries serve as channels of capital and SCR information flow. Second, there are interactions in the region's economic policies, financial resources, infrastructure, institutional strength, and political stability and thus regional sovereign ratings are susceptible to other member countries' unfavourable macroeconomic conditions. Third, the disparities in the levels of economic development of African countries affect the regional economic integration objectives such as the Millenium Development Goals (MDGs). Fourth, the stronger economies such as Nigeria, South Africa and Egypt commonly dominate and influence the terms of reference, as well as the operation of the regional blocs to the disadvantage of the poorer and weaker members leading to growing inequalities among member states. Lastly, the success of the common market areas depend on member countries aligning their national policies to regional policies to avoid conflicting frameworks and priorities. Hence, the findings suggest that it is imperative for regional countries to pursue developmental macroeconomic policies that enhance cooperation and integration, and to avoid negative ratings that will have regional spillover effects.

In summary, the empirical analyses in this thesis show that although African financial markets are weakly sensitive to SCR announcements, the information is important for the development of financial markets. In addition, CRAs' opinions significantly impact market confidence and the long-term stability of emerging markets. Thus, policymarkers should maintain prudence in crafting pro-growth policies and creating a conducive investment climate that fosters transparency.

6.4 Direction for further study

The findings in this study give rise to the following four suggestions for further study.

First, this study analyses the impact of SCRs on Africa's financial markets as one sample. Given the arguments in the literature that the behaviour of individual securities is different from index performance (Nam *et al*., 2006). Further study could be conducted to examine the effects of SCRs on individual stocks and bonds.

Second, this study only considers long-term SCRs, which is usually more sensitive to changes in macroeconomic indicators (Reusens and Croux, 2015). Thus, the effects of both short term foreign currency and domestic SCRs on financial markets could be further explored.

Third, the information content hypothesis argues that rating agencies handle confidential information and therefore, rating revisions include new information for the market that is rapidly included in asset prices (Mendoza-velazquez, 2009). Thus, credit rating reviews accompany changes in market activity and high trading volumes (Acharya and Pedersen, 2005), which is characterized by high liquidity as investors consider investing or withdrawing funds from some securities to others. In addition, investors prefer liquid financial markets because they facilitate transactions without causing drastic changes in asset prices (Brunnermeier and Pedersen, 2009). Whilst some studies such as Karam *et al.* (2014) and Abad *et al.* (2015) argue that liquidity shocks in the financial markets are induced by credit rating announcements, others such as Acharya and Pedersen (2005) and Covas and Fujita (2010) contend that liquidity shocks are driven by capital requirements for institutional investors and financial assets holding restrictions. Furthermore, Da and Gao (2009; 2010) report that liquidity shocks are clearly caused by asymmetric reactions. Thus, further study could explore the performance in the expected trading activity after credit rating announcements and the market pricing pressure before and after credit rating announcements.

Lastly, a number of emerging countries (such as; Benin, Guinea Bissau, Mozambique, Niger, Sudan and Tanzania, Togo and Zimbabwe) have significant capitalisation in both stock and bond markets although they do not have SCRs from the three international CRAs. However, a sizable number of these financial markets are made up of

international investors who either prefer credit rated securities or compare the issuing country to the other benchmarks in the rated sovereigns. Thus further study could consider how investors grapple with the uncertainties of information asymmetry before and after purchasing unrated securities in unrated sovereigns.

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