

https://dspace.org/

The Impact of Sovereign Credit

Ntswane, Lesley

2011-06-06
http://hdl.handle.net/10539/10010

Downloaded from a DSpace repository. https://dspace.org/

The Impact of Sovereign Credit Ratings on the exchange rate in South Africa

Lesley Ntswane

A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Business Administration

Johannesburg, 2008

ABSTRACT

This event study investigates the impact of sovereign credit ratings action on the foreign exchange rate in South Africa. The study uses the mean adjusted return model to establish the impact sovereign credit rating announcements by three rating agencies on the South African Rand against the American Dollar daily exchange rate and volatility between 1994 and 2007.

While previous studies, especially after the notable depreciation and subsequent recovery of the South African Rand, in 1998 and 2001-2002, have tried to identify the determinants of the Rand exchange rate, none of the studies has taken sovereign credit rating actions into account.

The results from this study have shown that sovereign credit rating announcements by Standard and Poor's have a statistically significant impact on the South African Rand exchange rate against the American Dollar. The impact was however not only positive during an upgrade as previously found in a similar study on foreign exchange rate, but negative excess returns were also computed during the event window period. Rating action announcements by Fitch and Moody's on the other hand, do not have any significant impact on the on the South African Rand exchange rate against the American Dollar. The sovereign credit rating announcements were, however, found to have insignificant impact on the foreign exchange rate volatility during the event window period. The study also found that sovereign credit ratings announcements have no significant impact on the gap between nominal exchange rate and the PPP equilibrium exchange rate. This may be a confirmation that sovereign rating action is not one of the factors that influence the speed towards mean reversion to close the arbitrage created by price differences in the long-run exchange rate measure through PPP.

What also stood out in this study was that in the period when the South African Rand experienced the highest depreciation against the American dollar in 2001, none of the rating agencies issued prior negative announcements. In fact the

South African rating was raised after the recovery of the Rand between 2002 and 2003.

The findings from this study, however, open an opportunity for further studies. South Africa's rating announcements between 1994 and 2007 provides only positive sovereign rating announcements. Previous studies have shown that the rating announcements had a significant effect on bond and stock prices where an announcement was a downgrade and especially for below investment grade rated securities. In addition to that, the only time an effect was noticed for an upgrade was when a rated sovereign moved from below investment to investment grade. Significant negative exchange rate reaction has also been found during a downgrade, for below investment sovereigns. This may explain the lower significant level impact on the exchange rate in the investment graded South Africa. It would be interesting to see a mix of rating announcements especially for developing economies such as South Africa. This presents an opportunity for further studies on the impact of sovereign credit ratings on exchange rates in developing economies and especially those that have experienced large currency depreciation in recent times.

DECLARATION

I, Lesley Lucas Ntswane, declare that this research report is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Name

Date

DEDICATION

To, my wife Motlapele, my daughters Monthati and Motheo and the rest of my family Motlakadibe, Kokoti and Kgomotso without your love, inspiration and support this past three years would have been unbearable.

ACKNOWLEDGEMENTS

I would like to express my gratitude to:

- Professor Mthuli Ncube, my supervisor, for his insight, time, encouragement and inspiration.
- Tertius Smith and Roland Cooper, at Fitch Ratings, for your time and patience.
- Giorgio Giurdanella, at Moody Investor services, for the data and assistance.
- Patrick Maumela, at the South African Reserve Bank, for the data.
- Jennifer Croll, at Wits Business School, for the language editing services.

TABLE OF CONTENTS

ABSTRACT II

DECLARATION IV

DEDICATION V

ACKNOWLEDGEMENTS VI

LIST OF TABLES X

LIST OF FIGURES XI

1 INTRODUCTION 1

1.1 PURPOSE OF STUDY 2
1.2 CONTEXT OF STUDY 2
1.3 PROBLEM STATEMENT 3
1.3.1 MAIN PROBLEM 3
1.3.2 SUB-PROBLEMS 4
1.4 SIGNIFICANCE OF STUDY 4
1.5 DELIMITATIONS AND LIMITATIONS 5
1.5.1 DELIMITATIONS 5
1.5.2 LIMITATIONS 6
1.6 DEFINITION OF TERMS 7
1.7 ASSUMPTIONS 7

2 LITERATURE REVIEW 8

2.1 INTRODUCTION 8
2.2 SOVEREIGN CREDIT RATINGS 8
2.2.1 DETERMINANTS OF SOVEREIGN CREDIT RATINGS 9
2.2.2 THE SIGNIFICANCE OF SOVEREIGN CREDIT RATINGS 10
2.2.3 INTERPRETATION OF THE SOVEREIGN CREDIT RATINGS 12
2.3 FOREIGN EXCHANGE RATES 13
2.3.1 DETERMINANTS OF FOREIGN EXCHANGE RATE 14
2.3.2 THE SOUTH AFRICAN ECONOMY 15
2.3.3 RATINGS ACTIONS 17
2.4 THE IMPACT OF SOVEREIGN CREDIT RATINGS ON THE EXCHANGE RATE 17
2.4.1 CREDIT RATINGS ACTION AND FINANCIAL INSTRUMENTS 18
2.4.2 CREDIT RATINGS AND CURRENCY CRISES 19
2.4.3 CONCLUSION ON THE FIRST SUB-PROBLEM LITERATURE REVIEW 21
2.4.4 HYPOTHESIS 1 21

2.5 THE IMPACT SOVEREIGN CREDIT RATINGS ON THE EXCHANGE RATE VOLATILITY 22
2.5.1 EXCHANGE RATE VOLATILITY....22
2.5.2 FOREIGN CAPITAL FLOW AND SOVEREIGN CREDIT RATINGS 23
2.5.3 CONCLUSION ON THE SECOND SUB-PROBLEM LITERATURE REVIEW 24
2.5.4 HYPOTHESIS 2 24
2.6 CONCLUSION OF LITERATURE REVIEW....25

3 RESEARCH METHODOLOGY....27

3.1 RESEARCH METHODOLOGY /PARADIGM 27
3.2 RESEARCH DESIGN....27
3.2.1 EVENT STUDY METHODOLOGY - DESIGN 27
3.2.2 EVENT STUDY METHODOLOGY – SOME LIMITATIONS 34
3.3 POPULATION AND SAMPLE....35
3.3.1 POPULATION....35
3.3.2 SAMPLE....36
3.4 DATA COLLECTION 38
3.5 DATA ANALYSIS AND INTERPRETATION 39
3.6 VALIDITY AND RELIABILITY....40
3.6.1 EXTERNAL VALIDITY 41
3.6.2 INTERNAL VALIDITY 41
3.6.3 RELIABILITY 41

4 PRESENTATION OF RESULTS....43

4.1 INTRODUCTION 43
4.2 RESULTS....43
4.2.1 HYPOTHESIS ONE....43
4.2.2 HYPOTHESIS TWO 54
4.3 CONCLUSIONS....56

5 INTERPRETATION OF RESULTS 58

6 CONCLUSION....62

6.1 SUMMARY OF THE MAIN FINDINGS....62
6.2 LIMITATIONS OF THE RESEARCH 64
6.3 SUGGESTIONS FOR FURTHER RESEARCH 64

REFERENCES....66

APPENDIX A 72

DETAILED RATING ACTIONS....72

APPENDIX B 75

DETAILED ECONOMIC DATA 75

APPENDIX C 78

AAR AND CAAR FOR EQUILIBRIUM EXCHANGE RATE APPROACH 78

APPENDIX D 90

AAR AND CAAR FOR DAILY NOMINAL EXCHANGE RATE RETURN APPROACH 90

LIST OF TABLES

Table 1: Agency International Credit Rating Scales.....13

Table 2: Applied parametric and non-parametric t-test statistics.....33

Table 3: CAAR's for rating announcements by all three agencies. 45

Table 4: CAAR's for Upgrade sovereign rating announcements by all three agencies.....46

Table 5: CAAR's for sovereign rating outlook and watch listing announcements by all three agencies. 46

Table 6: CAAR's for sovereign rating announcements by Fitch. 47

Table 7: CAAR's for sovereign rating announcements by Moody's.....48

Table 8: CAAR's for sovereign rating announcements by Standard and Poor's. 48

Table 9: CAAR's for all sovereign rating announcements by the three agencies. 49

Table 10: CAAR's for all sovereign rating upgrade announcements. 50

Table 11: CAAR's for sovereign rating outlook and watchlisting announcements by all thee agencies. 51

Table 12: CAAR's for sovereign rating announcements by Fitch. 52

Table 13: CAAR's for sovereign rating announcements by Moody's.....53

Table 14: CAAR's for sovereign rating announcements by Standard and Poor's.....53

Table 15: ZAR to USD exchange rate volatility before and after the sovereign credit rating announcements. 54

LIST OF FIGURES

Figure 1: Rating actions on RSA between 1994 and 2007.....37

Figure 2: Contaminated Rating actions against entire rating action sample on RSA between 1994 and 2007 38

Figure 3: ZAR against USD 1994 through 2007.....60

1 INTRODUCTION

Capital flows in the form of both portfolio and Foreign Direct Investment (FDI), have an impact on the real economy. While both types of capital flow are important in the economy, the preference for FDI is due to its long-term nature. It is resilient to sudden shifts in market sentiments which may lead to a reversal of portfolio capital flow (Ahmed et al. 2005). Indeed in earlier studies on the East Asian financial crises a number of authors have identified high levels of portfolio capital outflow as having exacerbated the crises (Kaminsky and Schmukler 1999; Radelet and Sachs 2000; Reinhart 2000).

FDI is also favoured in that it may be a vehicle for the transfer of technology, especially to developing countries (Borensztein et al. 1998). Borensztein et al. (1998) further state that there is a minimum threshold in terms of absorptive capability of the sovereign when an investor decides where their manufacturing factory will be build. One of the variables in deciding on the location of the manufacturing facilities or inflow of FDI is the exchange rate volatility (Ahmed et al. 2005). In a study on capital flow into South Africa Ahmed et al. (2005) found that while exchange rate volatility deters FDI, there was no evidence that exchange rate volatility has a statistically significant effect on portfolio flows.

This however does not discount the importance of portfolio investment. As mentioned above, for FDI to flow into a country, there should be capacity to absorb the FDI. One of the most important absorption factors that determine an ability to attract FDI is the countries infrastructure. South Africa's banking system, for example, has been lauded as one of the best in addition to the country having one of the cheapest power supplies in the world. These entire infrastructure however, require portfolio capital flow through access into foreign capital markets to finance (Reinhart 2002). Studies have, however, indicated that, especially for below-investment rate sovereigns, access to foreign capital becomes quite difficult in that investors, especially American investors, prefer rated instruments (Cantor 2005).

FDI and portfolio capital flow are both important for a sovereign and are not mutually exclusive. Indeed, Ahmed et al (2005) found that a number of explanatory variables were important for both FDI and portfolio capital inflow. Sovereign risk, however, continues to play a role long after such an FDI has been made in that a corporate organisation continues to look for access to cheap debt to increase its capacity and the international debt market is one such source. This is due to the fact the sovereign risk rating becomes the highest risk profile that the newly established corporate can attain while domiciled in the sovereign. In South Africa, for example, it has been found that the sovereign risk appears to be the single most important determinant of corporate default risk premia (Peter and Grandes 2005). The implication is that the corporate seeking foreign portfolio capital through debt will be judged on the risk level of the sovereign.

1.1 Purpose of study

Following the 1997 Asian crises, studies have been focussed on the ability of sovereign credit ratings to predict currency crises (Reinhart 2002; Mora 2006). The growing interdependency in the world economy, coupled with the need for developing economies to access international debt, has increased the requirement for foreign currency reserves by sovereigns not only to service their debts, but also to transact in the global market. In some instances, as is the case with South Africa, foreign currency reserves are held for strategic exchange control purposes (SARB 2007).This has, in turn, increased the requests for sovereign credit ratings (Gelos et al. 2003). The purpose of this research is to establish the impact of international sovereign ratings on the exchange rate in South Africa, which has implications for foreign investment for the country.

1.2 Context of study

The growing international investment across the nations, coupled with the relaxation of exchange controls, has seen an increase in demand for foreign exchange (SARB 2007). On the other hand, countries, especially developing

countries, need to access competitive credit markets to raise funds to improve their infrastructure and promote foreign investment. Sovereign credit ratings play an important role in determining the terms and extent to which these countries access these international foreign markets (Reinhart 2002). Added to that, investors prefer rated investments of similar risk over unrated investments (Cantor and Packer 1995). Indeed not only sovereigns but a corporate within the sovereign seeking access to international debt may be judged on the sovereign risk where it is domiciled (Peter and Grandes 2005).

Following an increased foreign trade, capital flow and the opening up of the South African economy since 1994, the foreign exchange market has grown significantly in South Africa (SARB 2007). What is of more importance however, is whether or not the currency is competitive enough to allow the economy to compete globally. A competitive and stable currency allows the country's goods to be competitive and improves the country's attractiveness to foreign investors. This leads to improved economic growth. However, competitiveness not only depends on the country's ability to transact, but also its attractiveness to foreign investors, who are influenced by sovereign credit ratings (Cantor and Packer 1995).

1.3 Problem statement

1.3.1 *Main problem*

The main problem of the study is to examine the impact international ratings, specifically sovereign credit ratings, have on the South African Rand (ZAR) exchange rate against the United States Dollar (USD). The study will include the evaluation of the South African foreign exchange rate changes and behaviour with respect to stability prior to, during and after the sovereign credit rating action.

1.3.2 *Sub-problems*

- The first sub-problem is to establish if there is any significant abnormal return in the ZAR against the USD foreign exchange rate during the sovereign credit rating announcements.

- The second sub-problem is to establish if the ZAR against the USD exchange rate remains stable, within the “normal” exchange rate fluctuation, prior to and after the sovereign credit rating actions.

1.4 Significance of study

The study fills a gap in the literature as no previous research has been conducted in South Africa. A number of studies have looked at the impact of sovereign ratings on the currency crises in emerging markets (Reisen and von Maltzan 1998; Kräussl 2005; Kim and Wu 2007), but only one study (Brooks et al. 2004) could be found where the impact of sovereign credit ratings on foreign exchange rate was investigated. Other studies that come closer to addressing the question of exchange rates and sovereign credit ratings investigated currency crises specifically focusing on crises in Mexico and East Asia (Reisen and von Maltzan 1998; Arellano 2003). While this study will focus on South Africa, the information generated through the study provides a starting point for further investigations in the future.

An emphasis on interest rates and inflation targeting has been the South African Reserve Banks approach in controlling exchange rates (IMF 2007). Previous studies (Cantor and Packer 1996; Levy-Yeyati and Sturzenegger 2003), however, have highlighted other factors in addition to interest rates and inflation targeting, that affect the flow of foreign currency to a sovereign. This study looks at one such factor, in the form of an opinion on the risk associated with a sovereign state.

Other earlier studies (Hand et al. 1992; Hite and Warga 1997) have looked at the impact the ratings have on investment yields and prices. These studies looked at the returns when investing in the financial market around the ratings

announcements. Even more studies have looked at the sovereign ratings ability to predict crises in financial markets (Frankel and Rose 1996; Kim and Wu 2007).This study fills the gap by analysing the impact the ratings have on the relative strength of the ZAR against the USD around such sovereign credit rating announcements.

Previous studies on the South African exchange rate have looked at determinants of foreign exchange rate in South Africa, but, none has investigated sovereign credit ratings as one such a determinant on the ZAR against the USD. Most of the studies on the ZAR, used cointegration techniques to identify persistent patterns of comovements among variables and did not use sovereign credit rating as one of the variables (Aron et al. 2000; Sarno and Taylor 2002; Macdonald and Ricci 2003) While Aron et al. (2000) looked at the ZAR deviation from equilibrium exchange rate, the study did not look at events that may have impacted on such deviations. This study closes the gap by looking at the impact one such event, being sovereign rating actions, may have on the ZAR exchange rate against the USD.

1.5 Delimitations and limitations

1.5.1 *Delimitations*

The study will solely focus on the ZAR exchange rate against a single reference currency, namely the USD. The author will not explore the exchange rates with other major trading partners such as the European Union and South Africa's neighbouring countries. This approach is informed by the fact that major commodities are quoted in USD in the international markets. In addition, the South African Reserve Bank (SARB), International Monetary Fund (IMF) and a number of studies reports use the USD as the reference currency. This allows a basis of comparison with other studies on exchange rates.

The study will also only evaluate the impact of the sovereign credit ratings announced by Fitch Ratings (Fitch), Moody's Investors Service (Moody's) and Standard and Poor's. While there are other factors quantitative and qualitative,

that impact on exchange rates such as, the Gross Domestic Product (GDP), foreign trade volumes, commodity prices, interest rate differentials and political stability, these fall outside of the scope of this study (Fischer 2001).

1.5.2 *Limitations*

South Africa has other major trading partners beside the United States of America (USA) and this necessitates the exchange of ZAR with a basket of other currencies beside the USD. The inclusion of such currencies in this study may have brought an added dimension such as the impact of increasing bilateral trade with countries such as China.

The ZAR exchange rate is not only impacted upon by the sovereign credit ratings or by the factors which go into a rating, other qualitative and quantitative factors influence the exchange rate. It would have been prudent to look at the relative impact of these other factors on the ZAR exchange rate.

The depreciation or appreciation of the ZAR may be accompanied by other announcements and economic events beside the sovereign credit ratings. While these events and announcements are not considered in the study, where these events can be identified around the sovereign credit rating announcements, they will be highlighted in the analysis on the study. This however will not negate the impact other factors not in the public domain, which may be missed by this study, may have on the foreign exchange rates.

One limitation to internal validity identified for this study was the event contamination as identified by Hand et al. (1992). In order to mitigate against this threat, a technique used by Hand et al. (1992) in a study of the impact of rating events on bonds and stocks was followed. This involves looking out for and identifying other events related to the foreign exchange rate during the sovereign credit rating window. This included especially looking for simultaneous announcements, through the business media and government publications, with regard to the currency and monitory policy issues during the event window period. With all the effort however, not all announcements with an impact on foreign exchange could have been detected.

1.6 Definition of terms

For the purpose of this study, the term sovereign credit rating action refers to any announcement by the rating agency with regard to the long-term and short-term, local and foreign currency sovereign credit ratings. This is the generally accepted definition of this term indicating a final rating, a rating outlook or a watchlisted rating (Hand et al. 1992).

1.7 Assumptions

The literature review commences from the premise that South Africa (RSA) is an emerging economy. This is reasonable given that RSA together with Brazil, China, India and Mexico which form the Outreach-5 are classified as such by the international community.

The second major assumption is that the currency market is part of the larger financial market and as such, returns on foreign exchange will largely be affected by similar factors.

2 LITERATURE REVIEW

2.1 Introduction

Previous studies have found that countries entering currency crises with high levels of debt tend to experience real exchange rate overshoots (devaluation in excess of the long run equilibrium level) (Cavallo et al. 2004). The consequences of this phenomenon is that, during currency devaluations, risk averse borrowers find it more costly to repay non-contingent debt (debt that will not be affected by future events) and this increases their probability to default (Arellano 2003). Sovereign credit ratings, which are opinions on the country's ability and willingness to meet their financial obligations, however systematically fail to predict currency crises, and tend to lag these crises with downgrades, mostly following the crises (Reinhart 2002). In a study on determinants and impact of sovereign credit ratings variables such as per capita income, GDP growth, inflation, external debt, level of economic development and default history are identified as the six variables that appear to play an important role in determining a sovereign rating (Reinhart 2002). The exchange rate on the other hand is impacted on by such macroeconomic factors as the economic output, interest rate differential, foreign direct investment, commodity prices, trade openness and domestic credit levels (Frankel and Rose 1996; Sarno and Taylor 2002). Given common determinants of sovereign credit ratings and the exchange rates, there is no reason therefore to doubt that sovereign credit ratings will impact on exchange rates. The question therefore, is do sovereign credit ratings provide information beyond that in the public or market domain such that their action will result in a significant impact on the exchange rates?

2.2 Sovereign Credit Ratings

Sovereign credit ratings are an opinion on the ability and willingness of a sovereign government to meet its financial commitments (Fitch 2007). Studies such as that by Reinhart (2002), have indeed established that sovereign credit ratings do predict financial obligation defaults by sovereign governments.

Sovereign credit ratings however are not to be confused with ratings for other entities within the rated sovereign. Sovereign credit rating is not an all encompassing country rating which reflects an opinion on all entities within the rated sovereign. The sovereign credit rating is solely an opinion on the credit risks of the rated sovereign. The sovereign credit rating does however have an influence on the ratings of the entities within the sovereign, in that it will mostly be the “best" credit risk in a country, with all the other entities ratings the same as, or lower than, the sovereign credit rating (S&P 2007).

Sovereign credit ratings are internationally comparable, relative measure of the sovereign (Fitch 2007). The rating process is voluntary and the request for a rating is initiated by either the sovereign government itself or a sponsor such as the International Monetary Fund (IMF) (Moody 2007). Other non-sovereign debt issuers such as local municipalities, banks and multinational corporate however can request independent ratings to that of the sovereign (Fitch 2007).

2.2.1 *Determinants of sovereign credit ratings*

In determining the ratings, the rating agencies use both quantitative (financial and economic) as well as qualitative (political and policy development) factors to summarise the sovereign governments relative risk against other sovereign countries (S&P 2007). As mentioned above, a sovereign credit rating is issued on request by the sovereign government or its sponsor, this makes it incumbent upon the requesting sovereign to supply information and data upon which the rating will be based (Fitch 2007).

In the study of determinants of sovereign credit ratings by Moody’s and Standard and Poor’s, it was found that ratings can be explained by a number of well defined criteria which the agencies appear to rate similarly (Cantor and Packer 1996). In their study the authors found that six variables, namely per capita income, GDP growth, inflation, external debt, level of economic development and default history appear to play an important role in determining the sovereign credit rating. The sovereign credit ratings were found to summarize and supplement the information contained in macroeconomic indicators in addition to being strongly correlated with market determined credit

spreads, presenting evidence of similar interpretations of publicly available information both by the rating agencies and market participants (Cantor and Packer 1996). S&P (2007) however, indicate that in addition to these quantitative factors, agency judgement is also important. It has indeed been found that, while the agencies' ratings have a largely predictable component, they also provide information, especially for non-investment grade sovereigns, that goes beyond that available in public owing to the difficulty of measuring sovereign risk for below investment grade sovereigns (Cantor and Packer 1996).

In supporting the impact those macroeconomic factors have on the sovereign credit ratings, Arellano (2003) states that emerging sovereigns with relatively smaller tradable sectors have a larger probability to default on their dollar denominated debt. To grow the tradable sector however these sovereigns require FDI, which in may be difficult to attract due to volatile foreign exchange in such markets (Borensztein et al. 1998). Calvo and Mishkin (2003) found that foreign currency liability may lead to stress when a sovereign currency depreciates. This increases the probability of default by a sovereign, especially for emerging markets, which leads to a downgrade of the sovereign rating (Reinhart 2002). This cycle of sovereign credit ratings, FDI, portfolio capital flow and currency depreciation was observed in some other studies especially in emerging markets during the currency crises of East Asia (Reisen and von Maltzan 1998; Reinhart 2002; Kräussl 2005).

2.2.2 *The significance of sovereign credit ratings*

Foreign capital inflows assists emerging markets to finance budget deficit, build markets and implement monitory policy (IMF 2007). Middle income countries, in emerging markets especially, increase their external borrowing and see an increase in FDI during the good times. In addition, spending increases during the good times, which allows the emerging markets to build their economic competency in global trade, leading to a further requirement for foreign capital (Lav and Berube 1999).

When exactly are the good times for these emerging markets? The good times for sovereigns are identified as when access to foreign capital is possible (Reinhart 2002). Foreign currency can be accessed through a number of ways. While traditionally this was through the trading of goods between sovereign states, financial markets have grown quite significantly over the years. South Africa, for example, paid 2% of GDP in net foreign dividends in the first half of 2007 compared to 1.6% for the whole year in 2006. This has seen the JSE Limited (JSE) be given a mandate by the South African Finance Minister to establish a ZAR currency futures market to improve liquidity in the domestic market for foreign currency (SARB 2008).

Other means of accessing foreign capital involve entering into future financial obligations by the sovereign through the selling of debt and stock in the international market. Investors, especially USA investors, prefer rated investments over unrated ones of the same risk (Cantor and Packer 1996).This has necessitated sovereigns to seek a rating for their debt and stocks in order to access foreign capital inflows, which has seen an increase in rated sovereign governments by Standard and Poor's from 11 in 1980 to over 100 by 2004 (Chambers 2004). In an event study and panel regression analysis Kräussl (2003) found that the rating agencies have substantial influence on the size and volatility of emerging market lending. The implications are that the sovereign credit rating upgrade results in both increased and more stable demand for bonds and stocks of a rated sovereign while potential investors decline significantly where a downgrade in rating is announced for below-investment rating (Kräussl 2005). Sovereign credit ratings not only facilitate access to foreign capital, but also the terms of access to such capital (Reinhart 2002). In addition to the financial intermediary sector development encouraged by long-term foreign currency ratings, long-term local currency ratings have been found to stimulate domestic market growth (Kräussl 2005).

In the study of the relationship between the sovereign and corporate risk Peter and Grandes (2005), found that sovereign risk appears to be the single most important determinant of corporate default premia in RSA. The implication is that the sovereign credit rating not only determines the access to foreign capital

by the sovereign but is also the most important determinant of corporate access to international debt.

2.2.3 *Interpretation of the sovereign credit ratings*

Three well known international rating agencies will be discussed in this study, namely Fitch, Moody's and Standard and Poor's. These agencies apply an ordinal scale in assigning sovereign credit rating. In broad terms there are two categories of ratings namely investment grade and non-investment grade. Two types of sovereign credit ratings namely, short and long-term, based on the time of maturity of the rated security can also be identified. Long-term ratings are those that have more than 13 months to maturity, while short-term rated securities are those that will mature within 13 months. Each symbol in one agency has an equivalent counterpart in the other agency (Fitch 2007; Moody 2007; S&P 2007).

Fitch's highest long-term rating is **AAA** denoting the lowest expectation of credit risk to **D** where an entity has defaulted. Short-term ratings begin with **F1** for the highest credit quality to **D** for an entity that has defaulted on all its financial obligations. Plus (+) or minus (-) modifiers may be appended to long-term ratings categories between **AAA** to **CCC** and short-term categories rated **F1** to indicate their relative status within the category (Fitch 2007).

Moody's long-term ratings start at Aaa for obligations judged to be of the highest quality, with minimal credit risk, to **C** for the lowest rated class with little prospect for recovery of principal or interest. Long-term ratings are further enhanced through appended modifiers 1, 2, and 3 for ratings between **Aa** through to **Caa** to indicate relative ranking within each rate. Short Term ratings range from **P-1** (Prime-1) for issuers with superior ability to repay short-term debt obligations to **NP** (Not Prime) for issuers with a high risk to honour short-term debt obligations (Moody 2007).

Standard and Poor's long-term ratings highest rating is **AAA**, for issuers with the extremely strong capacity to meet financial obligations, to **D** for an obligation in default. The ratings from **AA** to **CCC** may be modified by the addition of a

plus (+) or minus (-) sign to show relative standing within the major rating categories. Short-term ratings start from the highest **A1** for obligors with the highest capacity to meet short term financial commitments to **D** for Short-term obligations in default (Standard and Poor 2007). Tables 1 summarise the long and short-term rating categories for the three rating agencies.

Table 1: Agency International Credit Rating Scales

	Moody's		S&P		Fitch	
	Long Term	Short Term	Long Term	Short Term	Long Term	Short Term
Investment Grade	Aaa	P-1	AAA	A1+	AAA	F1+
	Aa1		AA+	A-1	AA+	F1
	Aa2		AA		AA	
	Aa3		AA-		AA-	
	A1		A+	A-2	A+	F2
	A2	P-2	A		A	
	A3		A-		A-	
	Baa1		BBB+	A-3	BBB+	F3
	Baa2	P-3	BBB		BBB	
	Baa3		BBB-		BBB-	
Speculative Grade	Ba1	Not Prime	BB+	B-1	BB+	B
	Ba2		BB		BB	
	Ba3		BB-		BB-	
	B1		B+		B+	
	B2		B		B	
	B3		B-		B-	
	Caa1		CCC+	B-3	CCC+	C
	Caa2		CCC		CCC	
	Caa3		CCC-		CCC-	
	Ca		CC		CC	
	C		C		C	
			D	D	D	D

Source: (Fitch 2007; Moody 2007; S&P 2007)

2.3 Foreign exchange rates

Foreign trade, investments and international borrowing involves payment for goods, investments or debt in foreign currency by the exporter, investee or

debtor (Cantor and Packer 1995). The foreign importer, investor or lender on the other hand needs to change their foreign currency to local currency in order to conclude a transaction with a local sovereign or entity. In changing their foreign currency to a local currency, a foreign importer, investor or borrower has to pay a certain price to acquire the local currency. This price paid for the foreign currency is called an exchange rate. The acquisition of foreign currency is facilitated through a foreign exchange market which does not have a specific location in the world (Mohr and Fourie 2000)

2.3.1 *Determinants of foreign exchange rate*

Like any other commodity, currency is driven by demand and supply, with the price the market is prepared to pay for the currency going up (appreciating) when demand outstrips supply and vice versa. Demand for currency is, however, derived. This is due to the currency being a means to facilitate a conclusion of a primary need between two parties, be it for transactional purposes, as a store of wealth or for speculative investment purposes (Mohr and Fourie 2000).

While traditionally the transactional purpose was the driving force for currency demand, this has changed with over US$430 billion of currency exchanged a day worldwide in 1989, 95% of which was non-transactional (Frankel and Froot 1990). Frankel and Froot (1990) found that currency crashes, defined as the 25% nominal depreciation of the local currency against a basket of other currencies, tend to occur when output growth is low, growth in domestic debt is high and a level of foreign interest rates is high. To elaborate further, internationally competitive output growth in tradables results in high demand for the sovereign's goods and increased transaction between the sovereign and other sovereigns and multinationals. Interest differentials of a sovereign against the foreign interest rates on the other hand, encourages flow of capital to the sovereign in that investors anticipate relatively higher returns from the high interest rate sovereign (Frankel and Froot 1990). In order to access both the sovereign goods and high interest rates, however, local currency should be acquired by the foreign entities, resulting in high demand for the local currency

and subsequent increase in the local currency's relative price (Mohr and Fourie 2000).

The demand in local currency can also be influenced through deliberate effort of a sovereign government or speculative investors (Mohr and Fourie 2000). In instances where the local currency is under speculative attack, a sovereign government may create demand of its own currency through the exchange of foreign currency reserves with the local currency (Frankel and Rose 1996). Little evidence however has been found that this intervention by the central bank decreases expected exchange rate volatility arising from speculative trading in the local currency (Bonser-Neal and Tanner 1996; Cantor and Packer 1996).

For the ZAR, foreign exchange rate can be defined through a number of variables. Commodity price movements, productivity and real interest rate differentials, openness of the trade, the size of the fiscal balance, the country's net foreign assets, ratios of investment and net capital inflows to GDP (Aron et al. 2000; Sarno and Taylor 2002; Macdonald and Ricci 2003; Ngandu 2005; Arora 2007). These are some of the variables that were established to have an impact on the sovereign credit rating, FDI and portfolio inflow emphasising the commonality of fundamental determinants of a sovereign risk and foreign exchange rate.

2.3.2 *The South African economy*

One of the common factors in the currency crises in emerging markets between 1994 and 2000 was that they all had pegged exchange rate regimes (Fischer 2001). While emerging countries with floating currency did not experience any currency crises, a level of control is still exercised in the floating currency regime through inflation targeting and interest rate control (Fischer 2001). Indeed it has been established that less flexible exchange rates regimes are strongly associated with slower growth and output volatility in developing markets (Levy-Yeyati and Sturzenegger 2003). Slow growth rate reduces the countries ability to attract foreign currency weakening the sovereign's foreign exchange rate due to low demand. Foreign currency is not only required for

transacting and investment purposes. Healthy foreign currency reserves may also be used by a sovereign government to increase demand for the local currency during crises or as a collateral for public bonds issued in the open market (Calvo and Mishkin 2003).

The RSA currency, the Rand, is floated against foreign currencies, meaning it is subject to demand and supply in an open market. Currencies from three Southern Africa countries, namely Lesotho's **Loti**, Swaziland's **Lilangeni** and the Namibian **Dollar**, are tied on par or pegged to the Rand (IMF 2007). RSA is a dominant economy in Sub Saharan Africa, with 7 of the 11 export product categories coming from South Africa (IMF 2007). In addition to that RSA is a member of the 5 strongest emerging markets, the outreach-5. RSA also accounts for 60% and 70% of Southern Africa Development Community (SADC) intra regional export and GDP respectively (IMF 2007). This makes RSA the dominant regional block and the ZAR one of the most highly trader emerging market currencies. While the South African currency is floated, inflation targeting and fiscal management through interest rates brings some level of control on the foreign exchange rate (SARB 2007). RSA is rated by all three rating agencies and due to the country's improved financial liquidly, there are growing foreign capital inflows, largely from portfolio investment. This has also been influenced by RSA's improved sovereign credit rating (SARB 2007). Foreign capital inflows such as the acquisition of a stake in Standard Bank of South Africa by the Industrial and Commercial Bank of China, saw the ZAR strengthening from R7,48 to R6,51 between the 17th of August and the 26th of October 2007 (SARB 2008). RSA sees foreign currency inflow as an important factor in economic growth, and this has been observed through the mandate by the finance minister to the JSE to improve liquidity through an establishment of a ZAR currency futures market (SARB 2007). The increase in foreign currency inflow to RSA can be observed through an increased foreign trade with exports increasing from R325.1 billion in 2005 to R480.9 billion in the first half of 2007.

2.3.3 *Ratings Actions*

In general, only credit quality changes that are believed to be permanent should result in a credit rating action (Hamilton and Cantor 2004). For the purpose of this study however, credit rating action refers to any rating agencies announcement with regard to a sovereign. The following announcements by the agencies will in essence constitute a credit rating action and will be tested as events that may have an impact on the foreign exchange rate in RSA:

Confirmation of a rating

Confirmations is a formally announced rating by the agencies, entered into database and rating action lists and formally announced through the media (Fitch 2007).

Rating Outlook

A rating outlook is an indication that the risk profile of a credit provider is likely to change. In addition the rating outlook will include an opinion of the agency with regard to the likely direction of the change (positive or negative) (Hamilton and Cantor 2004).

Watchlist

A watchlist is an indication that a credit rating is under active review, with a possible change in the issuer risk profile in a short-term (Fitch 2007; Moody 2007).

2.4 The impact of sovereign credit ratings on the exchange rate

In addition to their assessments of sovereigns capacity and willingness to honour their financial obligations, rating agents also issue an opinion on other debt issuers within the sovereign for capacity and ability to honour financial obligations (Fitch 2007; Moody 2007; S&P 2007). While available literature does not specifically offer much on the sovereign credit ratings impact on foreign

exchange specifically, different studies on the impact of respective ratings on specific securities abound (Hand et al. 1992; Calvo and Mishkin 2003; Lehmann 2004). What follows below is a review of previous studies on international ratings impact on financial instruments.

2.4.1 *Credit ratings action and financial instruments*

In an effort to access capital, different entities including sovereigns have issued debt in the form of bonds and stocks (Reinhart 2002). Credit ratings were found to summarise and supplement information contained in macroeconomic indicators, therefore strongly correlating with the market determined credit spreads (Cantor and Packer 1996). In an examination of market yields on selected sovereign debt issues, it was found that while sovereign credit ratings do assist issuers to gain access to international bond markets, the market does not put much faith in the sovereign ratings when pricing these issues (Cantor and Packer 1996). This however was found not to be the case with non-investment grade sovereign risk, which was difficult to measure. For these issues the market seems to value sovereign credit ratings as they appear to provide information beyond publicly available data (Cantor and Packer 1996). Cantor and Packer (1996) further found statistically significant bond yield movements in an expected direction, following sovereign credit rating announcements. This was found to be much stronger for below investment grade issues. A number of authors have indeed supported this observation. Reinhart (2002) found that credit ratings have been found to have an impact on bond and stock prices.

While sovereign credit ratings have been found to have a significant impact on emerging market sovereign bonds, they have no impact on the USD bond spreads. This is however contrary to the finding by Brooks et al. (2004) that the impact by sovereign credit ratings on returns was significant for both the domestic currency and USD denominated returns irrespective of whether the sovereign was a developed or an emerging market. In addition, negative ratings have potential to dampen private capital inflow, so greatly required by emerging markets (Reisen 1998). This is due to the fact that most investors, especially

USA investors, prefer rated investments against the similar unrated investments. Furthermore the sovereign credit ratings have substantial influence on the size and volatility of emerging market's access to foreign capital through lending (Kräussl 2005). Further studies on credit ratings for different debt types have supported the observation of the impact the ratings have on financial markets. Hand et al (1992) found that rating downgrades especially have an impact on the bond and stock prices.

Markets however sometime react to other announcements and news beside the credit rating announcements (Hand et al. 1992). A study on the chaotic financial environment of Asia between 1997-1998 concurs with this observation (Kaminsky and Schmukler 1999). In addition to credit ratings announcements, movements in the markets were also found to be triggered by local and neighbouring country news as well as news on agreements with international organisations. In addition, market overreaction seems to impact on the movement on market prices (Kaminsky and Schmukler 1999). While bond price movements followed negative watchlisting and rating downgrade announcements, the issue type and issuer nationality were also key factors that determined the magnitude of the price reaction to a negative watchlisting or rating downgrade announcement (Steiner and Heinke 2001). This is not surprising since entity ratings are hardly ever above the rating of a sovereign in which they are domiciled (Chambers 2004). Price reaction were also found to be significantly stronger for downgrades into speculative grades (Hand et al. 1992).

2.4.2 *Credit ratings and currency crises*

In the aftermath of the currency crises in emerging markets between 1994 and 2000, a couple of studies have looked at the rating action prior to and after the currency crises (Reinhart 2002; Mora 2006). A study on the East Asian currency crises, suggest credit rating agencies aggravated the crises by excessively downgrading those countries, further reducing their ability to access foreign capital (Mora 2006). Indeed it has been stated that due to positive rating announcements prior to the Asian currency markets high capital inflows, which

were abruptly withdrawn during the crises, aggravated the currency crises in emerging markets (Kaminsky and Schmukler 1999) . Reisen and von Maltzan (1998) concur with this view by stating that negative sovereign credit ratings have a potential to dampen private capital inflows into emerging markets.

It follows therefore that, with their insight into default risk and subsequent impact on capital flow, rating agencies should have predictable ability for currency crises. Reinhart (2002) however, found this not to be the case in a study on currency crises and sovereign credit ratings. While a strong link between currency crises and default was observed, sovereign credit ratings systematically failed to predict currency crises. Sovereign credit rate downgrades, were found to follow currency crises, suggesting that currency instability increases the default risk (Reinhart 2002). A model on endogenous default risk and its interaction with real exchange rates and income, found that default incentive and price premiums are higher during recession (Arellano 2003). This is further supported by an argument that East Asian crises, in addition to financial market risks, resulted from vulnerability to financial panic that arose from other economic weaknesses (Radelet and Sachs 2000).

It is also argued that rating agencies failed to anticipate currency and banking crises due to the little weight attached to indicators of liquidity, currency misalignments and asset pricing behaviour (Reinhart 2002). Radelet and Sachs (2000) concur by stating that emerging economic weaknesses including short-term debt, a sense of policy missteps and accidents triggered the financial panic in East Asia. A contrasting view however, is that while crisis prone countries are more likely to borrow short-term, a large share of short-term debt has not been a systematic, independent cause of past debt crises (Detragiache and Spilimbergo 2001). Foreign exchange has also been found to react abnormally to sovereign credit rating announcements (Brooks et al. 2004). Both upgrade and downgrade announcements were found to have a significant impact on foreign exchange rates in the expected direction for both developed and emerging markets. While the downgrade announcement was found to have a negative effect on both the national stock market and exchange rate, the upgrade had a positive effect on exchange rate only (Brooks et al. 2004).

2.4.3 *Conclusion on the first sub-problem literature review*

Credit ratings do not only play an important role in determining how a sovereign accesses foreign capital. The ratings have been found to have a significant impact on financial markets price reactions. This has been established not only for private stocks, but for sovereign issued bonds and stocks as well. However financial markets have been found to respond not only to credit rating actions. Other endogenous and exogenous factors, such as the international and neighbouring news as well as macroeconomic fundamentals, have been found to cause financial markets price movements (Boehmer et al. 1991; Hand et al. 1992; Kim and Wu 2007).

Sovereign credit ratings were however found to be lagging market reaction especially as currency movements between 1994 and 2000 confirm. In these cases, sovereign credit ratings were found to follow currency crises instead of predicting such crises. It may be argued however, as stated by Reinhart (2002) that because of their long-term view sovereign credit ratings fail to capture short-term liquidity factors that affect foreign exchange, but Detragiache and Spilimbergo (2001) argue that the short-term liquidity issues do not independently affect debt crises. The part played by sovereign credit ratings on financial markets, however, may not be ignored. In emerging markets, with very little information on which to make decisions, the markets depend on the sovereign credit ratings to guide movement of capital flow. This is clear from the price reactions in low grade rated markets to rating actions. In RSA sovereign risk has been found to also be the single most important determinant of corporate default premia (Peter and Grandes 2005). Brooks et al. (2004) also found that sovereign credit ratings, especially downgrades, are a key to a counties financial survival in that they negatively impact both the national stock markets as well as the exchange rate. Upgrades on the other hand impacted the exchange rate positively.

2.4.4 *Hypothesis 1*

The null hypothesis, H_0, to be tested is that sovereign credit rating actions have no impact on the return on ZAR against the USD exchange rate.

The alternative hypothesis, H_A, to be tested is that sovereign credit rating actions have an impact on the return on ZAR against the USD exchange rate.

H_0: $CAAR_t = 0$

H_A: $CAAR_t \neq 0$

Where:

$CAAR_t$ = the cumulative average abnormal return on the ZAR against the USD exchange rate.

2.5 The impact sovereign credit ratings on the exchange rate volatility

2.5.1 *Exchange rate volatility*

In a study on signals for currency crises in RSA, a number of factors that lead to foreign exchange volatility in emerging market economies such as that of RSA are identified (Knedlik 2006). The foreign exchange rate volatilities in emerging markets are attributed to the smaller size of the emerging market economies, where foreign exchange transactions have a greater impact on exchange rates. Added to that the risk associated with emerging market macroeconomics and political stability, the volatilities in emerging markets foreign exchange can understandably be expected.

One of the arguments for fixed exchange rates is that, where exchange rate movements lead to exchange rate volatility, risk averse investors tend to keep their investments in domestic markets (Dell'Ariccia 1999). The consequences for emerging markets of course are that financial markets and foreign capital flow will dry up, which may result in panic withdrawal of investment. This may increase the exchange rate volatility for floating currency markets, which may evolve into currency crises (Knedlik 2006). Currency crises on the other hand increase the incentive for developing markets to default on their debt with the resultant credit rating downgrades (Reinhart 2000) .

Investments especially FDI, tend to flow into a sovereign where foreign exchange is stable (Ahmed et al. 2005). Indeed while the ZAR has been one of the volatile currencies in the developing economies, with the peak in foreign exchange depreciation between 2001 and 2002, capital flow has been biased towards portfolio investment. Between 1994 and 2002 RSA has seen 1.5% of Gross Domestic in FDI compared to 3.5% in portfolio investment (Ahmed et al. 2005). The impact of this is that while the capital flow has been increasing the long-term crisis resilient investment in the form of FDI has been low. This opens the economy to the potential panic withdrawal portfolio investment previously experienced in East Asia (Reisen and von Maltzan 1998).

2.5.2 *Foreign Capital flow and Sovereign credit ratings*

Using the 1997 East Asian and 1994-1995 Mexican crises on the Granger causality test, it was found that emerging market economies are vulnerable to financial crises associated with excessive reversal of capital inflows leading to foreign exchange volatility and currency crises as stated above (Reisen and von Maltzan 1998).

Reisen and von Maltzan (1998) further found that sovereign credit ratings had a significant impact on emerging market sovereign bonds, while none was established for USD bond spreads. Sovereign credit ratings have been found to have a significant impact on emerging market sovereign bonds, in addition to negative ratings being found to potentially dampen private capital inflow, so greatly required by emerging markets.

In view of the panic withdrawals that may lead to currency crises, FDI is punted as a safer way to finance investment compared to portfolio investment (Frankel and Rose 1996). An argument for FDI is that investments are directly tied to real production investment, making it difficult for panic withdrawal. Portfolio investment, on the other hand, finances consumption and does not increase capacity necessary to generate export earnings and is easier to withdraw where there is an indication of possible crises. Capital outflow (in a panic) was found to have exacerbated the currency crises in East Asia (Radelet and Sachs 2000). The strongest argument for FDI is that it promotes stability, compared to

portfolio investment capital, in that in the event of looming crises, investors can swiftly withdrawn their capital while FDI cannot be quickly packed up during crises (Frankel and Rose 1996). It is also stated that in addition to reserves being low, domestic credit growth being high, interest rates rising and real exchange rate showing over-valuation, crises tend to occur when FDI flows dry up (Dimson and Marsh 1986). The foreign exchange volatility between 1998 and 2006, measured by a six months standard deviation of changes in the nominal exchange rate, was indeed associated with the market turbulence that started in the 4th quarter of 2002 in South Africa (Arora 2007).

2.5.3 *Conclusion on the second sub-problem literature review*

While sovereign credit ratings promote excess to capital inflows especially to emerging markets (Reinhart 2002), they may be promoting more of short-term portfolio investment. Portfolio investment unlike FDI, in emerging markets, is prone to panic withdrawal that may result in the currency crises and subsequent default witnessed in East Asia (Radelet and Sachs 2000). This leads to further downgrades of the sovereign's credit rating that may lead to deepening currency crises. FDI on the other hand, not only promotes capital inflows into the economy, but also promotes stability in the market. One of the conditions for growth in FDI however is foreign exchange stability. Indeed fluctuations in foreign exchange rate may destruct trade flow and deter portfolio investment associated which such trade flow.

2.5.4 *Hypothesis 2*

The null hypothesis, H_0, to be tested is that sovereign credit rating actions have no impact on the ZAR against the USD exchange rate volatility.

The alternative hypothesis, H_A, to be tested is that sovereign credit rating actions have an impact on the ZAR against the USD exchange rate volatility.

H_0: $A\sigma = 0$

H_A: $A\sigma \neq 0$

Where:

Aσ = the average volatility, represented by the standard deviation, of the log of change in the daily ZAR against the USD exchange rate.

2.6 Conclusion of Literature Review

Sovereign credit ratings do not only play an important role in determining how a sovereign accesses foreign capital. In addition to having a significant impact on financial market price reactions, the sovereign risk has been found to be the single most important determinant of corporate default risk. Impact of rating actions on bond and stock prices has been established in previous studies (P. Liu and Thakor 1984; Hand et al. 1992; Cantor and Packer 1996; Hite and Warga 1997). However, financial markets have been found to respond not only to credit rating actions, other endogenous and exogenous factors such as the international and neighbouring news as well as macroeconomic fundamentals have been found to cause movement in financial markets prices (Frankel and Froot 1990; Hand et al. 1992; Mora 2006).

Sovereign credit ratings were also found to be lagging market reaction especially in the light of currency movements of 1994 to 2000. In these cases, sovereign credit ratings were found to follow currency crises instead of predicting such crises. It may be argued however that because of their long-term view sovereign credit ratings fail to capture short-term liquidity factors that affect foreign exchange (Reinhart 2002), but Detragiache and Spilimbergo (2001) argue that the short-term liquidity issues do not independently affect debt crises. The part played by sovereign credit ratings on the development of financial markets, however, may not be ignored. In emerging markets, with very little information on which to make decisions, the markets depend on the sovereign credit ratings to guide movement of capital flow. This is clear from the very price reaction in low grade rated markets to rating action.

While sovereign credit ratings promote excess to capital inflows especially to emerging markets (Reinhart 2002), they may be attracting the type of investment not really beneficial to emerging markets. Indeed, as pointed out,

panic withdrawal of investment capital resulted in the currency crises in East Asia (Kaminsky and Schmukler 1999; P. Liu, Seyyed, F. J. and Smith, S. D 1999). FDI on the other hand not only promotes capital inflows into the economy, but is a type of investment that promotes stability in the market. Swift withdrawals of capital from emerging markets lead to foreign exchange volatility that may result in currency crises, with a potential for default. This leads to further downgrades of the sovereign's credit rating that may lead to deepening currency crises. In such an environment of high currency volatility, FDI tends to be the lowest, with a decline in trade flow and associated portfolio investment.

3 RESEARCH METHODOLOGY

3.1 Research methodology /paradigm

Quantitative research uses techniques that are likely to produce quantified and sometime generalised conclusions to study the relationship between facts (Bell 2005). This study on the impact of sovereign credit ratings on foreign exchange rates in RSA, lends itself to quantitative research methods as it concerns the establishment of the significance of one independent variable (sovereign credit rating action) on another dependent variable (foreign exchange rate) (De Vos 2002). Event study methodology, widely used in economic and financial research as described by Bowman (1983), was used for this study. Event studies compute the reaction of a dependent variable on the occurrence of an independent variable (Bowman 1983). For this study rating action events were tested for their impact on the foreign exchange rate in RSA.

3.2 Research Design

3.2.1 *Event study methodology - design*

An event study is described as the study of an impact of a specific event on market performance (MacKinlay 1997). Indeed a number of authors have employed event studies to study the impact, specifically of credit rating actions on financial markets (Hand et al. 1992; Steiner and Heinke 2001; Lehmann 2004). It is an important and methodological approach also known as performance index tests, residual analysis and abnormal return analysis (Brown and Warner 1980, 1985; McWilliams and McWilliams 2000).

A general flow of steps for event studies as identified by Brown and Warner (1980, 1985) and applied by McWilliam and McWilliam (2000) were followed in carrying out this study. These steps are identified below:

a. Identify the event/s of interest

In event studies, the event could either be a single event which occurs at one calendar time or a type of event which might occur frequently at different calendar times. The event of interest is one that gives rise to a flow of new information into the market (McWilliams and McWilliams 2000). In this study the events that give rise to new information flowing into the market are sovereign credit rating actions. These include sovereign credit rating announcements, watchlisting and outlooks.

b. Identify the event window

In order to accumulate these types of events together in a single study, event studies introduce the concept of "event time" and event window. Numerous similar events occurring on different calendar dates are combined by standardising when they take place. Standardisation is achieved by designating the event date, irrespective of its actual calendar date, as "Day 0" or "Month 0". Any period around the event date will then be designated relative to the event time (Boehmer et al. 1991). For example, one month after the event date would be designated as Month +1.The event window is the period over which the impact brought on by the event is expected to last. This includes both the periods prior to (in anticipation of the event) and after the event takes place (in reaction to the event). In previous studies, abnormal returns have been observed for periods as long as 100 days prior to and 90 days after a rating action (Steiner and Heinke 2001).

To capture the impact of the sovereign credit ratings on foreign exchange rates in RSA, the study looked at 20 days prior to and 20 days after sovereign credit rating actions by Fitch, Moody's and Standard and Poor's.

c. Abnormal reaction to event

In order to establish the impact of an event on a financial instrument, a measure of abnormality has to be established around the event window (Brown and Warner 1980; MacKinlay 1997). Both hypotheses, for this study were tested through the event study methodology. In the first event study, the impact of

sovereign credit rating action on the returns realised on the ZAR exchange rate against the USD were tested, while the second event study tested the impact of sovereign credit rating action on the volatility of the ZAR exchange rate against the USD.

Test for Hypothesis 1

To test the first hypothesis, the abnormal return on ZAR against the USD was tested for significance. In order to establish an abnormal return of the ZAR against the USD, a benchmark measure representing the normal return was established (Brown and Warner 1980; Steiner and Heinke 2001). The abnormal return is the difference between the actual return and the benchmark or expected return (Brown and Warner 1985). Brown and Warner (1985) identified three models for the determination of expected return. The difference between the three models is that briefly outlined below:

- The Mean Adjusted Return Model assumes that the ex ante expected return for a given security *i* is equal to a constant K_i, which can differ across securities.

- Market Adjusted Return Model assumes that ex ante expected returns are equal across securities, but not necessarily constant for a given security.

- Market and Risk Adjusted Model presumes that some version of the Capital Asset Pricing Model generates expected returns (Brown and Warner 1980).

Differences between methodologies is quite small, where abnormal return was present (Brown and Warner 1980) and therefore the type of model used to determine the expected returns is immaterial. For the purpose of this study Mean Adjusted Return Model was used to determine the benchmark expected return. The abnormal return was calculated as the difference between the observed return, during the event window of -20 through to +20 days, and the benchmark or expected return (Brown and Warner 1985). The abnormal return (A_t) for each day, *t* during the event window was calculated as:

$$A_t = R_t - K_t \quad (1)$$

Where, R_t is the observed return on the ZAR exchange rate against the USD at time *t* and K_t is the mean expected ZAR exchange rate against the USD return over the window period. Two approaches were adopted for the computation of the expected Mean Adjusted Return and excess returns for each approach were computed separately. The first approach used the Equilibrium Exchange Rate (EER) of the ZAR against the USD as the proxy for the baseline exchange rate on which return was to be earned. The second approach used the preceding day's exchange rate (E_{t-1}) as the baseline exchange rate on which the return is earned on day t. The common feature of the two approaches is that an average constant return K_t is expected over a period of time. The major difference between the two approaches is that one, the EER, is premised on the fact that the nominal exchange rates should move to equate prices between countries (Stephens 2004). For as long as the prices drift away from the relative price equity, the exchange rate will move to restore parity. Return is therefore earned on that exchange rate level expected to restore parity for as long at there is no equity in prices. The second approach is premised on the fact that as long as there is volatility in exchange rate, the holder of a currency denomination is rewarded for holding on to the currency for one day.

Return on EER approach

While there are a number of ways to calculate the EER the direct estimate of Purchasing Power Parity (PPP) was used in this study (Brook and Hargreaves 2000; Macdonald and Ricci 2003; Stephens 2004; Rime et al. 2007). The EER according to absolute PPP, which equates the price of goods and services across countries was estimated as (Stephens 2004)

$$s_t + c = p_t^* - p_t \quad (2)$$

Where s_t is the log nominal exchange rate, p_t is the log domestic price level, p_t^* is the log foreign price level and *c* is a constant, representing the permanent deviation from absolute PPP due to productivity differentials. Borrowing from McDonald (2000) and Brook and Hargreaves (2001), the log of Gross Domestic

Product (GDP) per capita was used as a proxy for productivity differential such that the constant *c*, was estimated as:

$$c = \log GDP^* - \text{Log } GDP \quad (3)$$

Where GDP is the local per capita GDP and GDP * is the foreign per capita GDP.

The mean expected return earned on EER was estimated as the mean of the expected daily returns K_d, over a 30 day period preceding the event window (-21 through -50)

$$K_t = \frac{1}{30}\sum_{d=-21}^{-50} K_d \quad (4)$$

Return on preceding day approach

The mean expected return over the window period, using the return on the preceding day nominal exchange rate approach was estimated as the mean of the expected daily returns K_d, 120 days prior to the event date. To ensure that the event period does not prejudice the estimated expected return, the event window should be excluded from the estimation period (Brown and Warner 1985). For this study the estimation period used was 120 days prior to the event date until day 21 before the event window (-120 through -21)

$$K_t = \frac{1}{100}\sum_{d=-21}^{-120} K_d \quad (5)$$

Where K_d, is the lognormal change in daily exchange rate.

$$K_d = \log E_t - \log E_{t-1} \quad (6)$$

Where E_t is the nominal daily exchange rate on day t.

Organizing and grouping the abnormal returns

Borrowing from the methodology used by other researchers(Hand et al. 1992) the daily abnormal returns for each window period were averaged to an

Abnormal Average Return (AAR_t) for each event day and the AAR_t for the event window was computed as

$$AAR_t = \frac{1}{n}\sum_{t=n}^{1} At \quad (7)$$

Where n is the number of events for which AAR_t was computed.

The cumulative average abnormal return, $CAAR_{t,}$ for each day of the window period from -20 through to+20 was computed as

$$CAAR_t = \sum_{t=n}^{-20} AARt \quad (8)$$

Where n is the number of days from the event day 0, from -20 through +20.

Test for statistical significance

To test if the event had an impact on abnormal returns of the ZAR against the USD, test statistics, were carried out on $CAAR_t$ prior to and after the announcement date a well as on the actual announcement date, to tests if they were significantly non-zero (Steiner and Heinke 2001). Table 2 lists some of the statistical tests that may be used to establish whether the $CAAR_t$ were significantly non-zero. Following on previous studies that found non-parametric tests to be ill specified while the t-statistics were accurate in analysing abnormal performance, the t-statistic test was used for this study (MacKinlay 1997).

Table 2: Applied parametric and non-parametric t-test statistics.

Statistical test	Statistic for daily abnormal returns	Statistic for cumulative abnormal returns
Simple t-test	$t = \sqrt{N}\dfrac{\mathrm{DAR}_t}{\sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(\mathrm{AR}_{it}-\mathrm{DAR}_t)^2}}$	$t = \sqrt{N}\dfrac{\mathrm{CDAR}_{km}}{\sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(\mathrm{CAR}_{ikm}-\mathrm{CDAR}_{km})^2}}$
Brown and Warner (1985) t-statistic	$t_{\mathrm{BW}} = \dfrac{\sum_{i=1}^{N}\dfrac{\mathrm{AR}_{it}}{\sqrt{\sum_{t=k}^{t=m}\left(\mathrm{AR}_{it}-\frac{1}{\lvert m-k\rvert+1}\sum_{t=k}^{t=m}\mathrm{AR}_{it}\right)^2}}}{\dfrac{m-k}{\sqrt{N}}}$	$t_{\mathrm{BW}} = \dfrac{\sum_{i=1}^{N}\dfrac{\mathrm{AR}_{it}}{\sqrt{\sum_{t=k}^{t=m}\left(\mathrm{AR}_{it}-\frac{1}{\lvert m-k\rvert+1}\sum_{t=k}^{t=m}\mathrm{AR}_{it}\right)^2}}}{\dfrac{m-k}{\sqrt{(m-k+1)N}}}$
Wilcoxon sign rank test	$z = \dfrac{W^+ - \frac{N(N+1)}{4}}{\sqrt{\frac{N(N+1)(2N+1)}{24}}}$	
Corrado (1989) rank sum test	$z_{\mathrm{C}} = \dfrac{\frac{1}{\sqrt{N}}\sum_{i=1}^{N}\left(\frac{K_{it}}{1+M_i}-0.5\right)}{\sqrt{\frac{1}{G}\sum_{t=1}^{G}\left(\frac{1}{N}\sum_{i=1}^{N}\left(\frac{K_{it}}{1+M_i}-0.5\right)\right)^2}}$	$z_{\mathrm{C}} = \dfrac{\frac{1}{\sqrt{N}}\sum_{i=1}^{N}\sum_{t=k}^{m}\left(\frac{K_{it}}{1+M_i}-0.5\right)}{\sqrt{(m-k+1)\frac{1}{G}\sum_{t=1}^{G}\left(\frac{1}{\sqrt{N}}\sum_{i=1}^{N}\left(\frac{K_{it}}{1+M_i}-0.5\right)\right)^2}}$

Where t, statistic of simple t-test; t_{BW}, Brown and Warner (1985) t-statistic; z, Wilcoxon z; W^+, sum of ranks belonging to positive abnormal returns; N, number of observations; z_{C}, Corrado (1989) z; K_{it}, individual rank K of abnormal return of bond i on day t; M_i, number of non missing values of bond i; G, maximum rank.

Hypothesis 2

Exchange rate volatility

For the second event study, the impact of sovereign credit rating actions on the ZAR exchange rate against the USD volatility was tested. The first step was to identify a variable that represents volatility. The standard deviation of the first differences of the logarithmic ZAR against the USD exchange rate, used previously as the indicator for volatility (Reisen and von Maltzan 1998) was used.

$$\sigma = \sqrt{\frac{\sum(E_t - E_{tm})^2}{(20-1)}} \tag{9}$$

$$E_{tm} = \frac{1}{20}\sum_{t=-1,+20}^{-20,+1} E_t \tag{10}$$

$$E_{tm} = \log (E_t - E_{t-1}) \tag{11}$$

Where E_t is the observed daily change in logarithmic exchange rate, E_{tm} is the mean of observed daily change in logarithmic exchange rate.

Organizing and grouping the abnormal returns

The average volatility before and after the event date were computed for each event period as

$$A\sigma = \frac{1}{n}\sum_{t=n}^{1} \sigma \qquad (12)$$

Where n is the number of events for which Aσ was computed.

Test for statistical significance

Similar t-test statistics as discussed above, were carried out for the period prior to and after the event date to tests if average volatility, Aσ was significantly non-zero.

3.2.2 *Event Study methodology – some limitations*

Limitations of event study methodology have been identified by a number of authors. Four of these limitations which were identified as potentially having an impact on this study are highlighted below:

- Boehmer et al (1991) argue that event studies are naive and intrinsically univariate, in that they do not quantify the impact of an event on a financial instrument being studied. Indeed in this study a correlation between the sovereign credit rating action and the ZAR exchange rate against the USD is not quantified.
- MacKinlay (1997) points to a number of possible biases that can arise in the context of conducting an event study, the most important being nonsynchronous trading. Nonsynchronous trading in this study arises when the daily foreign exchange rates recorded by the South African Reserve Bank are taken to be recorded at the same time daily. This may not be the case and given the movement of currency exchange rate even in a single day, this may skew the findings of this study.

- Kräussl (2005) identifies the importance of intervention of authorities in defending a currency under speculative attack as one aspect that may be missed when studying currencies in event studies. For this study this refers to a simultaneous sovereign credit rating action and authority's intervention resulting in the contamination of the studies event. The impact of contaminating announcements, in event study methodology, was further emphasised by Hand et al (1992). As far as it was possible such events were identified, through a search of media releases by authorities such as the Department of Finance, SARB, the IMF, the US Federal Reserve Bank and the World Bank. Where such releases were identified on days -1, 0 and +1, the event was considered as contaminated. While this may assist with identifying such contaminating events, these are not the only sources of foreign exchange market information.

- Parametric test statistics such as the t-statistics, assume normal distribution of excess returns. Daily returns have been found to be far from normally distributed, the excess returns however, have been found to be close enough to or are normally distributed (Brown and Warner 1985). This was found to improve as more securities were added to the analysis; this study however uses a single security represented by the ZAR against the USD exchange rate.

3.3 Population and sample

3.3.1 *Population*

The research population for this study comprises all the credit rating actions (short-term and long-term as well as the foreign and local currency) announced by Fitch, Moody's and Standard and Poor's on RSA, as well the daily ZAR against the USD exchange rates, annual Consumer Price Index (CPI) for RSA and the USA and the annual per capita GDP for RSA and the USA.

3.3.2 *Sample*

The sample used in this study is all the sovereign credit rating actions (Short-term and long-term as well as the foreign and local currency) announced by Fitch, Moody's and Standard and Poor's on RSA as well the daily ZAR against the USD exchange rates, annual CPI for RSA and the USA and the annual per capita GDP for RSA and the USA between 1994 and 2007.

The data is restricted to the years between 1994 and 2007 to coincide with the new dispensation in RSA. This was done to eliminate the apartheid years and the effect of the political dispensation, such as sanctions associated with RSA prior to the first democratic elections in 1994.

a. Exclusions of events

Sovereign credit rating actions on RSA between 1994 and 2007 are the main determinants of sample data used for this study. The three rating agencies namely Fitch, Moody's and Standard and Poor's are independent entities. This sometime culminates in the rating agencies making simultaneous announcements within the same 40 day window period of an event. To reduce the impact of sovereign credit rating action cross contamination, where two or more rating actions take place within the window period, the first rating action was taken as the rating action to be tested. This resulted in the number of rating actions studied reduced from 25 to 21. Figure 1 presents the number of events studied and the total number of rating actions by the rating agencies, while the detailed rating actions by respective agencies are presented in Appendix A.

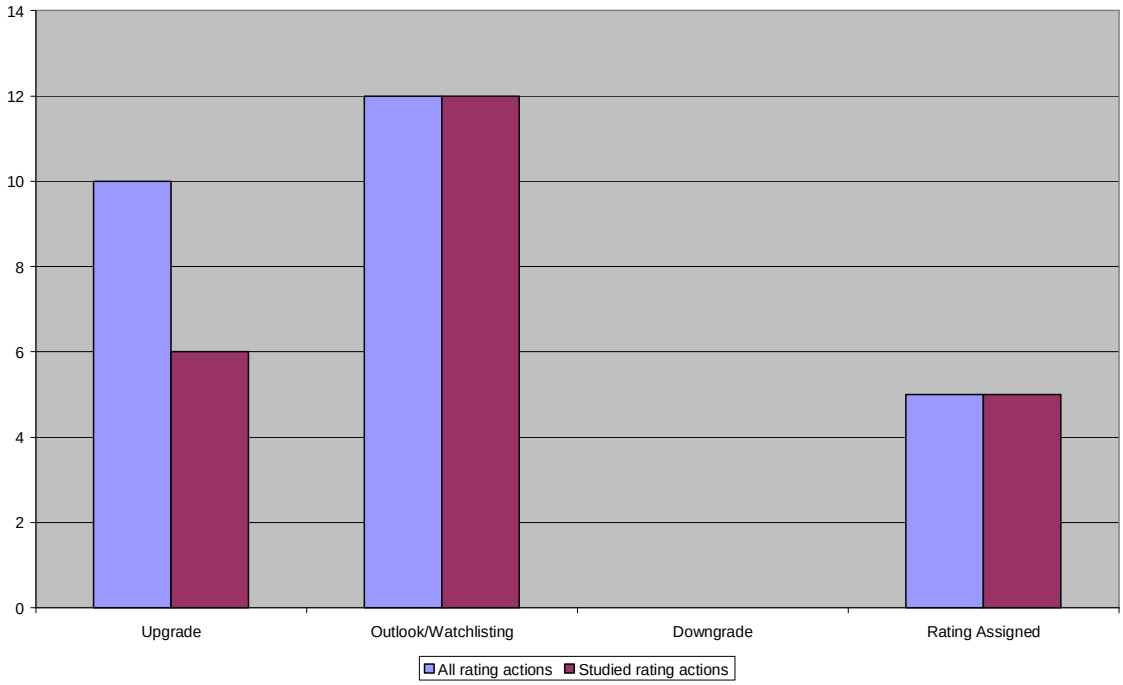


Figure 1: Rating actions on RSA between 1994 and 2007

b. Contaminated events

Hand et al. (1992) highlighted the impact of contamination in their studies where a contaminant announcement or event accompanying the event had an impact on the results achieved. Intervention on foreign exchange has indeed been noted as a contaminant in studies on foreign exchange rate movements. Where an announcement on the movement in the interest rates for example, made around a sovereign credit rating announcement, it becomes unclear where the impact on the foreign exchange rate may be attributed, making the event contaminated. To counter this effect of contamination of events, a scan of simultaneous announcements, especially government fiscal and monetary policy announcements, was carried out around the event date. Figure 2 presents the contaminated events in comparison to all events included in the study.

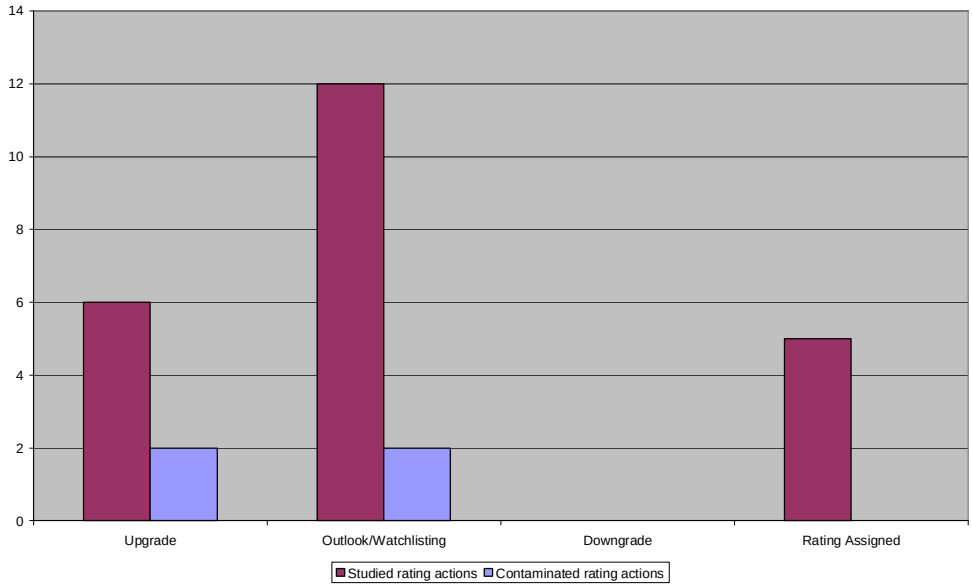


Figure 2: Contaminated Rating actions against entire rating action sample on RSA between 1994 and 2007

3.4 Data collection

The following data, necessary for analysis of the impact of sovereign credit rating on the ZAR foreign exchange rate to USD were required:

- All the sovereign credit ratings actions data was collected from the historical databases of Fitch, Moody's and Standard and Poor's. The rating actions announcement release dates, representing the event date were captured.

- Historical daily spot ZAR against the USD exchange rate data was sourced from the IMF database. The data was compared to the source data at the SARB who collate the daily exchange rate data for validation.

- Yearly CPI data, representing the national price levels for the USA and RSA were sourced from the IMF historical databases. The data were compared to the United States and South African economic data collection statutory agencies for validation. Where the data were found to be in conflict the national statistical data statutory body was used. For the

USA the Economic Research Division of the Federal Reserve is the authority while Statistics South Africa is the RSA equivalent.

- Yearly per capita GDP data were used as a proxy for productivity of the traded goods sector and to calculate the "c" in equation 3. The GDP per capita data were sourced from the IMF historical databases. The data were compared to the USA and RSA economic data collection statutory agencies for validation as explained above.

Appendix B describes in details the data used for this study as well as the source of each data set.

3.5 Data analysis and interpretation

To test for evidence to reject or in support of the null hypothesis, the t-value statistics were carried out. For this study the test statistics for the mean, where the t-value which is an indication of how many standard errors the sample mean is from the true mean represented by the null hypothesis value for each event window period were used (Albright et al. 1998). The t-value was calculated for each sovereign credit rating announcement on RSA by Fitch, Moody's and Standard and Poor's.

Sample Mean

For each event, represented by sovereign credit rating announcement or action on RSA, the sample mean was calculated. During each rating action window period:

- For the first hypothesis, the sample mean is represented by the Cumulative Average Abnormal Return (CAAR) of the ZAR against the USD exchange rate, before, during and after a rating announcement.

- For the second hypothesis, the sample mean is represented by the mean volatility (mean standard deviation of changes in logarithm exchange rate) before and after the event date.

Separate analysis of event type

To further analyse the impact of each sovereign credit rating announcement on the foreign exchange rate, event types, represented by an upgrade and outlook or watchlisting were analysed separately. Separate analyses on the rating actions by respective agencies were also carried out to establish the impact of each agency's rating action on the ZAR against the USD exchange rate.

Test statistics

For hypothesis 1, CAAR's prior to a rating announcement, on the day of an announcement and after an announcement were tested for statistical significance at 1%, 5% and 10% significance levels to determine if they were statistically equal to zero, in which case the null hypothesis was accepted as above or below zero in which case the null hypothesis was rejected.

Statistical significance of the average volatilities before and after the event date was tested for hypothesis 2. The null hypothesis was accepted where the average excess volatility was statistically equal to zero and rejected if statistically above or below zero.

Event contamination

Following Hand et al (1992) treatment of contaminated events, statistical analysis of the data was carried out with and without contaminated events.

3.6 Validity and reliability

While reliability has to do with the accuracy and precision of the measurement procedure or process, validity has to do with the extent the instrument measures what we are meant to measure (De Vos 2002). This in essence refers not only to the data used for the research but also to the analysis and interpretation of such data.

3.6.1 *External validity*

The choice of post-apartheid data as a sample for this study, allows for this study to be comparable to other past and future similar studies in that the biggest contamination of events presented by the impact of sanctions on foreign exchange rates experienced by RSA prior to1994, is removed. This is very important in that RSA is largely compared to other emerging countries in many economic studies and the outcome of such a study for RSA becomes important for these emerging economies. It becomes prudent therefore that the period being studied is free of the apartheid associated sanction years.

3.6.2 *Internal validity*

In this study internal validity refers to the condition that the observed impact on the foreign exchange in RSA is as a result of the sovereign credit ratings actions and not any other event (Onwuegbuzie 2000). Hand et al. (1992) alluded to the contamination of credit rating events as discussed 3.22 and 3.5 above, where other events may be taking place simultaneously as the rating action. To eliminate the contamination of the impact of sovereign credit ratings on exchange rate, analysis of such impact was carried out where contaminated events were included and where they were excluded. Contaminated events in this case were identified as any economic and political news announcements deemed to have an impact on the ZAR exchange rate.

3.6.3 *Reliability*

Reliability in this study has to do with reliability and repeatability of the results. For this study reliability is largely dependent on the ZAR against the USD exchange rate databases as well as the sovereign credit ratings actions databases. Firstly, to ensure reliability of the ZAR against the USD exchange rate databases, IMF databases on country foreign exchange rate were used and secondly, these were compared to those published by the SARB, for completeness. The sovereign credit ratings actions were sourced direct from

the respective agencies databases and it is taken that these are the most reliable sources of such data.

4 PRESENTATION OF RESULTS

4.1 Introduction

The following sections present the statistical analysis results for the study on the impact of sovereign credit ratings on ZAR against USD exchange rate. The first section presents the statistical results for the first hypothesis followed by the presentation of the second hypothesis results and finally a summary of all results. For each hypothesis tested statistical results for all identified events are presented, followed by the presentation of the results for events that excluded those identified as contaminated, followed by those events identified as outlook/watchlist, followed by those events identified as upgrade and then the results for events identified for each of the three rating agencies.

4.2 Results

4.2.1 *Hypothesis One*

The null hypothesis tested for this event study is that abnormal returns on the ZAR against the USD exchange rate will not significantly be more or less than zero during the sovereign credit rating consideration. To reject the null hypothesis and accept the alternative hypothesis, the abnormal returns on the ZAR against the USD exchange rate, should be significantly different from zero.

The impact of the sovereign credit ratings actions on the ZAR against the USD exchange rate was tested for statistical significance for the period 20 days before the sovereign rating announcement (-20 through -1), 20 days after the sovereign rating announcement (+1 through +20) and on the date of a rating announcement. First the tests for statistical significance were carried out for all identified events. This was followed by a test on the reaction to those events that excluded contaminated events as stated in 3.2.2 above. To establish the reaction of the ZAR against the USD exchange rate to the type of event, the events were separated as those that were identified as a sovereign rating

upgrade and those that indicating a possible move of the sovereign rating, (positive/negative outlook and watchlisling). Two approaches to testing the first hypothesis as stated in 3.2.1. were followed. First the results for the EER approach are presented followed by the daily nominal exchange rate changes approach results.

Return on EER Approach

For the EER approach return is earned on the calculated equilibrium exchange rate reflecting the over or undervaluation of the ZAR against the USD exchange rate. The statistical tests carried out for this approach therefore, test for abnormality of overvaluation or undervaluation of the ZAR against the USD exchange rate prior to, during and after a sovereign rating announcement on South Africa. Daily AAR's and CAAR's for this approach are presented in Appendix C.

a. Sovereign credit rating announcements by all three agencies.

The response by the ZAR against the USD exchange rate to sovereign rating actions (by all three rating agencies) was first computed for all announcements. This was followed by a computation of those rating actions termed uncontaminated over the window period. Statistically the, the ZAR against the USD exchange rate were not significantly different to zero during the sovereign credit rating actions window period, when contaminated and uncontaminated events were computed. Neither the AAR nor the CAAR responded significantly at 1%, 5% and 10% significant level during the rating announcement on RSA. Table 3 presents the computation of the impact of sovereign ratings announcement by all three agencies on the ZAR against the USD exchange rate.

Table 3: CAAR's for rating announcements by all three agencies.

	Before Event		At Event Date		After Event	
	Mean	t-Test Statistic	Mean	t-Test Statistic	Mean	t-Test Statistic
Contaminated	0.247	0.718	0.596	0.591	1.089	0.476
Uncontaminated	0.178	0.283	0.404	0.332	0.638	0.356

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level.

b. Sovereign credit rating upgrades announcements by all three agencies.

To establish the impact of the type of rating action on the ZAR against the USD exchange rate, sovereign ratings upgrade announcements were computed separately. Statistically the ZAR against the USD exchange rate reaction to the rating action announcement was found to be insignificant through the window period. As shown in tables 4 below, the ZAR against USD exchange rate AAR and CAAR were insignificant at 1%, 5% and 10% significant levels.

Table 4: CAAR's for Upgrade sovereign rating announcements by all three agencies.

	Before Event		At Event Date		After Event	
	Mean	t-Test Statistic	Mean	t-Test Statistic	Mean	t-Test Statistic
Contaminated	0.823	1.188	1.677	1.262	2.810	1.365
Uncontaminated	1.177	1.236	2.348	1.324	3.594	1.383

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level.

c. Sovereign credit rating outlook and watchlisting announcements by all three agencies.

Statistically a sovereign rating outlook or watchlisting announcement was found to have no significant impact on the ZAR against the USD exchange rate. At 1%, 5% and 10% significant level the excess exchange rate returns were found to be insignificant during the rating announcement as shown in tables 5.

Table 5: CAAR's for sovereign rating outlook and watch listing announcements by all three agencies.

	Before Event		At Event Date		After Event	
	Mean	t-Test Statistic	Mean	t-Test Statistic	Mean	t-Test Statistic
Contaminated	-0.063	-0.079	-0.060	-0.039	-0.037	-0.016

	Before Event		At Event Date		After Event	
	Mean	t-Test Statistic	Mean	t-Test Statistic	Mean	t-Test Statistic
Uncontaminated	-0.172	-0.157	-0.391	-0.181	-0.686	-0.215

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level.

d. Agency specific sovereign credit rating announcements.

The lack of significant impact on the ZAR against the USD exchange rate was also found not to be depended on the rating agency making an announcement. As shown in tables 6 to 8 below, a sovereign rating announcement by either Fitch, Moody's or Standard and Poor's did not have any significant impact on the ZAR against the USD exchange rate CAAR. This was also found to be the case where announcements established to have been contaminated by simultaneous none rating announcements were excluded from the computation.

Table 6: CAAR's for sovereign rating announcements by Fitch.

	Before Event		At Event Date		After Event	
	Mean	t-Test Statistic	Mean	t-Test Statistic	Mean	t-Test Statistic
Contaminated	0.282	0.337	0.569	0.350	0.886	0.368
Uncontaminated	0.419	0.371	0.822	0.375	1.337	0.414

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level.

Table 7: CAAR's for sovereign rating announcements by Moody's.

	Before Event		At Event Date		After Event	
	Mean	t-Test Statistic	Mean	t-Test Statistic	Mean	t-Test Statistic
Contaminated	0.404	0.818	1.166	1.248	2.324	1.404
Uncontaminated	-0.217	-0.569	-0.102	-0.178	0.066	0.079

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level.

Table 8: CAAR's for sovereign rating announcements by Standard and Poor's.

	Before Event		At Event Date		After Event	
	Mean	t-Test Statistic	Mean	t-Test Statistic	Mean	t-Test Statistic
Contaminated	-0.141	-0.160	-0.397	-0.235	-0.693	-0.277
Uncontaminated	0.078	0.066	-0.049	-0.022	-0.300	-0.089

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level

Return on daily nominal exchange rate approach.

For the changes in the daily nominal exchange rate approach, return is earned on the preceding day's ZAR against the USD exchange rate. The statistical tests carried out for this approach therefore, test for abnormality in return earned from one day to the other prior to, during and after a sovereign rating announcement on South Africa.

a. *Sovereign Credit Rating Announcements by all three agencies.*

The sovereign rating announcements (by all thee rating agencies) are initially presented with both the contaminated and uncontaminated events computed over the window period. Statistically the sovereign credit rating actions did not have any significant impact on the ZAR against the USD exchange rate CAAR, over the 41 days studied. The impact remained statistically insignificant when contaminated events were excluded from the computation as presented in table 9 below. Daily AAR and CAAR's are presented in Appendix D.

Table 9: CAAR's for all sovereign rating announcements by the three agencies.

	Before Event		At Event Date		After Event	
	Mean	t-Test Statistic	Mean	t-Test Statistic	Mean	t-Test Statistic
Contaminated	0.021	0.414	0.027	0.543	0.033	0.616
Uncontaminated	0.007	0.381	0.012	0.370	0.009	0.567

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level.

b. *Sovereign credit ratings upgrade announcements by all three agencies.*

Sovereign ratings upgrade announcements, by all three agencies when computed together, were found to be statistically insignificant on the ZAR against the USD exchange rate. The CAAR remained significantly equally to zero when both contaminated and uncontaminated rating announcements were computed. Table 10 presents the CAAR's for sovereign credit rating upgrade announcements.

Table 10: CAAR's for all sovereign rating upgrade announcements.

	Before Event		At Event Date		After Event	
	Mean	t-Test Statistic	Mean	t-Test Statistic	Mean	t-Test Statistic
Contaminated	-0.001	-0.057	0.001	0.094	0.020	0.741
Uncontaminated	0.002	0.155	0.009	0.467	0.012	0.566

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level.

c. *Sovereign credit rating outlook and watchlisting announcements by all three agencies*

Over the period of the study between 1994 and 2007, the South African sovereign credit rating had only one negative outlook, by Moody's on the 17th of July in 1998. The outlook and watchlisting of RSA sovereign credit ratings have been either positive or stable throughout the study. From the computed CAAR's the impact of outlook and watchlisting announcements on the ZAR against the

USD exchange rate remained insignificant during the rating action announcements. Tables 11 present the CAAR's during the 41 days studied where a sovereign credit rating outlook or watchlisting was announced on South Africa.

Table 11: CAAR's for sovereign rating outlook and watchlisting announcements by all thee agencies.

	Before Event		At Event Date		After Event	
	Mean	t-Test Statistic	Mean	t-Test Statistic	Mean	t-Test Statistic
Contaminated	0.005	0.598	0.010	0.728	0.007	0.371
Uncontaminated	-0.002	-0.240	-0.003	-0.157	-0.008	-0.313

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level.

d. Agency specific sovereign credit rating announcements.

As shown in tables 12 below, Fitch sovereign credit rating announcements, had no statistically significant impact on the ZAR against USD exchange rate CAAR over the window period. Rating announcements by Moody's as presented in tables 13 on the other hand were found to have a statistically significant impact on the CAAR after a rating announcement at 10% significant level. However, the impact became insignificant when contaminated events were excluded from the CAAR computation indicating that the ZAR against the USD exchange rate was responding to some exogenous events not embodied in the sovereign credit rating.

Standard and Poor's sovereign credit rating announcements while statistically insignificant when contaminated events were included in the computation of the CAAR become statistically significant when such contaminating events were excluded. Statistically the CAAR was significantly less than zero at 10% level, 20 days prior to an announcement including the day when an announcement was actually made (-20 through 0 days) when contaminated events were excluded from the computation of the CAAR. The impact on the CAAR, following a Standard and Poor's sovereign rating announcement on the other hand, was insignificant, indicating that the market moved attention from the rating announcement as soon as the rating action was confirmed. Table 14 presents Standard and Poor's sovereign rating announcement impact on CAAR.

Table 12: CAAR's for sovereign rating announcements by Fitch.

	Before Event		At Event Date		After Event	
	Mean	t-Test Statistic	Mean	t-Test Statistic	Mean	t-Test Statistic
Contaminated	0.000	0.005	0.001	0.075	0.004	0.248
Uncontaminated	0.004	0.450	0.007	0.431	0.016	0.949

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level.

Table 13: CAAR's for sovereign rating announcements by Moody's.

	Before Event		At Event Date		After Event	
	Mean	t-Test Statistic	Mean	t-Test Statistic	Mean	t-Test Statistic
Contaminated	0.023	1.423	0.041	1.941	0.061	2.072*
Uncontaminated	0.023	0.926	0.046	1.487	0.034	1.003

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

*Two-tailed test significant at 10% level.

Table 14: CAAR's for sovereign rating announcements by Standard and Poor's.

	Before Event		At Event Date		After Event	
	Mean	t-Test Statistic	Mean	t-Test Statistic	Mean	t-Test Statistic
Contaminated	-0.002	-0.283	-0.008	-0.691	-0.007	-0.381
Uncontaminated	-0.011	-2.510*	-0.023	-2.301*	-0.023	-0.983

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level.

4.2.2 *Hypothesis Two*

The null hypothesis tested for the second event study is that the average ZAR against USD exchange rate volatility is not significantly different from zero during the sovereign credit rating actions window. To reject the null hypothesis and accept the alternative hypothesis, the average volatility before and after the rating action event should be significantly different from zero.

The average volatilities of the ZAR to USD exchange rate were computed separately for the period preceding the rating action event date from those after the event date. The average volatility for the 20 day periods represented by the standard deviation of the daily natural log exchange rate differences was computed for all events identified and accepted for the study, as well as those events identified as uncontaminated. Further computation of the average volatilities for events identified as upgrade, outlook and watchlisting as well as for events for respective rating agencies were tested for statistical significance. The results of the average volatilities are presented in tables 15.

Table 15: ZAR to USD exchange rate volatility before and after the sovereign credit rating announcements.

	Before Event		**After Event**	
	Std Dev	**t-Test Statistic**	**Std Dev**	**t-Test Statistic**
All Rating Actions				
Contaminated	0.006	0.799	0.008	-0.089
Uncontaminated	0.007	0.600	0.005	0.351
Upgrade Rating Actions				

	Before Event		After Event	
	Std Dev	**t-Test Statistic**	**Std Dev**	**t-Test Statistic**
Contaminated	0.002	3.057	0.014	-0.137
Uncontaminated	0.002	2.350	0.003	0.300

Outlook Rating Actions

Contaminated	0.003	-1.485	0.006	-0.257
Uncontaminated	0.003	-1.496	0.006	-0.258

Fitch Rating Actions

Contaminated	0.003	-0.761	0.005	0.029
Uncontaminated	0.003	0.297	0.005	0.319

Moody's Rating Actions

Contaminated	0.011	0.857	0.008	1.389
Uncontaminated	0.014	0.635	0.006	0.304

	Before Event		After Event	
	Std Dev	**t-Test Statistic**	**Std Dev**	**t-Test Statistic**
Standard and Poor's Rating Actions				
Contaminated	0.003	-0.673	0.008	-1.989*
Uncontaminated	0.003	-1.130	0.003	-1.543

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level

As seen in table 15 the impact by the sovereign credit ratings action on the ZAR against the USD exchange rate volatility were only statistically significant for an upgrade action and for announcements by Standard and Poor's. At 5% significant level the impact on exchange rate volatility was noted prior to a rating upgrade announcement with the impact after the announcement statistically insignificant. Significant impact on exchange rate volatility at 10% was noted after the rating announcements by Standard and Poor's. Both these impacts on volatility however were insignificant when uncontaminated sovereign credit rating actions were excluded from the computation.

4.3 Conclusions

The results presented above indicate that the ZAR to USD exchange rate did react abnormally to the sovereign rating actions, specifically those announced by Standard and Poor's. The significance of the impact of the sovereign credit ratings however was weak at 10% significant level and only pronounced when uncontaminated events of Standard and Poor's were computed. This is an

indication that exogenous events simultaneously announced with the rating actions, mitigated the impact of the rating action on the CAAR when contaminated Standard and Poor's events were computed. On the contrary Moody's announced rating actions were significant after an announcement when contaminated events were computed at 5% significant level. The impact on the CAAR by Moody's announced rating actions became insignificant when contaminated events were excluded from the computation, indicating a reaction to announcements other than the rating action. Fitch announced rating actions remained insignificant when both the contaminated and uncontaminated events were computed. The type of a rating action announcement, either an upgrade or outlook or watchlisting did not have any significant impact on the ZAR against the USD exchange rate, indicating that the impact on the CAAR computed for Standard and Poor's were not dependent on the type of rating action announcement made by the agency.

The impact on the CAAR by Standard and Poor's announced rating actions were also only computed for the period prior to the announcement date and lasted until the actual announcement was made. The impact on the CAAR was insignificant after an announcement was made and post announcement, remained insignificant for the 20 days after an announcement.

The normal return on which the abnormal return was earned also played a role on the impact by sovereign credit rating action on the ZAR against the USD exchange rate. While the significant impact on the CAAR for Standard and Poor's announced rating actions was computed for the return on the nominal exchange rate, the impact on the return on the EER was insignificant. The CAAR remained significantly equal to zero for all events types computed for the return on EER.

The impact on the stability of exchange rate did show some significant abnormality during an upgrade and Standard and Poor's sovereign credit rating announcements. The impact however became insignificant when contaminated events were excluded from the computation.

5 INTERPRETATION OF RESULTS

The results of this study indicate that statistically the sovereign credit ratings actions have no significant impact on the ZAR to the USD exchange rate when the return on the EER approach is employed to compute the returns. The sovereign credit ratings actions were found to have no statistically significant impact on the ZAR against the USD exchange rate CAAR on the announcement day or 20 days prior to and after the sovereign rating announcement.

Except for an upper speculative rating of BB by Fitch between 1994 and 1998, South Africa has been rated as investment grade by all three rating agencies since 1994. Added to that only once during the period between 1994 and 2007, did RSA's sovereign credit rating have a possible downgrade outlook in 1998. The South African sovereign credit ratings between 1994 and 2007 would therefore be classified as an investment grade with a stable to positive outlook. The findings of this study, where there is no significant impact on return earned on the EER would therefore be consistent with previous studies on similarly rated entities. Indeed, previous studies on the impact of credit ratings on bonds and stocks have found that rating announcements impact was significant for downgrades and more pronounced for downgrades into speculative grades (Hand et al. 1992; Hite and Warga 1997; Reisen and von Maltzan 1998). Contrary to Reisen and von Maltzan (1998) however, who found the positive announcement to have tended to reduce volatility in both bond and stock markets, statistically the positive announcements did not have any significant impact on the ZAR against the USD exchange rate volatility prior to or after the rating upgrade announcement.

The lack of significant impact by the sovereign rating announcements on the ZAR against the USD exchange rate return on EER was found across announcements by all three agencies as well as for different ratings types. The only differences noticed as shown in tables 6 through 8 above, were differences in the CAAR across the different rating agencies. While CAAR's remained constant before and after the rating action by Moody's, the CAAR's increased

and decreased slightly after rating action announcements by Fitch and Standard and Poor's respectively when uncontaminated events were computed.

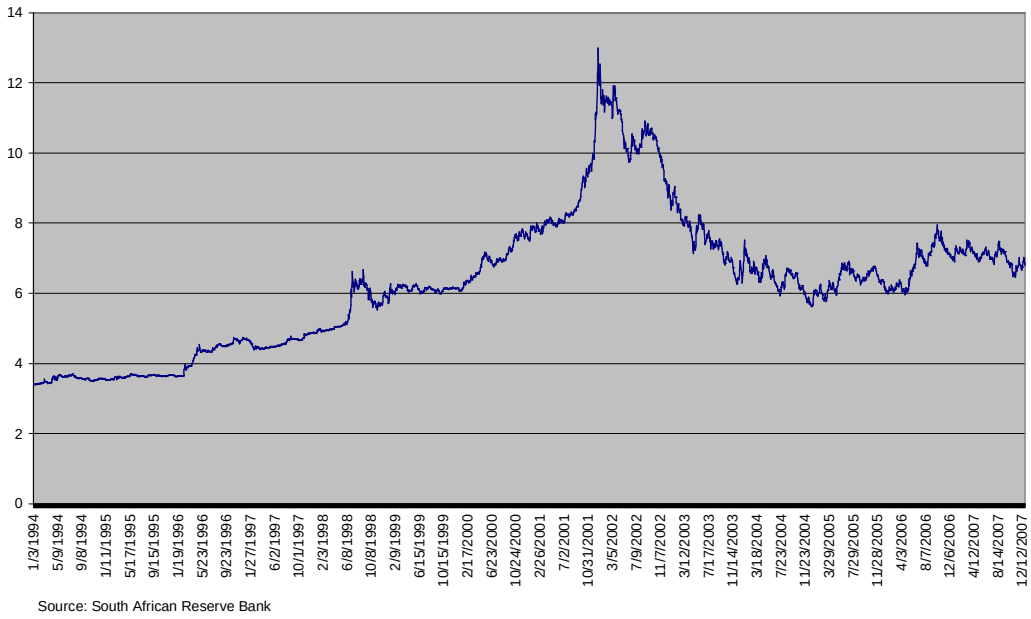
The sovereign credit rating announcements were however found to have a significant impact on the ZAR against the USD exchange rate where return was earned on the preceding day's nominal exchange rate. This was found to be expectant to a possible rating action by Standard and Poor's. The significant impact on the ZAR against the USD exchange rate CAAR at 10% significant level was found in the period prior to (-20 through -1) a rating action announcement by Standard and Poor's. The significant impact by Standard and Poor's rating announcement was found to last until the actual rating action announcement (day 0) and the market reverted to normality as soon as the actual announcement was made, between days +1 through +20. The significant impact was also found where uncontaminated rating action announcements were computed indicating that other none rating action announcements, drowned the rating action impact, when announced simultaneously with the Standard and Poor's rating action announcements. Rating action announcements by Moody's and Fitch did not have any significant impact on CAAR. In fact as shown in table 13, the impact by Moody's rating action announcement after the rating action event became insignificant when contaminated events were excluded from the computation, indicating that the impact was actually coming from an announcement other than Moody's rating action announcement.

Contrary to the findings by Brooks et al. (2004), where return was earned on the preceding day's nominal exchange rate , this study found that a rating upgrade, did not induce a statistically significant positive AAR reaction on the two day event date (t=0, t=+1). As presented in Appendix D, the impact on AAR was significant on from 2 days after an announcement (t=+2) and lasted on average for less than 3 days. Except for a significant impact on the ZAR against the USD exchange rate by a Standard and Poor's, all other announcements remained insignificant during the event window (t=0, t=+1). This concurs, with earlier studies by Brooks et al (2004). Contrary to the findings by Brooks et al (2004), however, the significant impact on ZAR against USD exchange rate by

Standard and Poor's rating announcements on, were not in the right direction, with negative CAAR computed during the periods of positive ratings.

While there was a significant impact on the ZAR against USD exchange rate volatility before a sovereign credit rating announcement and after an announcement by Standard and Poor's, these became insignificant when contaminated events were excluded. In the absence of any simultaneous news, the daily exchange rate volatility remained normal throughout the sovereign rating announcements.

The ZAR exchange rate against the USD has been depreciating between 1994 and 2007, the highest depreciation was experienced in 2001. By January of 2002 the ZAR was trading at 50% below the spot exchange rate it had been in 2001 against the USD. Figure 3 presents the spot exchange rate of the ZAR against the USD between 1994 and 2007.



Source: South African Reserve Bank

Figure 3: ZAR against USD 1994 through 2007.

Interestingly, none of the rating agencies announcements preceded this decline in the ZAR value. In fact in the middle of this highest depreciation in the ZAR, which began in the 3rd quarter of 2000, the RSA sovereign credit rating was raised by Moody's, and Fitch. This may be the confirmation of an earlier study by Reinhart (2002), that sovereign credit ratings systematically followed the

currency crises in East Asia. For the ZAR against the USD exchange rate the lack of rating action during these episodes of currency crises in RSA may however have been due to two things. Firstly due to a sovereign credit rating being of a long-term view, the short-term market turbulences may not be reflected. Secondly the economic and political fundamentals informing the sovereign rating were such that a rating action was not triggered.

6 CONCLUSION

6.1 Summary of the main findings

The insignificant impact on the ZAR against the USD exchange rate when return is earned on the EER is an indication that sovereign credit ratings announcements neither influence the overvaluation nor the undervaluation of the exchange rate. One would therefore not expect the overvalued or undervalued ZAR against the USD exchange rate to converge closer or move further away from the EER during a rating announcement. The overvaluation or undervaluation of the ZAR against the USD exchange rate would therefore remain irrespective of the rating announcement. This is significant in that the rating announcement will not accelerate the convergence of the nominal exchange rate towards an equilibrium exchange rate with the associated effect on the equalisation of prices.

One may however, not ignore the significant abnormal reaction of the ZAR against the USD exchange rate to sovereign rating announcements, when the return is earned on the preceding day's nominal exchange rate. This significant impact was found to be consistent with a previous study where not only negative announcements but also positive announcements had an impact on foreign exchange rate (Brooks et al 2004). Contrary to a study by Brooks et al. (2004) however, the reaction of the ZAR against the USD was not only in the right direction during an upgrade announcement, negative excess returns were computed during the positive sovereign rating announcements on RSA. The impact on the CAAR however was only significant for announcements by Standard and Poor's.

While at 10% significant level the sovereign rating announcement by Standard and Poor's was computed on the date of an announcement (t=0), contrary to the findings by Brooks et al. (2004), the reaction was not significant after an announcement date, on days t=+1 through t=+20. The significant impact was found to be both expectant prior to a rating action announcement and becoming insignificant once an announcement had been made. Based on the results from

this study therefore, there is a significant impact on the ZAR against the USD by a sovereign credit rating action by Standard and Poor's and the null hypothesis that sovereign credit rating actions have no impact on the return on ZAR against the USD exchange rate is rejected.

Except for an upper speculative rating of BB by Fitch between 1994 and 1998, South Africa has been rated as investment grade by all three rating agencies since 1994. Added to that only once during the period between 1994 and 2007, did South African sovereign credit rating move to a possible downgrade outlook in 1998. The South African sovereign credit ratings between 1994 and 2007 would be classified as an investment grade with a stable to positive outlook. The findings of this study were further found to be consistent with previous studies on investment grade rated sovereigns. Indeed previous studies on the impact of credit ratings on bonds and stocks have found that rating announcement impact was more pronounced for downgrades into speculative grades (Hand et al. 1992; Hite and Warga 1997; Reisen and von Maltzan 1998). This may explain the low 10% significant level of the impact on the CAAR by Standard and Poor's rating action announcements when the return on nominal daily exchange rate approach was used, with the market reverting back to normality soon after a rating action has been confirmed.

Contrary to Reisen and von Maltzan (1998) however, who found that positive announcements tend to reduce volatility in both bond and stock markets, statistically the positive announcements did not have any significant impact on the ZAR to USD exchange rate volatility. However, neither did any type of announcement nor an announcement by a specific rating agency, have a significant on the ZAR against the USD exchange rate volatility. The null hypothesis that sovereign credit rating actions have no impact on the ZAR against the USD exchange rate volatility is therefore accepted.

What stands out in the study is the lack of anticipation of potential currency crises in RSA in 1998 and 2001. This however, is contrary to earlier studies that ratings react to currency crises, with downgrades entrenching the crises leading to further depreciation of the currency (Radelet and Sachs 2000; Reinhart 2002). Instead, in the case of RSA the currency crises were followed by rating

upgrades as opposed to downgrades as the currency recovered. This may reinforce the view of sovereign ratings taking a long-term view of the counties risk and therefore not reacting to short-term market changes (Cantor and Packer 1995).

6.2 Limitations of the research

This study followed event study methodology with tests for statistical significance, by t-tests for significance. This type of study is based on an assumption of normal distribution of excess returns (McWilliams and McWilliams 2000). While this is not always the case, the test for normality was assumed for this study. Parametric tests were therefore carried out to for statistical significance. Brown and Warner (1995), however states that while daily returns did not follow a normal distribution, the excess returns were closer to normal distribution that findings from t-statistics will hold. Brown and Warner (1995) also found that the normal distribution of excess returns was more satisfied as the numbers of securities were added to the test, but in the study only one security, as represented by the ZAR against the USD exchange rate was tested.

While effort was made to scan for simultaneous announcements beside the rating actions, there is never a guarantee that all the contaminants were detected. This may lead to type I and Type II errors in that the abnormal reaction or lack thereof may have been due to simultaneous market news. The impact of simultaneous market news was observed during this study where significant levels of the impact of an event weakened or disappeared when the contaminated events were excluded from a computation. On the other hand, insignificant impact on some days during the window period became significant when contaminated events were excluded.

6.3 Suggestions for further research

Beside the number of testable sample population of 21 events, RSA sovereign credit ratings presented only one type of event. All but one RSA sovereign ratings between 1994 and 2007 were of positive announcements. Previous

studies have indicated that announcements effect of rating actions were more significant for negative announcements with significant effect for positive announcements only for upgrades from non-investment to investment grade. While upgrades within an investment grade rating for RSA have shown significant impact, the inclusion of a cross section of exchange rates will enhance the study with increased sample size and broader types of events.

The limitations highlighted above on the RSA data present an opportunity for further studies on the impact of sovereign credit ratings on foreign exchange rate. Further studies will however require a bigger sample size, with a mix of ratings between non-investment and investment grade samples. As a start, a study on a basket of currencies exchange rate against the USD for similar developing economies as that of South Africa such as that of India, Brazil, China and Mexico may be undertaken. In addition, studies on a basket of currencies from broader range economies that will include both developing and developed economies to asses the impact not only on exchange rate against the USD but also against a broader range of currencies could be undertaken. For example, South Africa in addition to being the largest economy in SADC, is a net exporter in the region and so one would expect SADC member states foreign exchange rate against the USD for example to move with the ZAR against the USD exchange rate. A number of the member states are however rated below South Africa by the rating agencies while Botswana for example, has a better rating. Would the rating change for the poorly rated member countries have a more pronounced impact on foreign exchange than the highly rated Botswana Pula against the ZAR for example?

REFERENCES

Ahmed, F., Arezki, R. and Funke, N. (2005) *The composition of capital flows: is South Africa different?*, IMF Working Paper No. 05/40

Albright, S. C., Winston, W. L. and Zappe, C. (1998) *Data Analysis and Decision Making with Microsoft Excel*, Wadsworth Publ. Co. Belmont, CA, USA.

Arellano, C. (2003) *Default Risk, the Real Exchange Rate and Income Fluctuations in Emerging Economies*, Manuscript, Duke University.

Aron, J., Elbadawi, I. and Kahn, B. (2000) *Real and Monetary Determinants of the Real Exchange Rate in South Africa*, Development Issues in South Africa, MacMillan,London

Arora, V. (2007) *Monetary Policy Transparency and Financial Market Forecasts in South Africa*, IMF Working Papers, W07(123).

Bell, J. (2005) *Doing Your Research Project: A Guide for First-Time Researcher in Education, Health and Social Science*, Open University Press.

Boehmer, E., Musumeci, J. and Poulsen, A. B. (1991) *Event-study methodology under conditions of event-induced variance*, Journal of Financial Economics, 30(2), p. 253-272.

Bonser-Neal, C. and Tanner, G. (1996) *Central bank intervention and the volatility of foreign exchange rates: evidence from the options market,* Journal of International Money and Finance, 15(6), p. 853-878.

Borensztein, E., De Gregorio, J. and Lee, J. W. (1998) *How does foreign direct investment affect economic growth?* Journal of International Economics, 45(1), p. 115-135.

Bowman, R. G. (1983) *Understanding and Conducting Event Studies,* Journal of Business Finance & Accounting, 10(4), p. 561-584.

Brook, A. M. and Hargreaves, D. (2000) *A Macroeconomic Balance Measure of New Zealand's Equilibrium Exchange Rate,* Reserve Bank of New Zealand Discussion Paper, 9.

Brooks, R., Faff, R. W., Hillier, D. and Hillier, J. (2004) *The national market impact of sovereign rating changes*, Journal of Banking and Finance, 28(1), p. 233-250.

Brown, S. J. and Warner, J. B. (1980) *Measuring security price performance,* Journal of Financial Economics, 8(3), p. 205-258.

Brown, S. J. and Warner, J. B. (1985) *Using Daily Stock Returns: The Case of Event Studies*, Journal of Financial Economics, 14(1), p. 3-31.

Calvo, G. A. and Mishkin, F. S. (2003) *The Mirage of Exchange Rate Regimes for Emerging Market Countries,* last accessed 06 June, 2008, from http://www.nber.org/papers/w9808.

Cantor, R. and Packer, F. (1995) *Sovereign Credit Ratings*, Current Issues in Economics and Finance, 1(3), p. 1-6.

Cantor, R. and Packer, F. (1996) *Determinants and Impact of Sovereign Credit Ratings,* last accessed 2 July, 2008, from http://web.cenet.org.cn/upfile/26118.pdf.

Cavallo, M., Kisselev, K., Perri, F. and Roubini, N. (2004) *Exchange rate overshooting and the costs of floating,* last accessed 16 August, 2008, from http://www.sf.frb.org/economics/conferences/0406/Perri.pdf.

Chambers, J., Alexeeva, D. and Beers, D. (2004) *Transition Data for Rated Sovereigns*, Standard and Poor's Staff Publication

De Vos, A. S. (2002) *Research at grass roots*, Van Schaik, Pretoria.

Dell'Ariccia, G. (1999) *Exchange Rate Fluctuations and Trade Flows: Evidence from the European Union*, IMF Staff Papers, 46(3), p. 315-334.

Detragiache, E. and Spilimbergo, A. (2001) *Short-Term Debt and Crises*, International Monetary Fund, Washington, DC.

Dimson, E. and Marsh, P. (1986) *Event Study Methodologies and the Size Effect: The Case of UK Press Recommendations*, Journal of Financial Economics, 17(1), p. 113-142.

Fischer, S. (2001) *Exchange Rate Regimes: Is the Bipolar View Correct?* Journal of Economic Perspectives, 15(2), p. 3-24.

Fitch (2007) *A Different Kind of Rating Agency*, Fitch,New York.

Frankel, J. A. and Froot, K. A. (1990) *Chartists, fundamentalists, and trading in the foreign exchange market*, American Economic Review, 80(2), p. 181-185.

Frankel, J. A. and Rose, A. K. (1996) *Currency crashes in emerging markets: An empirical treatment*, Journal of International Economics, 41(3-4), p. 351-366.

Gelos, G., Sahay, R. and Sandleris, G. (2003) *Sovereign Borrowing by Developing Countries: What Determines Market Access?*, Unpublished, International Monetary Fund.

Hamilton, D. T. and Cantor, R. (2004) *Rating Transition and Default Rates Conditioned on Outlooks*, Journal of Fixed Income, 14(2), p. 54-70.

Hand, J., Holthausen, R. W. and Leftwich, R. W. (1992) *The Effect of Bond Rating Agency Announcements on Bond and Stock Prices*, Journal of Finance, 47(2), p. 733–752.

Hite, G. and Warga, A. (1997) *The Effect of Bond-Rating Changes on Bond Price Performance*, Financial Analysts Journal, 53(3), p. 35-51.

IMF (2007) *Regional Economic Outlook Sub-Saharan Africa,* last accessed 28 September, 2008, from http://www.imf.org/external/pubs/ft/reo/2007/AFR/ENG/sreo1007.htm.

Kaminsky, G. L. and Schmukler, S. L. (1999) *What triggers market jitters? A chronicle of the Asian crisis*, Journal of International Money and Finance, 18(4), p. 537-560.

Kim, S. J. and Wu, E. (2007) *Sovereign Credit Ratings, Capital Flows and Financial Sector Development in Emerging Markets*, University of New South Wales, Sydney

Knedlik, T. (2006) *'Signalling currency crises in South Africa',* In *SARB Conference 2006*, Pretoria, South African Reserve Bank.

Kräussl, R. (2005) *Do credit rating agencies add to the dynamics of emerging market crises?* Journal of Financial Stability, 1(3), p. 355-385.

Lav, I. and Berube, A. (1999) *When it Rains it Pours: A Look at the Adequacy of State Rainy Day Funds and Budget Reserves*, Centre on Budget and Policy Priorities Report

Lehmann, A. (2004) *Sovereign Credit Ratings and Private Capital*, African Development Review, 16(2), p. 252-268.

Levy-Yeyati, E. and Sturzenegger, F. (2003) *To Float or to Trail: Evidence on the Impact of Exchange Rate Regimes*, American Economic Review, 93(4), p. 1173–1193.

Liu, P., Seyyed, F. J. and Smith, S. D (1999) *The Independent Impact of Credit Rating Changes- The Case of Moody's Rating Refinement on Yield Premiums*, Journal of Business Finance & Accounting, 26(3-4), p. 337-363.

Liu, P. and Thakor, A. V. (1984) *Interest Yields, Credit Ratings, and Economic Characteristics of State Bonds: An Empirical Analysis: Note*, Journal of Money, Credit and Banking, 16(3), p. 344-351.

Macdonald, R. and Ricci, L. A. (2003) *Estimation of the Equilibrium Real Exchange Rate for South Africa*, IMF Working Paper No. 03/44

MacKinlay, A. C. (1997) *Event Studies in Economics and Finance*, Journal of Economic Literature, 35(1), p. 13-39.

McWilliams, T. P. and McWilliams, V. B. (2000) *Another look at theoretical and empirical issues in event study methodology*, Journal of Applied Business Research, 16(3), p. 1–11.

Mohr, P. and Fourie, L. (2000) *Economics for South African Students*, University of South Africa, Van Schaik, Pretoria.

Moody (2007) *Moody's Rating Symbols and Definitions*, Moody's Investors Service, New York.

Mora, N. (2006) *Sovereign credit ratings: Guilty beyond reasonable doubt?* Journal of Banking and Finance, 30(7), p. 2041-2062.

Ngandu, S. (2005) *Mineral prices and the exchange rate: What does the literature say,* Employment Growth & Development Initiative Human Sciences Research Council, Pretoria.

Onwuegbuzie, A. J. (2000) *Expanding the Framework of Internal and External Validity in Quantitative Research*, Annual meeting of the Association for the Advancement of Educational Research, Ponte Vedra, FL.

Peter, M. and Grandes, M. (2005) *How Important is Sovereign Risk in Determining Corporate Default Premia? The Case of South Africa*, IMF Working Paper WP/05/217.

Radelet, S. and Sachs, J. (2000) *The Onset of the East Asian Financial Crisis*, Currency Crises, p. 105-153.

Reinhart, C. M. (2000) *Sovereign Credit Ratings Before and After Financial Crises*, mimeograph, University of Maryland (October).

Reinhart, C. M. (2002) Default, *Currency Crises and Sovereign Credit Ratings*, NBER Working Paper.

Reisen, H. (1998) *Sovereign Credit Ratings, Emerging Market Risk and Financial Market Volatility*, HWWA-Institut für Wirtschaftsforschung-Hamburg.

Reisen, H. and von Maltzan, J. (1998) *Sovereign Credit Ratings, Emerging Market Risk and Financial Market Volatility*, Intereconomics, 33(2), p. 73-82.

Rime, D., Sarno, L. and Sojli, E. (2007) *Exchange Rate Forecasting, Order Flow and Macroeconomic Information*, Norges Bank Research Department Working Paper, 2.

S&P (2007) *Standard & Poor's Ratings Definitions*, Standard & Poor's Ratings, New York.

SARB (2007) *Monetary Policy Review*, Vol. 2008, South African Reserve Bank, Pretoria.

SARB (2008) *Annual Economic Report*, Vol. 2008, South African Reserve Bank, Pretoria.

Sarno, L. and Taylor, M. P. (2002) *Purchasing Power Parity and the Real Exchange Rate*, IMF Staff Papers*,* 49(1), p. 65-105.

Steiner, M. and Heinke, V. G. (2001) *Event study concerning international bond price effects of credit rating actions,* International Journal of Finance & Economics*,* 6(2), p. 139-157.

Stephens, D. (2004) *The equilibrium exchange rate according to PPP and UIP*, Reserve Bank of New Zealand, Auckland

APPENDIX A

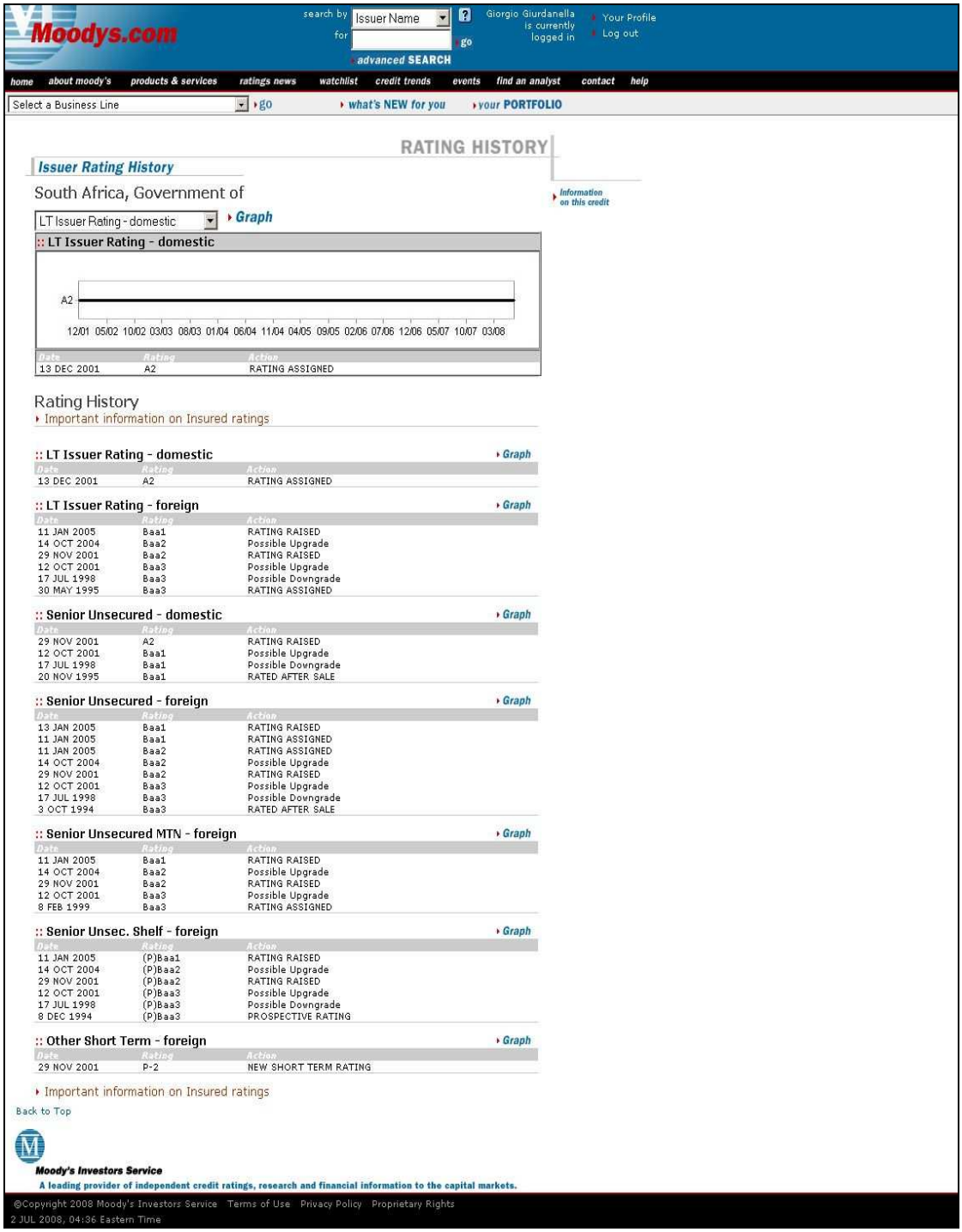
Detailed Rating Actions

Fitch Rating Actions

Country	Date	Foreign currency rating		Outlook/Watch	Local currency rating
		long-term	short-term		long-term
South Africa	25 Aug 2005	BBB+	F2	stable	A
South Africa	21 Oct 2004	BBB	F3	positive	A-
South Africa	2 May 2003	BBB	F3	stable	A-
South Africa	11 Mar 2003	BBB-	F3	Rating Watch positive	BBB+
South Africa	20 Aug 2002	BBB-	F3	positive	BBB+
South Africa	21 Sep 2000	BBB-	F3	stable	BBB+
South Africa	27 Jun 2000	BBB-	F3	-	BBB+
South Africa	19 May 2000	BB+	B	-	BBB+
South Africa	28 May 1998	BB	B	-	BBB
South Africa	17 Feb 1998	BB	B	Rating Watch positive	BBB
South Africa	5 Jun 1996	BB	B	-	BBB
South Africa	26 Oct 1995	BB	B	-	-
South Africa	22 Sep 1994	BB	-	-	-

Source: Fitch Ratings

Moody's Rating Actions



Source: Moody's Investor Services

Standard and Poor Rating Actions

Sovereign/Date	Local currency rating LT/Outlook/ST	Foreign currency rating LT/Outlook/ST	Foreign currency recovery rating	Country T&C assessment
South Africa (Republic of)				
Nov. 3, 2005	A+/Stable/A-1	BBB+/Stable/A-2		A
Nov. 1, 2005	A+/Stable/A-1	BBB+/Stable/A-2		BBB+
Aug. 1, 2005	A+/Stable/A-1	BBB+/Stable/A-2		
May 7, 2003	A/Stable/A-1	BBB/Stable/A-3		
Nov. 12, 2002	A-/Positive/A-2	BBB-/Positive/A-3		
Feb. 25, 2000	A-/Stable/A-2	BBB-/Stable/A-3		
March 6, 1998	BBB+/Stable/A-2	BB+/Stable/B		
Nov. 20, 1995	BBB+/Positive/—	BB+/Positive/—		
Oct. 3, 1994		BB/Positive/—		

Source: Standard & Poor's Ratings Direct.

APPENDIX B

Detailed Economic Data

RSA Economic Data

Country	Units	Scale	1994	1995	1996	1997	1998	1999	2000
South Africa	National currency	Billions	779.429	803.71	838.33	860.52	864.97	885.37	922.15
South Africa	Annual percent change		3.234	3.116	4.307	2.647	0.517	2.358	4.155
South Africa	U.S. dollars	Billions	135.82	151.12	143.83	148.84	134.22	133.11	132.96
South Africa	National currency	Units	19409.66	19,597.79	20,045.91	20,207.29	19,978.72	20,148.22	20,711.91
South Africa	U.S. dollars	Units	3382.244	3,684.84	3,439.25	3,495.07	3,100.05	3,029.06	2,986.45
South Africa	Current international dollar	Units	5541.663	5,709.85	5,951.14	6,098.88	6,096.76	6,237.46	6,551.68
South Africa	National currency per current international dollar		2.166	2.34	2.48	2.64	2.81	2.97	3.16
South Africa	Index, 2000=100		66.6	72.4	77.7	84.4	90.2	94.9	100
South Africa	Annual percent change		8.824	8.709	7.32	8.623	6.872	5.211	5.374
South Africa	Index, 2000=100		67.507	72.163	78.855	83.802	91.271	93.501	100
South Africa	Annual percent change		9.779	6.897	9.274	6.273	8.912	2.444	6.95
South Africa	Persons	Millions	40.157	41.01	41.82	42.584	43.294	43.943	44.523
Country	**Units**	**Scale**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
South Africa	National currency	Billions	947.37	982.12	1,012.76	1,062.03	1,115.14	1,175.22	1,235.63
South Africa	Annual percent change		2.735	3.668	3.12	4.864	5.001	5.388	5.14
South Africa	U.S. dollars	Billions	118.56	111.13	166.66	216.34	242.22	257.28	282.63
South Africa	National currency	Units	21,037.57	21,565.74	22,011.87	22,858.58	23,782.85	24,750.77	25,822.55
South Africa	U.S. dollars	Units	2,632.83	2,440.23	3,622.15	4,656.40	5,165.87	5,418.46	5,906.49
South Africa	Current international dollar	Units	6,814.34	7,107.38	7,408.75	7,887.36	8,488.38	9,112.73	9,761.39
South Africa	National currency per current international dollar		3.32	3.61	3.70	3.81	3.87	4.02	4.27
South Africa	Index, 2000=100		105.7	115.4	122.1	123.8	128	134	143.5
South Africa	Annual percent change		5.7	9.177	5.806	1.392	3.393	4.688	7.09
South Africa	Index, 2000=100		104.559	117.556	117.944	122.017	126.382	133.657	145.684

Country	Units	Scale	1994	1995	1996	1997	1998	1999	2000
South Africa	Annual percent change		4.559	12.43	0.33	3.454	3.577	5.756	8.999
South Africa	Persons	Millions	45.032	45.541	46.01	46.461	46.888	47.482	47.851

Source: International Monetary Fund.

USA Economic Data

Country	Units	Scale	1994	1995	1996	1997	1998	1999	2000
United States	National currency	Billions	7,835.48	8,031.70	8,328.90	8,703.50	9,066.88	9,470.35	9,816.95
United States	Annual percent change		4.02	2.504	3.7	4.498	4.175	4.45	3.66
United States	U.S. dollars	Billions	7,072.23	7,397.65	7,816.83	8,304.33	8,746.98	9,268.43	9,816.98
United States	National currency	Units	29,755.96	30,142.44	30,895.76	31,901.74	32,848.34	33,920.21	34,773.69
United States	National currency	Units	26,857.44	27,762.90	28,996.24	30,438.61	31,689.37	33,196.97	34,773.78
United States	U.S. dollars	Units	26,857.44	27,762.90	28,996.24	30,438.61	31,689.37	33,196.97	34,773.78
United States	Current international dollar	Billions	7,072.23	7,397.65	7,816.83	8,304.33	8,746.98	9,268.43	9,816.98
United States	Index, 2000=100		86.081	88.496	91.095	93.225	94.667	96.743	100
United States	Annual percent change		2.596	2.805	2.937	2.338	1.547	2.193	3.367
United States	Index, 2000=100		85.968	88.144	91.123	92.669	94.158	96.678	100
United States	Annual percent change		2.597	2.532	3.379	1.697	1.607	2.676	3.436
United States	Persons	Millions	263.325	266.458	269.581	272.822	276.022	279.195	282.31
Country	**Units**	**Scale**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
United States	National currency	Billions	9,890.65	10,048.85	10,301.10	10,675.73	11,003.50	11,319.40	11,567.18
United States	Annual percent change		0.751	1.599	2.51	3.637	3.07	2.871	2.189
United States	U.S. dollars	Billions	10,127.95	10,469.60	10,960.75	11,685.93	12,433.93	13,194.70	13,843.83
United States	National currency	Units	34,673.53	34,879.84	35,417.03	36,370.08	37,141.47	37,847.73	38,306.08
United States	National currency	Units	35,505.43	36,340.28	37,685.03	39,811.63	41,969.76	44,118.01	45,845.48
United States	U.S. dollars	Units	35,505.43	36,340.28	37,685.03	39,811.63	41,969.76	44,118.01	45,845.48
United States	Current international dollar	Billions	10,127.95	10,469.60	10,960.75	11,685.93	12,433.93	13,194.70	13,843.83
United States	Index, 2000=100		102.817	104.457	106.858	109.708	113.41	117.069	120.415

Country	Units	Scale	1994	1995	1996	1997	1998	1999	2000
United States	Annual percent change		2.817	1.596	2.298	2.668	3.375	3.226	2.858
United States	Index, 2000=100		101.604	104.124	106.243	109.794	113.517	116.438	121.237
United States	Annual percent change		1.604	2.48	2.035	3.342	3.391	2.573	4.122
United States	Persons	Millions	285.251	288.099	290.852	293.53	296.259	299.077	301.967

Source: International Monetary Fund.

APPENDIX C

AAR and CAAR for Equilibrium Exchange Rate Approach

All Events

	Contaminated				Uncontaminated			
Day	AAR	t-Test Statistic	CAAR	t-Test Statistic	AAR	t-Test Statistic	CAAR	t-Test Statistic
-20	0.01	0.28	0.01	0.28	0.01	0.20	0.01	0.28
-19	0.02	0.39	0.03	0.33	0.02	0.26	0.03	0.33
-18	0.02	0.36	0.05	0.34	0.01	0.21	0.04	0.34
-17	0.02	0.33	0.07	0.34	0.01	0.20	0.05	0.34
-16	0.02	0.34	0.09	0.34	0.01	0.21	0.07	0.34
-15	0.02	0.41	0.11	0.35	0.02	0.27	0.09	0.35
-14	0.03	0.55	0.14	0.38	0.02	0.39	0.11	0.38
-13	0.02	0.36	0.15	0.38	0.01	0.19	0.12	0.38
-12	0.02	0.45	0.17	0.38	0.01	0.23	0.13	0.38
-11	0.03	0.54	0.20	0.40	0.02	0.29	0.15	0.40
-10	0.03	0.64	0.23	0.42	0.02	0.36	0.17	0.42
-9	0.03	0.74	0.27	0.45	0.03	0.48	0.20	0.45
-8	0.04	0.75	0.30	0.47	0.03	0.46	0.23	0.47
-7	0.03	0.70	0.34	0.49	0.02	0.35	0.24	0.49
-6	0.03	0.70	0.37	0.50	0.02	0.34	0.26	0.50
-5	0.04	0.76	0.40	0.52	0.02	0.37	0.28	0.52
-4	0.04	0.79	0.44	0.53	0.02	0.40	0.31	0.53
-3	0.04	0.84	0.48	0.55	0.02	0.44	0.33	0.55
-2	0.04	0.79	0.52	0.56	0.02	0.39	0.35	0.56

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
-1	0.04	0.85	0.56	0.58	0.03	0.47	0.38	0.58
0	0.04	0.89	0.60	0.59	0.03	0.50	0.40	0.59
+1	0.05	1.00	0.64	0.61	0.03	0.59	0.44	0.61
+2	0.04	0.86	0.68	0.62	0.02	0.45	0.46	0.62
+3	0.05	0.98	0.73	0.64	0.03	0.55	0.49	0.64
+4	0.04	0.85	0.77	0.65	0.02	0.38	0.51	0.65
+5	0.04	0.88	0.82	0.66	0.02	0.37	0.53	0.66
+6	0.04	0.83	0.86	0.66	0.02	0.31	0.55	0.66
+7	0.05	0.94	0.90	0.67	0.02	0.35	0.57	0.67
+8	0.05	0.92	0.95	0.68	0.02	0.35	0.59	0.68
+9	0.04	0.89	0.99	0.69	0.02	0.31	0.61	0.69
+10	0.05	0.89	1.04	0.70	0.02	0.32	0.63	0.70
+11	0.05	0.86	1.09	0.71	0.02	0.27	0.64	0.71
+12	0.05	0.96	1.14	0.72	0.02	0.33	0.66	0.72
+13	0.05	0.99	1.19	0.72	0.02	0.32	0.68	0.72
+14	0.06	1.03	1.24	0.74	0.02	0.33	0.70	0.74
+15	0.06	1.14	1.31	0.75	0.02	0.41	0.72	0.75
+16	0.06	1.15	1.37	0.76	0.03	0.46	0.75	0.76
+17	0.06	1.11	1.42	0.77	0.02	0.41	0.77	0.77
+18	0.06	1.14	1.48	0.78	0.03	0.47	0.80	0.78
+19	0.06	1.15	1.55	0.79	0.03	0.44	0.82	0.79
+20	0.07	1.26	1.61	0.81	0.03	0.53	0.85	0.81

Upgrade Events

	Contaminated				Uncontaminated			
Day	AAR	t-Test Statistic	CAAR	t-Test Statistic	AAR	t-Test Statistic	CAAR	t-Test Statistic
-20	0.08	1.14	0.08	1.14	0.11	1.23	0.11	1.23
-19	0.08	1.21	0.16	1.17	0.11	1.22	0.23	1.23
-18	0.08	1.22	0.24	1.19	0.11	1.16	0.34	1.20
-17	0.08	1.15	0.32	1.18	0.11	1.17	0.45	1.20
-16	0.08	1.19	0.40	1.18	0.12	1.27	0.57	1.21
-15	0.08	1.21	0.48	1.19	0.12	1.29	0.70	1.22
-14	0.08	1.15	0.56	1.18	0.12	1.27	0.82	1.23
-13	0.07	1.04	0.63	1.17	0.10	1.12	0.92	1.22
-12	0.07	1.08	0.71	1.16	0.10	1.06	1.02	1.20
-11	0.08	1.09	0.78	1.15	0.11	1.17	1.13	1.20
-10	0.08	1.17	0.86	1.16	0.11	1.21	1.25	1.20
-9	0.07	1.07	0.93	1.15	0.10	1.20	1.35	1.20
-8	0.08	1.25	1.01	1.16	0.11	1.33	1.46	1.21
-7	0.08	1.27	1.09	1.17	0.11	1.28	1.57	1.22
-6	0.08	1.22	1.16	1.17	0.10	1.20	1.67	1.22
-5	0.08	1.28	1.24	1.18	0.10	1.25	1.77	1.22
-4	0.08	1.44	1.32	1.19	0.11	1.51	1.87	1.24
-3	0.09	1.55	1.41	1.21	0.11	1.71	1.99	1.26
-2	0.08	1.53	1.49	1.23	0.11	1.86	2.10	1.29
-1	0.09	1.57	1.59	1.25	0.13	1.75	2.23	1.31
0	0.09	1.50	1.68	1.26	0.12	1.68	2.35	1.32
+1	0.10	1.51	1.77	1.28	0.12	1.59	2.47	1.34
+2	0.09	1.41	1.86	1.28	0.11	1.51	2.58	1.35
+3	0.10	1.55	1.96	1.30	0.12	1.60	2.70	1.36

	Contaminated				Uncontaminated			
Day	AAR	t-Test Statistic	CAAR	t-Test Statistic	AAR	t-Test Statistic	CAAR	t-Test Statistic
+4	0.10	1.53	2.06	1.31	0.12	1.57	2.82	1.37
+5	0.10	1.46	2.16	1.32	0.11	1.59	2.93	1.38
+6	0.10	1.44	2.26	1.33	0.11	1.58	3.04	1.39
+7	0.10	1.42	2.36	1.34	0.11	1.47	3.15	1.39
+8	0.10	1.45	2.47	1.34	0.11	1.39	3.26	1.39
+9	0.11	1.40	2.57	1.35	0.11	1.28	3.37	1.39
+10	0.11	1.43	2.69	1.35	0.12	1.30	3.50	1.39
+11	0.11	1.39	2.80	1.36	0.12	1.34	3.62	1.38
+12	0.12	1.41	2.92	1.36	0.12	1.30	3.74	1.38
+13	0.13	1.48	3.05	1.37	0.12	1.39	3.86	1.38
+14	0.14	1.54	3.19	1.38	0.13	1.45	3.99	1.38
+15	0.14	1.59	3.33	1.39	0.13	1.50	4.13	1.39
+16	0.13	1.54	3.47	1.39	0.13	1.45	4.26	1.39
+17	0.14	1.63	3.60	1.40	0.14	1.45	4.40	1.39
+18	0.14	1.61	3.74	1.41	0.15	1.43	4.55	1.39
+19	0.14	1.57	3.89	1.42	0.15	1.42	4.70	1.39
+20	0.14	1.56	4.03	1.42	0.14	1.41	4.84	1.40

Outlook/Watchlisting Events

	Contaminated				Uncontaminated			
Day	AAR	t-Test Statistic	CAAR	t-Test Statistic	AAR	t-Test Statistic	CAAR	t-Test Statistic
-20	-0.01	-0.09	-0.01	-0.09	-0.01	-0.09	-0.01	-0.09
-19	0.00	-0.04	0.00	-0.04	0.00	-0.03	-0.01	-0.06
-18	-0.01	-0.08	-0.01	-0.08	-0.01	-0.07	-0.02	-0.06
-17	-0.01	-0.09	-0.01	-0.09	-0.01	-0.12	-0.03	-0.08
-16	-0.01	-0.12	-0.01	-0.12	-0.02	-0.16	-0.05	-0.09
-15	-0.01	-0.13	-0.01	-0.13	-0.02	-0.16	-0.07	-0.10
-14	-0.01	-0.12	-0.01	-0.12	-0.02	-0.18	-0.09	-0.11
-13	-0.01	-0.18	-0.01	-0.18	-0.02	-0.24	-0.11	-0.13
-12	-0.01	-0.16	-0.01	-0.16	-0.03	-0.26	-0.14	-0.14
-11	-0.01	-0.12	-0.01	-0.12	-0.03	-0.27	-0.16	-0.16
-10	-0.01	-0.10	-0.01	-0.10	-0.02	-0.23	-0.19	-0.16
-9	0.00	0.01	0.00	0.01	-0.02	-0.15	-0.20	-0.16
-8	0.00	0.04	0.00	0.04	-0.02	-0.16	-0.22	-0.16
-7	0.00	0.00	0.00	0.00	-0.02	-0.23	-0.24	-0.17
-6	0.00	0.03	0.00	0.03	-0.02	-0.19	-0.26	-0.17
-5	0.00	0.05	0.00	0.05	-0.02	-0.20	-0.28	-0.17
-4	0.00	0.02	0.00	0.02	-0.02	-0.24	-0.31	-0.17
-3	0.01	0.10	0.01	0.10	-0.02	-0.17	-0.32	-0.17
-2	0.01	0.10	0.01	0.10	-0.02	-0.22	-0.35	-0.18
-1	0.00	0.04	0.00	0.04	-0.02	-0.24	-0.37	-0.18
0	0.01	0.09	0.01	0.09	-0.02	-0.21	-0.39	-0.18
+1	0.01	0.13	0.01	0.13	-0.01	-0.14	-0.41	-0.18

	Contaminated				Uncontaminated			
Day	AAR	t-Test Statistic	CAAR	t-Test Statistic	AAR	t-Test Statistic	CAAR	t-Test Statistic
+2	0.00	0.07	0.00	0.07	-0.02	-0.16	-0.42	-0.18
+3	0.01	0.12	0.01	0.12	-0.01	-0.13	-0.44	-0.18
+4	0.00	0.01	0.00	0.01	-0.03	-0.26	-0.46	-0.18
+5	0.00	0.01	0.00	0.01	-0.03	-0.26	-0.49	-0.18
+6	-0.01	-0.07	-0.01	-0.07	-0.04	-0.36	-0.53	-0.19
+7	0.00	0.01	0.00	0.01	-0.03	-0.33	-0.56	-0.20
+8	0.00	0.03	0.00	0.03	-0.03	-0.29	-0.59	-0.20
+9	0.00	0.00	0.00	0.00	-0.03	-0.34	-0.62	-0.20
+10	0.00	-0.02	0.00	-0.02	-0.03	-0.35	-0.66	-0.21
+11	-0.01	-0.07	-0.01	-0.07	-0.04	-0.42	-0.70	-0.21
+12	0.00	0.00	0.00	0.00	-0.04	-0.36	-0.73	-0.22
+13	0.00	-0.02	0.00	-0.02	-0.04	-0.40	-0.77	-0.22
+14	0.00	-0.04	0.00	-0.04	-0.04	-0.44	-0.81	-0.23
+15	0.00	0.06	0.00	0.06	-0.03	-0.38	-0.85	-0.23
+16	0.01	0.10	0.01	0.10	-0.03	-0.33	-0.88	-0.24
+17	0.00	0.06	0.00	0.06	-0.03	-0.36	-0.91	-0.24
+18	0.00	0.07	0.00	0.07	-0.03	-0.32	-0.94	-0.24
+19	0.01	0.11	0.01	0.11	-0.03	-0.32	-0.97	-0.24
+20	0.02	0.23	0.02	0.23	-0.02	-0.21	-0.99	-0.24

Fitch Events

	Contaminated				Uncontaminated			
Day	AAR	t-Test Statistic	CAAR	t-Test Statistic	AAR	t-Test Statistic	CAAR	t-Test Statistic
-20	0.03	0.34	0.03	0.34	0.04	0.35	0.04	0.35
-19	0.03	0.37	0.06	0.36	0.04	0.40	0.08	0.38
-18	0.03	0.34	0.09	0.35	0.04	0.38	0.12	0.38
-17	0.02	0.29	0.11	0.34	0.04	0.35	0.16	0.37
-16	0.03	0.33	0.14	0.33	0.04	0.38	0.21	0.37
-15	0.03	0.31	0.16	0.33	0.04	0.37	0.25	0.37
-14	0.03	0.34	0.19	0.33	0.04	0.40	0.29	0.38
-13	0.02	0.25	0.21	0.32	0.03	0.31	0.32	0.37
-12	0.02	0.28	0.23	0.32	0.03	0.32	0.36	0.36
-11	0.02	0.31	0.26	0.32	0.04	0.34	0.39	0.36
-10	0.03	0.39	0.29	0.32	0.04	0.40	0.44	0.37
-9	0.03	0.41	0.32	0.33	0.05	0.44	0.48	0.37
-8	0.03	0.39	0.35	0.34	0.04	0.41	0.52	0.37
-7	0.03	0.37	0.38	0.34	0.04	0.38	0.56	0.37
-6	0.03	0.39	0.41	0.34	0.04	0.39	0.60	0.38
-5	0.03	0.39	0.44	0.34	0.04	0.37	0.64	0.37
-4	0.02	0.33	0.46	0.34	0.03	0.32	0.67	0.37
-3	0.03	0.37	0.49	0.35	0.04	0.37	0.71	0.37
-2	0.02	0.34	0.51	0.35	0.03	0.34	0.74	0.37
-1	0.03	0.38	0.54	0.35	0.04	0.41	0.78	0.37
0	0.03	0.40	0.57	0.35	0.04	0.42	0.82	0.37

	Contaminated				Uncontaminated			
Day	AAR	t-Test Statistic	CAAR	t-Test Statistic	AAR	t-Test Statistic	CAAR	t-Test Statistic
+1	0.03	0.43	0.60	0.35	0.05	0.48	0.87	0.38
+2	0.03	0.36	0.63	0.35	0.05	0.46	0.91	0.38
+3	0.03	0.44	0.66	0.36	0.05	0.51	0.97	0.39
+4	0.03	0.41	0.69	0.36	0.05	0.46	1.01	0.39
+5	0.03	0.34	0.72	0.36	0.04	0.43	1.06	0.39
+6	0.02	0.21	0.73	0.35	0.04	0.37	1.09	0.39
+7	0.02	0.29	0.76	0.35	0.04	0.44	1.14	0.39
+8	0.02	0.31	0.78	0.35	0.04	0.44	1.18	0.40
+9	0.03	0.34	0.80	0.35	0.05	0.46	1.23	0.40
+10	0.03	0.40	0.84	0.35	0.05	0.51	1.28	0.40
+11	0.03	0.41	0.87	0.35	0.05	0.51	1.33	0.40
+12	0.04	0.50	0.90	0.36	0.06	0.58	1.39	0.41
+13	0.04	0.50	0.94	0.36	0.05	0.56	1.44	0.41
+14	0.04	0.50	0.98	0.37	0.05	0.54	1.50	0.42
+15	0.05	0.63	1.02	0.37	0.06	0.65	1.56	0.42
+16	0.05	0.63	1.07	0.38	0.06	0.68	1.62	0.43
+17	0.04	0.60	1.11	0.39	0.06	0.64	1.69	0.44
+18	0.05	0.62	1.16	0.39	0.07	0.66	1.75	0.44
+19	0.05	0.61	1.21	0.40	0.07	0.66	1.82	0.45
+20	0.05	0.63	1.26	0.40	0.07	0.73	1.89	0.45

Moody's Events

	Contaminated				Uncontaminated			
Day	AAR	t-Test Statistic	CAAR	t-Test Statistic	AAR	t-Test Statistic	CAAR	t-Test Statistic
-20	0.02	0.32	0.02	0.32	-0.04	-0.54	-0.04	-0.54
-19	0.02	0.33	0.04	0.33	-0.04	-0.64	-0.08	-0.59
-18	0.01	0.23	0.05	0.30	-0.05	-0.76	-0.12	-0.65
-17	0.01	0.24	0.07	0.28	-0.05	-0.74	-0.17	-0.67
-16	0.01	0.19	0.08	0.26	-0.05	-0.77	-0.22	-0.69
-15	0.02	0.44	0.10	0.29	-0.03	-0.73	-0.25	-0.70
-14	0.05	1.17	0.15	0.39	-0.01	-0.35	-0.26	-0.68
-13	0.04	0.75	0.18	0.43	-0.03	-0.87	-0.29	-0.70
-12	0.05	1.08	0.23	0.49	-0.01	-0.70	-0.30	-0.70
-11	0.05	1.25	0.28	0.56	-0.01	-0.52	-0.31	-0.70
-10	0.06	1.57	0.34	0.64	0.00	0.57	-0.30	-0.69
-9	0.07	2.02	0.41	0.74	0.02	1.07	-0.28	-0.67
-8	0.07	1.83	0.48	0.82	0.01	1.35	-0.27	-0.63
-7	0.07	1.57	0.55	0.88	0.00	0.21	-0.27	-0.61
-6	0.07	1.63	0.63	0.93	0.01	0.39	-0.26	-0.58
-5	0.09	1.86	0.71	0.99	0.02	1.91	-0.24	-0.53
-4	0.10	2.15	0.81	1.06	0.03	2.06	-0.21	-0.46
-3	0.09	1.92	0.90	1.12	0.03	0.82	-0.19	-0.38
-2	0.09	1.78	0.99	1.16	0.02	0.58	-0.17	-0.31
-1	0.09	2.07	1.08	1.20	0.03	1.12	-0.13	-0.24

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
0	0.09	2.18	1.17	1.25	0.03	1.53	-0.10	-0.18
+1	0.10	2.05	1.27	1.29	0.04	1.68	-0.06	-0.11
+2	0.09	1.78	1.36	1.32	0.03	0.91	-0.04	-0.06
+3	0.11	1.97	1.47	1.36	0.03	1.07	0.00	-0.01
+4	0.10	1.59	1.57	1.37	0.02	0.47	0.01	0.02
+5	0.11	1.60	1.68	1.39	0.02	0.60	0.04	0.05
+6	0.11	1.53	1.79	1.40	0.01	0.38	0.05	0.07
+7	0.12	1.55	1.90	1.41	0.01	0.33	0.07	0.09
+8	0.11	1.52	2.01	1.42	0.01	0.33	0.08	0.10
+9	0.11	1.44	2.12	1.42	0.00	0.13	0.08	0.11
+10	0.10	1.30	2.22	1.42	0.00	-0.10	0.08	0.10
+11	0.11	1.27	2.33	1.41	0.00	-0.08	0.08	0.09
+12	0.12	1.30	2.45	1.41	0.00	-0.06	0.07	0.08
+13	0.13	1.32	2.57	1.40	0.00	-0.01	0.07	0.08
+14	0.13	1.29	2.70	1.40	0.00	-0.03	0.07	0.08
+15	0.13	1.35	2.84	1.40	0.00	0.07	0.08	0.08
+16	0.13	1.50	2.97	1.40	0.01	0.34	0.09	0.09
+17	0.12	1.44	3.10	1.41	0.01	0.24	0.10	0.10
+18	0.14	1.62	3.24	1.42	0.03	0.65	0.13	0.12
+19	0.14	1.53	3.38	1.42	0.02	0.46	0.15	0.13
+20	0.15	1.59	3.52	1.43	0.03	0.55	0.17	0.15

Standard and Poor's

	Contaminated				Uncontaminated			
Day	AAR	t-Test Statistic	CAAR	t-Test Statistic	AAR	t-Test Statistic	CAAR	t-Test Statistic
-20	-0.01	-0.17	-0.01	-0.17	0.02	0.14	0.02	0.14
-19	0.00	-0.04	-0.02	-0.10	0.03	0.21	0.04	0.18
-18	0.00	-0.04	-0.02	-0.08	0.02	0.18	0.06	0.18
-17	0.00	-0.03	-0.02	-0.07	0.02	0.17	0.08	0.17
-16	-0.01	-0.07	-0.03	-0.07	0.02	0.14	0.10	0.17
-15	-0.01	-0.08	-0.04	-0.07	0.02	0.15	0.12	0.17
-14	-0.01	-0.14	-0.05	-0.08	0.01	0.11	0.13	0.16
-13	-0.02	-0.19	-0.07	-0.09	0.01	0.05	0.13	0.14
-12	-0.02	-0.23	-0.08	-0.11	-0.01	-0.05	0.13	0.12
-11	-0.02	-0.25	-0.10	-0.12	0.00	-0.03	0.13	0.11
-10	-0.02	-0.24	-0.12	-0.13	0.00	-0.03	0.12	0.10
-9	-0.02	-0.26	-0.15	-0.14	-0.01	-0.06	0.12	0.08
-8	-0.02	-0.20	-0.16	-0.15	0.00	-0.01	0.11	0.08
-7	-0.02	-0.26	-0.18	-0.15	-0.01	-0.07	0.11	0.07
-6	-0.03	-0.39	-0.21	-0.17	-0.02	-0.19	0.09	0.05
-5	-0.03	-0.44	-0.24	-0.18	-0.02	-0.25	0.06	0.04
-4	-0.03	-0.46	-0.28	-0.20	-0.02	-0.25	0.04	0.02
-3	-0.03	-0.49	-0.31	-0.21	-0.03	-0.27	0.01	0.01
-2	-0.03	-0.39	-0.34	-0.22	-0.02	-0.19	-0.01	0.00
-1	-0.03	-0.37	-0.37	-0.23	-0.02	-0.19	-0.03	-0.01
0	-0.03	-0.39	-0.40	-0.24	-0.02	-0.22	-0.05	-0.02
+1	-0.03	-0.35	-0.42	-0.24	-0.02	-0.18	-0.07	-0.03
+2	-0.03	-0.47	-0.46	-0.25	-0.03	-0.27	-0.09	-0.04

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
+3	-0.03	-0.49	-0.49	-0.26	-0.03	-0.29	-0.12	-0.05
+4	-0.04	-0.55	-0.53	-0.27	-0.03	-0.35	-0.15	-0.06
+5	-0.04	-0.48	-0.57	-0.28	-0.03	-0.31	-0.18	-0.07
+6	-0.03	-0.37	-0.59	-0.28	-0.03	-0.26	-0.21	-0.07
+7	-0.02	-0.29	-0.62	-0.28	-0.02	-0.19	-0.23	-0.08
+8	-0.02	-0.18	-0.63	-0.28	-0.01	-0.12	-0.25	-0.08
+9	-0.02	-0.28	-0.65	-0.28	-0.02	-0.21	-0.27	-0.08
+10	-0.02	-0.27	-0.68	-0.28	-0.02	-0.17	-0.29	-0.09
+11	-0.03	-0.36	-0.71	-0.28	-0.03	-0.25	-0.32	-0.09
+12	-0.03	-0.32	-0.73	-0.28	-0.02	-0.21	-0.34	-0.10
+13	-0.03	-0.32	-0.76	-0.28	-0.02	-0.21	-0.37	-0.10
+14	-0.02	-0.27	-0.78	-0.28	-0.02	-0.18	-0.39	-0.10
+15	-0.03	-0.30	-0.81	-0.28	-0.02	-0.20	-0.41	-0.11
+16	-0.03	-0.28	-0.84	-0.28	-0.02	-0.15	-0.43	-0.11
+17	-0.02	-0.23	-0.86	-0.28	-0.02	-0.12	-0.44	-0.11
+18	-0.03	-0.32	-0.89	-0.28	-0.02	-0.18	-0.46	-0.11
+19	-0.03	-0.30	-0.91	-0.28	-0.02	-0.16	-0.48	-0.11
+20	-0.03	-0.32	-0.94	-0.29	-0.02	-0.18	-0.51	-0.11

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level

APPENDIX D

AAR and CAAR for Daily Nominal Exchange Rate Return Approach

All Events

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
-20	0.014	0.279	0.014	0.279	0.004	2.019	0.004	2.019*
-19	0.003	1.291	0.018	0.342	0.003	0.928	0.007	2.453**
-18	-0.001	-0.532	0.017	0.322	-0.002	-0.949	0.005	1.534
-17	-0.001	-0.708	0.015	0.299	-0.001	-0.306	0.004	1.088
-16	0.001	0.501	0.016	0.310	0.001	0.563	0.005	1.305
-15	0.002	0.763	0.018	0.343	0.002	0.760	0.007	1.378
-14	0.004	0.978	0.022	0.419	0.004	0.789	0.011	1.265
-13	-0.007	-2.727**	0.015	0.291	-0.008**	-2.877**	0.002	0.345
-12	0.002	0.860	0.017	0.336	0.001	0.375	0.004	0.367
-11	0.003	1.578	0.020	0.389	0.002	1.248	0.006	0.604
-10	0.003	0.979	0.022	0.442	0.003	0.819	0.008	0.695
-9	0.002	0.759	0.025	0.499	0.004	1.145	0.013	0.859
-8	0.000	0.141	0.025	0.504	-0.001	-0.288	0.012	0.971
-7	-0.002	-0.851	0.023	0.468	-0.004*	-2.024	0.007	0.672

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
-6	0.000	-0.065	0.023	0.462	0.000	-0.111	0.007	0.653
-5	0.001	0.514	0.024	0.493	0.000	0.134	0.008	0.598
-4	0.001	0.440	0.025	0.511	0.001	0.484	0.009	0.689
-3	0.001	0.426	0.026	0.530	0.001	0.409	0.010	0.863
-2	-0.001	-0.791	0.025	0.502	-0.001	-0.692	0.008	0.680
-1	0.002	0.744	0.027	0.536	0.003	0.972	0.012	0.881
0	0.000	0.116	0.027	0.543	0.001	0.523	0.012	0.923
+1	0.004	1.236	0.031	0.617	0.003	1.127	0.016	1.060
+2	-0.005	-2.306**	0.027	0.522	-0.005*	-2.011	0.011	0.742
+3	0.004	2.374**	0.031	0.595	0.004*	2.057	0.014	0.957
+4	-0.003	-1.115	0.028	0.531	-0.006**	-2.728	0.008	0.570
+5	0.002	0.788	0.030	0.558	0.000	0.080	0.009	0.560
+6	-0.002	-1.112	0.027	0.517	-0.002	-1.188	0.006	0.403
+7	0.004	1.681	0.031	0.581	0.001	0.607	0.007	0.473
+8	-0.001	-0.415	0.030	0.564	0.000	0.128	0.008	0.514
+9	-0.001	-0.411	0.029	0.541	-0.002	-0.534	0.006	0.414
+10	0.001	0.412	0.030	0.547	0.001	0.363	0.007	0.468
+11	0.000	-0.054	0.030	0.546	-0.002	-0.701	0.005	0.293
+12	0.004	1.467	0.034	0.608	0.002	0.817	0.007	0.406
+13	0.001	0.687	0.035	0.623	-0.001	-0.374	0.006	0.393
+14	0.003	1.251	0.038	0.664	0.000	0.271	0.007	0.435
+15	0.002	0.721	0.040	0.710	0.002	0.709	0.009	0.527
+16	-0.001	-0.365	0.039	0.698	0.002	0.942	0.011	0.590
+17	-0.002	-1.056	0.036	0.659	-0.001	-1.007	0.009	0.522

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
+18	0.003	1.020	0.039	0.691	0.003	0.897	0.013	0.635
+19	0.001	0.574	0.041	0.701	-0.001	-0.356	0.012	0.610
+20	0.003	1.083	0.043	0.757	0.002	0.734	0.014	0.697

Upgrade Events

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
-20	0.002	0.855	0.002	0.855	0.003	0.879	0.003	0.879
-19	0.003	0.636	0.005	1.054	0.001	0.181	0.004	0.652
-18	0.000	0.179	0.005	0.774	-0.002	-0.603	0.002	0.208
-17	-0.005	-1.610	0.000	0.001	-0.001	-0.286	0.001	0.159
-16	0.004	1.121	0.004	0.530	0.010	2.509*	0.011	1.317
-15	0.000	0.155	0.004	0.549	0.000	-0.160	0.010	1.174
-14	-0.002	-0.477	0.003	0.285	-0.001	-0.163	0.010	0.890
-13	-0.008	-1.830	-0.005	-0.626	-0.014	-2.341*	-0.004	-0.449
-12	0.000	-0.066	-0.006	-0.558	-0.004	-0.916	-0.008	-0.669
-11	0.003	0.710	-0.003	-0.254	0.009	2.231*	0.001	0.085
-10	0.001	0.131	-0.002	-0.163	0.001	0.102	0.002	0.098
-9	-0.007	-2.354*	-0.009	-0.700	-0.005	-1.206	-0.003	-0.227
-8	0.006	2.430*	-0.003	-0.260	0.004	1.282	0.001	0.079

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
-7	0.001	0.372	-0.002	-0.159	-0.002	-0.472	0.000	-0.026
-6	-0.002	-1.045	-0.004	-0.359	-0.005	-1.464	-0.005	-0.336
-5	0.000	0.045	-0.004	-0.310	-0.003	-0.647	-0.009	-0.488
-4	0.004	0.895	0.000	-0.023	0.006	0.918	-0.002	-0.134
-3	0.002	0.570	0.002	0.132	0.005	0.981	0.003	0.168
-2	-0.002	-0.733	0.000	-0.026	0.001	0.134	0.004	0.166
-1	0.006	1.110	0.005	0.361	0.008	0.937	0.012	0.593
0	-0.004	-1.572	0.001	0.094	-0.003	-0.848	0.009	0.467
+1	0.006	0.882	0.008	0.477	0.000	0.008	0.009	0.488
+2	-0.007	-3.494**	0.001	0.067	-0.008	-2.847**	0.001	0.042
+3	0.006	3.338**	0.007	0.398	0.006	2.079**	0.007	0.324
+4	0.003	0.584	0.010	0.476	-0.002	-0.521	0.005	0.222
+5	0.001	0.104	0.010	0.413	-0.002	-0.866	0.003	0.111
+6	-0.004	-1.051	0.006	0.246	-0.001	-0.599	0.001	0.058
+7	0.003	0.747	0.009	0.344	0.001	0.244	0.003	0.116
+8	0.000	0.043	0.009	0.367	-0.001	-0.131	0.002	0.094
+9	0.002	0.340	0.011	0.429	0.002	0.267	0.004	0.188
+10	0.006	1.278	0.017	0.650	0.008	1.087	0.012	0.522
+11	0.001	0.103	0.018	0.603	-0.005	-0.915	0.007	0.365
+12	0.006	1.143	0.023	0.720	0.001	0.131	0.008	0.383
+13	0.005	2.196*	0.028	0.831	0.003	2.741*	0.011	0.558
+14	0.009	1.949	0.037	0.975	0.007	2.312*	0.018	0.838
+15	-0.001	-0.385	0.036	1.001	0.001	0.411	0.019	0.850
+16	-0.007	-1.163	0.029	0.899	0.000	0.085	0.019	0.787

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
+17	0.001	0.215	0.030	1.012	0.002	1.029	0.021	0.834
+18	0.005	0.881	0.035	1.054	0.007	0.891	0.029	0.911
+19	0.002	0.608	0.037	1.030	0.001	0.533	0.030	0.905
+20	-0.002	-0.454	0.035	0.952	-0.005	-1.025	0.025	0.794

Outlook/Watchlisting Events

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
-20	0.003	1.173	0.003	1.173	0.003	1.031	0.003	1.031
-19	0.003	0.728	0.005	1.744	0.004	0.740	0.007	1.824
-18	-0.002	-0.726	0.003	1.155	-0.002	-0.649	0.004	1.287
-17	0.000	-0.162	0.003	0.619	-0.003	-1.269	0.001	0.180
-16	-0.001	-0.766	0.001	0.305	-0.002	-0.869	-0.001	-0.241
-15	-0.001	-0.615	0.001	0.121	0.000	-0.223	-0.002	-0.251
-14	0.001	0.331	0.001	0.217	-0.001	-0.341	-0.002	-0.340
-13	-0.003	-1.551	-0.002	-0.301	-0.004	-1.822	-0.006	-0.991
-12	0.001	0.493	-0.001	-0.094	-0.001	-0.491	-0.008	-0.947
-11	0.001	0.667	0.001	0.102	-0.001	-0.498	-0.008	-1.026

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
-10	0.001	0.372	0.002	0.205	0.002	1.246	-0.006	-0.609
-9	0.005	1.458	0.007	0.635	0.005	1.150	0.000	-0.030
-8	0.001	0.716	0.008	0.786	0.000	-0.217	-0.001	-0.073
-7	-0.002	-0.814	0.006	0.579	-0.004	-1.531	-0.005	-0.427
-6	0.002	0.854	0.008	0.706	0.002	0.889	-0.003	-0.211
-5	0.001	0.290	0.008	0.703	0.000	-0.037	-0.003	-0.191
-4	-0.001	-0.627	0.008	0.578	-0.002	-1.418	-0.005	-0.304
-3	0.003	1.325	0.011	0.850	0.004	1.435	-0.001	-0.063
-2	0.000	0.072	0.011	0.759	-0.002	-1.012	-0.003	-0.201
-1	-0.003	-1.733	0.008	0.576	-0.001	-0.972	-0.005	-0.275
0	0.002	1.809	0.010	0.728	0.002	1.784	-0.003	-0.157
+1	0.002	0.456	0.012	0.789	0.004	1.009	0.002	0.083
+2	-0.003	-1.051	0.009	0.570	-0.001	-0.480	0.000	0.006
+3	0.002	0.914	0.011	0.711	0.002	0.861	0.002	0.100
+4	-0.005	-1.903*	0.006	0.391	-0.007	-2.799**	-0.005	-0.255
+5	0.000	0.093	0.007	0.395	0.000	-0.119	-0.006	-0.262
+6	-0.004	-1.173	0.003	0.177	-0.006	-1.765	-0.012	-0.573
+7	0.004	1.168	0.007	0.361	0.002	0.839	-0.010	-0.443
+8	0.001	0.363	0.007	0.424	0.003	1.479	-0.007	-0.323
+9	-0.002	-0.859	0.006	0.319	-0.003	-1.178	-0.010	-0.463
+10	-0.001	-0.600	0.005	0.243	0.000	-0.192	-0.010	-0.448
+11	-0.002	-0.543	0.002	0.113	-0.004	-0.751	-0.014	-0.519
+12	0.003	0.983	0.005	0.253	0.003	0.808	-0.011	-0.391
+13	-0.001	-0.633	0.004	0.206	-0.002	-0.750	-0.012	-0.479

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
+14	-0.001	-0.488	0.003	0.164	-0.002	-0.853	-0.014	-0.588
+15	0.004	0.936	0.007	0.332	0.004	0.654	-0.011	-0.391
+16	0.002	0.831	0.009	0.387	0.003	1.480	-0.008	-0.286
+17	-0.002	-0.682	0.007	0.320	-0.001	-0.627	-0.009	-0.333
+18	0.000	0.096	0.007	0.325	0.002	0.512	-0.007	-0.246
+19	0.002	1.022	0.009	0.402	0.000	0.149	-0.007	-0.232
+20	0.005	1.355	0.014	0.573	0.006	1.326	-0.001	-0.025

Fitch Events

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
-20	0.0014	0.599	0.001	0.599	0.003	0.933	0.003	0.933
-19	0.001	0.395	0.003	0.937	0.003	0.612	0.005	1.650
-18	-0.002	-0.710	0.001	0.343	-0.001	-0.292	0.004	1.602
-17	-0.003	-1.393	-0.002	-0.435	-0.002	-0.871	0.002	0.553
-16	0.003	0.904	0.001	0.139	0.003	0.935	0.006	1.007
-15	-0.001	-0.735	0.000	-0.016	-0.001	-0.509	0.005	0.779
-14	0.001	0.819	0.001	0.187	0.002	1.366	0.007	1.038

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
-13	-0.006	-2.344**	-0.004	-0.740	-0.007	-2.302*	0.000	0.037
-12	0.001	0.559	-0.003	-0.511	0.000	-0.114	0.000	-0.005
-11	0.002	0.683	-0.002	-0.244	0.002	0.946	0.002	0.264
-10	0.004	1.707	0.002	0.232	0.004	1.352	0.006	0.605
-9	0.000	0.105	0.003	0.235	0.002	0.355	0.008	0.646
-8	-0.001	-0.348	0.002	0.191	-0.002	-1.059	0.006	0.494
-7	-0.001	-0.773	0.001	0.057	-0.002	-0.858	0.004	0.333
-6	0.001	0.490	0.002	0.162	0.001	0.425	0.005	0.460
-5	-0.001	-0.313	0.001	0.062	-0.002	-0.657	0.003	0.199
-4	-0.003	-1.771	-0.002	-0.180	-0.003	-1.949*	0.000	0.001
-3	0.001	0.635	-0.001	-0.044	0.002	1.101	0.002	0.170
-2	-0.001	-0.749	-0.002	-0.147	-0.001	-0.672	0.001	0.061
-1	0.002	0.567	0.000	0.013	0.005	1.046	0.006	0.373
0	0.001	0.849	0.001	0.075	0.001	1.493	0.007	0.431
+1	0.001	0.446	0.002	0.170	0.004	1.088	0.011	0.636
+2	-0.003	-1.358	-0.001	-0.059	-0.001	-0.429	0.010	0.544
+3	0.004	2.121*	0.003	0.209	0.004	2.116*	0.013	0.774
+4	-0.001	-0.433	0.002	0.146	-0.003	-1.169	0.011	0.594
+5	-0.003	-1.254	-0.001	-0.062	-0.001	-0.470	0.010	0.534
+6	-0.006	-2.559**	-0.007	-0.472	-0.004	-1.378	0.006	0.352
+7	0.004	1.710	-0.004	-0.229	0.004	1.666	0.010	0.613
+8	0.001	0.599	-0.003	-0.162	0.000	0.137	0.011	0.648
+9	0.001	0.401	-0.001	-0.082	0.002	0.423	0.012	0.774
+10	0.003	1.119	0.002	0.130	0.004	1.113	0.017	0.954

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
+11	0.000	-0.051	0.002	0.119	-0.001	-0.382	0.015	0.837
+12	0.003	1.170	0.005	0.323	0.004	0.913	0.019	1.037
+13	0.000	-0.141	0.005	0.322	-0.002	-0.819	0.017	0.997
+14	0.001	0.253	0.006	0.348	0.000	-0.021	0.017	0.975
+15	0.005	1.270	0.010	0.591	0.005	1.009	0.022	1.153
+16	0.000	0.208	0.011	0.575	0.002	1.060	0.024	1.174
+17	0.000	-0.113	0.010	0.552	-0.001	-0.598	0.023	1.087
+18	0.002	0.538	0.012	0.612	0.004	0.771	0.026	1.169
+19	0.000	0.022	0.012	0.578	0.000	0.184	0.027	1.136
+20	0.000	-0.091	0.012	0.538	0.002	0.385	0.029	1.178

Moody's Events

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
-20	0.005	1.788	0.005	1.788	0.007	1.807	0.007	1.807
-19	0.000	0.006	0.005	1.158	-0.002	-0.475	0.005	0.667
-18	-0.003	-0.814	0.002	0.358	-0.006	-1.280	-0.001	-0.159
-17	-0.001	-0.254	0.001	0.217	0.002	0.763	0.001	0.095

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
-16	-0.002	-0.932	-0.001	-0.308	-0.003	-0.765	-0.002	-0.409
-15	0.006	0.994	0.005	0.576	0.008	0.857	0.006	0.441
-14	0.014	1.197	0.019	0.937	0.017	0.929	0.023	0.722
-13	-0.007	-1.255	0.012	0.748	-0.012	-1.549	0.011	0.442
-12	0.006	1.197	0.018	0.866	0.008	0.942	0.019	0.567
-11	0.005	1.603	0.023	1.058	0.003	1.892	0.022	0.638
-10	0.003	0.507	0.026	0.954	0.008	0.839	0.030	0.685
-9	0.006	0.743	0.032	0.924	0.011	1.039	0.040	0.755
-8	-0.001	-0.078	0.032	1.207	-0.006	-0.437	0.034	0.864
-7	0.000	0.032	0.032	1.354	-0.006	-0.915	0.028	0.808
-6	0.002	4.419***	0.034	1.468	0.002	2.895*	0.030	0.872
-5	0.007	1.964	0.041	1.690	0.007	1.825	0.037	0.996
-4	0.007	1.320	0.047	2.208*	0.008	1.072	0.045	1.388
-3	-0.003	-0.469	0.044	2.756**	-0.002	-0.192	0.043	1.841
-2	-0.002	-0.647	0.042	2.776**	-0.002	-0.331	0.041	1.968
-1	0.002	0.428	0.044	2.467*	0.006	0.903	0.047	1.757
0	-0.004	-0.846	0.041	1.941	-0.001	-0.198	0.046	1.487
+1	0.009	0.904	0.050	2.167*	0.005	0.703	0.051	1.413
+2	-0.006	-1.252	0.044	2.245*	-0.009	-1.322	0.042	1.370
+3	0.008	1.829	0.052	2.331*	0.006	1.026	0.048	1.370
+4	-0.002	-0.260	0.050	2.258*	-0.011	-2.160	0.037	1.157
+5	0.007	1.120	0.057	2.310*	0.003	2.413*	0.040	1.257
+6	-0.005	-1.042	0.052	2.010	-0.005	-1.100	0.035	0.970
+7	0.007	1.320	0.059	2.011	-0.001	-0.168	0.034	0.887

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
+8	-0.005	-0.967	0.054	2.185*	0.000	-0.070	0.034	1.039
+9	-0.002	-0.614	0.052	2.117*	-0.006	-1.175	0.028	0.949
+10	-0.003	-0.902	0.049	1.859	-0.005	-2.074	0.023	0.758
+11	0.006	0.755	0.055	1.672	0.000	0.033	0.023	0.665
+12	0.007	1.133	0.062	1.657	0.001	0.136	0.024	0.670
+13	0.005	1.386	0.067	1.730	0.001	0.362	0.025	0.774
+14	0.006	0.866	0.073	1.663	0.000	-0.136	0.025	0.791
+15	0.001	0.116	0.074	1.739	0.003	0.545	0.027	0.762
+16	-0.002	-0.237	0.071	1.930	0.006	1.136	0.033	0.852
+17	-0.009	-1.930	0.063	1.886	-0.002	-0.825	0.031	0.841
+18	0.010	2.464*	0.073	2.131*	0.012	2.114	0.043	1.097
+19	0.001	0.228	0.074	2.117*	-0.004	-0.703	0.039	1.130
+20	0.006	2.438*	0.080	2.150*	0.004	1.213	0.042	1.143

Standard and Poor's Events

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
-20	0.000	0.381	0.000	0.381	-0.001	-0.586	0.001	-0.586

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
-19	0.007	2.057*	0.008	1.925	0.007	1.412	0.005	1.126
-18	0.000	-0.024	0.008	1.601	-0.002	-2.208*	0.005	0.733
-17	0.000	0.174	0.008	1.559	-0.002	-0.805	0.005	0.477
-16	-0.002	-1.216	0.006	1.218	-0.002	-0.704	0.005	0.138
-15	0.000	-0.149	0.006	1.078	0.000	0.143	0.006	0.153
-14	-0.003	-1.211	0.003	0.495	-0.003	-0.839	0.006	-0.362
-13	-0.003	-0.766	0.000	-0.040	-0.005	-1.071	0.004	-1.726
-12	-0.002	-0.603	-0.003	-0.313	-0.007	-1.995	0.005	-2.876*
-11	0.000	-0.145	-0.003	-0.438	0.002	0.569	0.005	-2.637*
-10	0.000	-0.105	-0.003	-0.471	0.000	-0.127	0.005	-2.422*
-9	0.000	-0.218	-0.004	-0.496	-0.001	-0.808	0.006	-2.495*
-8	0.004	2.226*	0.000	-0.055	0.003	1.551	0.004	-2.529*
-7	-0.003	-2.085*	-0.004	-0.449	-0.004	-2.360*	0.005	-2.732*
-6	-0.006	-1.770	-0.009	-0.910	-0.008	-1.923	0.008	-2.964*
-5	-0.002	-0.968	-0.011	-0.947	-0.003	-1.952	0.009	-2.901*
-4	0.000	-0.107	-0.011	-0.959	0.000	0.154	0.010	-2.558*
-3	-0.001	-0.337	-0.012	-0.998	-0.001	-0.264	0.011	-2.451*
-2	0.004	0.643	-0.008	-0.718	0.004	0.552	0.009	-2.303
-1	0.000	0.115	-0.008	-0.652	0.000	0.041	0.011	-1.950
0	0.000	-0.170	-0.008	-0.691	-0.001	-0.394	0.010	-2.301*
+1	0.002	0.633	-0.007	-0.573	0.002	0.556	0.010	-2.143*
+2	-0.005	-2.778**	-0.012	-0.961	-0.005	-2.125*	0.012	-2.239*
+3	0.000	-0.183	-0.013	-0.970	-0.001	-0.428	0.012	-2.312
+4	-0.003	-1.298	-0.015	-1.061	-0.003	-1.187	0.014	-2.136*

	Contaminated				Uncontaminated			
Day	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**	**AAR**	**t-Test Statistic**	**CAAR**	**t-Test Statistic**
+5	0.002	0.806	-0.013	-0.823	0.002	0.422	0.016	-1.829
+6	0.005	2.044*	-0.008	-0.496	0.003	1.077	0.016	-1.669
+7	0.003	0.548	-0.006	-0.316	0.004	0.633	0.019	-1.184
+8	0.005	1.223	0.000	-0.018	0.005	0.805	0.023	-0.778
+9	-0.005	-1.473	-0.005	-0.259	-0.006	-1.453	0.022	-1.087
+10	0.001	0.194	-0.005	-0.234	0.003	0.915	0.023	-0.905
+11	-0.004	-0.944	-0.009	-0.377	-0.005	-0.932	0.027	-0.953
+12	0.002	0.817	-0.007	-0.290	0.003	0.994	0.029	-0.795
+13	0.000	0.105	-0.007	-0.291	0.000	-0.052	0.028	-0.820
+14	0.002	1.125	-0.004	-0.191	0.003	1.127	0.028	-0.722
+15	-0.002	-0.955	-0.006	-0.266	-0.001	-0.518	0.030	-0.717
+16	0.001	0.247	-0.005	-0.197	0.003	0.549	0.034	-0.526
+17	0.002	1.454	-0.003	-0.111	0.003	2.110	0.035	-0.443
+18	-0.005	-1.562	-0.008	-0.302	-0.005	-1.143	0.035	-0.589
+19	0.001	0.581	-0.007	-0.255	0.002	0.893	0.036	-0.511
+20	-0.001	-0.702	-0.008	-0.303	-0.002	-1.151	0.035	-0.595

*** Two-tailed test significant at 1% level.

** Two-tailed test significant at 5% level.

* Two-tailed test significant at 10% level