An Assessment of Kenya's Sovereign Risk

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STUDENT'S DECLARATION

I, the undersigned, declare that this is my original work and it has not been submitted to any other college, institution or university other than the University of Nairobi for academic credit.

Signed: _____   Date: _____

    Angela Mandi (X50/75446/2009)

This project has been presented for examination with my approval as the appointed supervisor.

Signed: _____   Date: _____

    Prof. Leopold Mureithi

DEDICATION

To my parents; Joseph Wilfred Otuke Mandi and Kathleen Ayako Owour Mandi. Thank you!

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ABSTRACT

This paper sought to assess Kenya's sovereign risk by applying the bottom-up, micro assessment approach as espoused by Edward Altman and Herbert Rijken, which proposes that the risk profile of a sovereign mirrors the risk profile and health of its private sector. The study sought to determine whether the Z-score risk model developed by Edward Altman can be applied to measure Kenya's sovereign risk. Using the Z-score model, Kenya's yearly historical probability of default over a period of 7 years was calculated and results validated by back-testing and application of statistical tests. Finally, the study considered whether the Z-score model could be adapted for Kenya's operating environment.

The findings of the study inferred that Kenya's historical probability of default and by extension its sovereign risk, as measured using the z-score model, has historically been low. This conclusion, low probability of default, was found to be consistent with the conclusions drawn using the more conventional macro based sovereign risk measurement models (S&P and the EIU models). However, the validation processes indicated that the micro based z-score model was not sufficiently robust to be applied to measure Kenya's sovereign risk and the Z-score model would need to be modified and adapted to better reflect Kenya's dynamics.

The study has implications for monetary and fiscal policy, private sector policy as well as sovereign risk model development for developing economies such a Kenya.

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Chapter 1: Introduction

1.1. Background

Sovereign risk has been broadly defined as the probability that a country may not pay its debts (IMF, 2011). The IMF however, went ahead to state that the aforementioned definition was 'too narrow' with the financial crisis of 2008 exposing the intricacies of sovereign risk. IMF highlighted "the very complex interactions between fiscal balances, public and private debt, and the financial sector and the impact on financial stability".

In seeking to support their respective economies during periods of recession or times of crisis, Governments tend to offer significant levels of financial support. The impact of such intervention has been reflected in a deterioration of fiscal balances, increased debt levels and weakening monetary conditions (interest rates, exchange rates and by extension inflation). The private sector/households similarly exhibit signs of stress such as reduction in production, scaling down of capacity expansion, increased events of default, increased social and political tension to name but a few. The above scenario was witnessed in the aftermath of the 2008 Global financial crisis. (ECB, 2010: Yap, Reyes & Cuenca 2010).

In the aftermath of the 2008 global financial crisis, Governments, corporates and financial systems the world over were forced to grapple with rapidly deteriorating confidence in the credit worth of counterparties, both corporate and sovereigns, as critical players in the markets. A notable number of sovereigns e.g. Portugal, Ireland, Greece, Spain saw their risk profiles revised from strong, favourable, low risk economies to weaker/ higher risk economies. Some economies stood at the brink of default on their credit obligations rising concern on debt service ability as well as capacity to support their respective economies.

Kenya is not immune to events of crisis (financial and non-financial) which impacts on its risk profile. Kenya attained its independence from British rule in 1968 and its economic performance has been characterized by periods of strong economic growth as well as depressed economic performance, 'booms and busts', fuelled by both domestic events (droughts, state of political stability, domestic policies) and external shocks.

Legovini (2002) notes that the first 15 post-independence years saw sustained economic growth and social developments while the post 1980 period was typified by slow or negative growth, mounting

macroeconomic imbalances and significant losses in social welfare. Legovini (2002) points out that some of the factors that impacted negatively on Kenya's economic performance included a series of trade shocks (oil shocks), poor macroeconomic responses to shocks, and a change in the structure of the economy which saw the government start to become an increasingly dominating force/player, with increased establishment of state owned companies and increased government expenditure. The fiscal imbalances that accompanied the growth in government investment put pressure on Kenya's domestic credit and inflation.

Kenya suffered significant deterioration of its terms of trade in the 1970s leading to the balance of payments crises of 1974 (primarily as a result of the first oil shock) and 1978-80 (the second oil shock). Some of these shocks to the economic system have been exogenous such as severe droughts of 1984 and 1997-2000, the 1998 Niño floods and the rising HIV/AIDS virus prevalence while others were/are endogenous.

Nonetheless, Kenya, like all other economies, must execute policies that are aimed at sustained economic growth and development, in an environment that is susceptible to shocks and uncertainties. An understanding of Sovereign risk is critical in the development of a framework to manage Sovereign risk in the drive to achieve Kenya's growth and development goals.

1.2. Problem Statement

Stability is a fundamental corner stone for the overall development of an economy. An economy that is assessed as exhibiting low risk generally benefits from lower cost of capital, higher levels of investments, steady growth in GDP and relatively higher standards of living. If Kenya is to achieve the objectives laid out in its economic blueprint, 'Vision 2030', management of its sovereign risk is an imperative.

Key Economic Indicators on Kenya: Political unrest, volatile FX rate, volatile interest rates, episodes of high inflation, susceptibility to oil shocks, unsustainable long term growth, point to an economy that is susceptible to instability.

Whilst uncertainty/ risk (Sovereign risk) is systematic in any economy, economies and societies that thrive, identify areas of material risk, develop effective policies to manage/ mitigate these risks and in so doing create a stable environment in which growth and development are nurtured. The Kenyan economy is no exception.

The proposed research seeks to measure Kenya's sovereign risk and in so doing identify the significant parameters critical for the management of Kenya's sovereign risk.

Problem statement: Sovereign risk is systematic in any economy. To manage its sovereign risk, Kenya's policy makers must constantly measure and manage its sovereign risk given its economic, social and political implications.

1.3. Purpose of the Study

Strauss-Kahn (2011) stated that "the crisis that erupted in 2008 is leaving a legacy of high public debt and sharply elevated sovereign risk. This legacy—at least in the European context—has come close to undermining financial stability and the prospects for recovery. Understanding sovereign risk and how it impacts stability in the financial sector as well as the functioning of debt capital markets has, therefore, become crucial".

Financial meltdowns and sovereign crisis' are features of society since time immemorial. Engels (1897) in his work on Socialism described this recurrence as follows:

"As a matter of fact, since 1825, when the first general crisis broke out, the whole industrial and commercial world, production and exchange among all civilized peoples and their more of less barbaric hangers-on, are thrown out of joint about once every ten years. Commerce is at a standstill, the markets are glutted, products accumulate, as multitudinous as they are unsalable, hard cash disappears, credit vanishes, factories are closed, the mass of workers are in want of the means of subsistence, because they have produced too much of the means of subsistence; bankruptcy follows upon bankruptcy, execution upon execution. The stagnation lasts for years; productive forces and products are wasted and destroyed wholesale, until the accumulated mass of commodities finally filter off, more or less depreciated in value, until production and exchange gradually begin to move again. Little by little the pace quickens. It becomes a tort. The industrial trot breaks into a canter, the canter in turn grows into the head-long gallop of a perfect steeplechase of industry, commercial credit, and speculation, which finally after breakneck leaps, ends where it began- in the ditch of a crisis. And so over and over again."

As will be highlighted in the literature review on the subject matter, it is quite apparent that economic crisis' are bound to occur and are thus not exceptions but a norm. As such, understanding and managing sovereign vulnerabilities is of great importance to policy makers as they seek to achieve economic growth and development as well as social and political stability.

The purpose of this research is to assess 'Sovereign Risk' with specific reference to the Kenyan economy. In seeking to understand the concept of Sovereign Risk, the study sought to apply a micro based approach, the Z-score, to measure Kenya's sovereign risk.

1.4.   Research Question

The primary question of this study is: **What is Kenya's sovereign risk?**

From the above primary question, the study sought to answer the following secondary questions:

1. What is Kenya's sovereign risk as measured using the micro 'bottom-up' approach?

2. Is the micro 'bottom-up' approach an appropriate mechanism for the measurement of Kenya's sovereign risk?

3. Can the micro bottom-up model be adapted to better suite Kenya?

1.5.   Objective of the study

The objective of the study was to:

1. Apply the micro approach to measure Kenya's sovereign risk.

2. Assess the consistency in the risk measure as measured using the Z-score micro bottom-up approach relative to a macro based risk measurement approach.

3. Assess whether the z-score model can be adapted for Kenya.

1.6.   Significance/ Justification of the study

An understanding of Kenya sovereign risk is critical for the following reasons:

- Access to liquidity/funding: The perceived risk of a country will impact its access to the funding market and by extension liquidity as well as the terms and conditions that are imposed on the country by fund providers.

- Cost of funding: An increase or the perception of increase in sovereign risk has implications on the cost at which funding is extended to sovereign borrowers in support execution of their fiscal and monetary policies. An increase in the risk profile of the Sovereign is projected on to the corporate and private sector impacting them as well.

- Financial stability: The IMF at a roundtable discussion on the financial crisis and sovereign risk (2011) suggested that there is a link between sovereign risk and the banking sector and that the

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elevated sovereign risk seen in the post financial crisis period had a direct impact on the financial stability of an economy and the global financial system as a whole as well as the prospects of recovery.

- Politics and political stability: As has been witnessed in the Eurozone, financial sector instability has a direct effect on the political environment affecting an administration's ability to govern, impact on the support of the population for Government policies.

- Social development: Sovereign risk has direct impact on the growth prospects of an economy and by extension the standards of living of population.

- Lenders/ Fund providers: The study is also important in providing fund providers with an understanding of sovereign risk that would enable them structure funding appropriately and position their portfolios to mitigate sovereign risk.

- Policy responses: "Understanding the linkages between sovereign risk and the banking sector and how policy makers should deal with these linkages is of critical importance". (Kahn, 2011)

1.7.   Chapter Summary

Chapter One provides the background of the subject matter and an overview of the definition of the term sovereign risk. The problem statement and the purpose of the study are highlighted, both of which frame the research question and the objectives of the research. Finally, the justification of the study outlined. Chapter Two covers literature review on the subject matter which informs the framework of the study.

Chapter 2: Literature Review

2.1   Introduction

This chapter provides an overview of the definition of the term Sovereign risk, the theoretical literature on sovereign risk including the micro and macro approaches of assessing sovereign risk and finally the chapter provides an empirical assessment of Kenya's sovereign risk as determined by the more familiar macro risk rating models developed Standard & Poors, Moody's and Economist Intelligence Unit (EIU).

2.2   Theoretical Literature Review

2.1.1.   Definition

Transactions of any nature are predicated on the assumption that the parties to a transaction have information symmetry e.g. the investor is comprehensively informed of the nature and form of the investment into which they commit their resources, whether the investment meets desired levels of return and the probability that the investment will generate sufficient funds to repay the borrowed, invested resources. The Borrower on the other hand seeks to attract investors by providing confidence in both their willingness and capacity to repay the borrowed resource, in addition to achieving the desired level of return to the investors.

The uncertainty or information asymmetry in a transaction is interpreted as risk. This uncertainty increases the probability that the borrower will fail to meet their obligations as and when they fall due. In financial transactions, this concept is known as credit risk.

Drawing from the above context, Sovereign risk is assessed as 'the credit risk associated with operations involving credit for sovereign states' (Canuto, Santos & Porto, 2004). As is the case in private transaction, sovereign risk is determined by the willingness and the capacity of a sovereign state to meet their obligations. Canuto, Santos & Porto (2004) state the determinants for payment capacity and of willingness to repay debt are of a nature reflecting macroeconomic variables such as the available stock of foreign currency reserves and balance of payments flows, economic growth prospects and capacity to generate tax receipts, a variety of political factors to name but a few of the drivers detailed in the empirical literature hereafter.

Simply put and as was noted at the IMF roundtable on Sovereign risk (2011), *Sovereign risk can be defined as "the probability that a country may not pay its debts."*

2.1.2 Fiscal theory of sovereign risk and default

Uribe (2006) stated that certain monetary and fiscal arrangements are 'incompatible with price stability and government solvency'. In the case of an independent central bank whose policy is to manage prices within a predetermined band, adjustment of price levels has limited applicability as a shock absorber of negative fiscal shocks. Uribe (2006) specifically notes that by sticking to a specific price level target, a government gives up the option to inflate away some of the real value of public debt in response to deteriorating fiscal budget and under such circumstances, default on public debt is inevitable. Argentina debt crisis of 1999 - 2002 is cited as a case in point. Prior to the debt crisis, Argentina had adopted a peso-dollar parity policy which had been in place for almost 10 years and had been instituted by the 1991 Convertibility law. A prolonged recession starting 1999 saw real GDP decrease markedly, national deficit increased and debt surpassed 50% of GDP. The deterioration in macroeconomic fundamentals raised doubt on the ability of the Argentine government to manage the fiscal imbalances which was reflected in a significant increase in the country risk premium (difference between the interest rate on Argentine and US dollar-denominated government bonds of similar maturities). The Argentine government eventually defaulted. Katel (2011) noted 3 factors present at the time as being factors that resulted in the default.

1 The fixed exchange rate between Argentine peso and the US dollar (created at the start of the 1990s by the Economy Minister at the time, Domingo Cavallo).

2 The large amounts of borrowing by former Argentine president, Carlos Menem.

3 An increase in debt due to reduced tax revenues.

Other monetary arrangements that Uribe (2006) cites as potentially increasing the pressure for default under certain fiscal scenarios include aggressive inflation targeting by setting the nominal interest rate as an increasing function of inflation with a reaction coefficient larger than unity. This type of policy rule is often referred to as a Taylor rule after John Taylor's (1993) seminal paper. Brazil's inflation targeting policy is a case in point, were interest rates adjustments were used to control inflation but has resulted in rapid growth in public debt.

2.1.3. Contingent Claims Approach (CCA)

Contingent claims analysis is used to construct a marked-to-market balance sheet for the sovereign and derive a set of forward-looking credit risk indicators that serve as a barometer of sovereign risk. This approach for the assessment of sovereign risk was articulated by Gapen, Gray, Lim and Xiao (2008).

The basis of the analysis is to assess the risk arising from unstable sector balance sheets (corporate, finance and public sectors). External shocks such an interest, exchange rates and market sentiments could result in rapid decline of the assets on the sector balance sheets relative to their liabilities and in extreme cases result in sector insolvency. In which case, risk could be transferred across sectors triggering widespread distress. The risk transfer in this case is 'bottom –up' emanating from the corporate sector through the bank sector and ultimately to the Sovereign balance sheet as was the case in the Asian Crisis and debt crisis in Latin America.

The CCA approach in measuring sovereign risk builds on the dynamics between the sovereign asset, asset volatility and debt obligations in the determination of sovereign distress. CCA derives estimates of sovereign asset values and asset volatility (which are not directly observable) from the value and volatility of sovereign liabilities (which are observable). The asset values are compared against existing contractual liabilities to provide a market-based assessment of sovereign risk i.e. a marked-to-market balance sheet for the sovereign. Sovereign risk is assessed to increase as the positive safety margin between the market value of sovereign assets and contractual obligations decreases and eventually falls below contractual obligations.

The CCA approach outlines a set of key credit risk indicators to measure sovereign balance sheet risk: distance to distress, probability of default (PD), credit spreads, and the market value of risky foreign currency denominated debt.

2.1.4. The Theory of Sovereign Debt and Default

Wright (2011) noted that private defaults on domestic contracts are subject to due legal process and institutions governing bankruptcy. However in instance of sovereign defaults, creditors have limited legal remedies on account of the doctrine of sovereign immunity and even though over time the doctrine is no longer absoluteness, it remains difficult to enforce judgement for recovery. However, Sovereigns are motivated to meet their obligations on account of costs associated with default which include restricted access to financial markets or access granted at a prohibitive cost that reflects the high probability of default associated with the Sovereign. In addition, the domestic cost of default is viewed through the impact on the domestic economy and political system of the country. The economy would be impacted through diminished international trade, weakening of the financial system causing a domestic banking crisis.

2.1.5. Sovereign Default Risk Assessment from the Bottom-Up

Altam, Rijken (2010) assess sovereign risk by analyzing the health and aggregate default risk of a nation's private corporate sector, terming this assessment "bottom-up" analysis.

The Bottom-up approach measures sovereign risk by focuses on the underlying profitability and financial condition of a nation's private corporate sector. Building on the Altman Z-score methodology (1968), the Bottom-up approach measures the cumulative median probability of default of the non-financial sector for the next five years, both as an absolute measure of corporate vulnerability and a relative measure that can be compared to the risk of other sovereigns and to the market's assessment as reflected in the prices of credit default swaps.

In testing their approach, Altam and Rijken measured the default probabilities of listed corporate entities in nine European countries, as well as the U.S., at two different points in time; the start of 2009 (and thus prior to the recognition of the Euro crisis by markets and most credit professionals) and for the first four months in 2010 (essentially, the beginning of the recognition of the crisis). Based on these two observations, Altam and Rijken (2011) suggest that the corporate health index of the private sector would not only have served as an effective early warning indicator, but provided a (mostly) useful hierarchy of relative sovereign risks.

The approach utilizes measures of probability of default to determine corporate vulnerability and draw conclusion on the vulnerability of the Sovereign.

2.1.6 Micro – Macro relationship

Belev & DiBartolo (2013) note that a sovereign entity can be viewed as a collective enterprise of tax payers, who assign a management body (the Government) the authority to manage and allocate the funds/resources. The assets of the enterprise (stream of taxes, fees, and all government receipts), net of government expenditure, is what stands as a guarantee of the debt obligations of the Government.

The contingent claims analysis (CCA) as articulated in the work of Gapen, Gray, Lim and Xiao (2008) articulate the linkage between the private (micro) and Sovereign (macro). Gapen, Gray, Lim and Xiao (2008) note that economies have become increasingly reliant on private capital flows and by extension are exposed to the volatility of these capital flows. Gapen, Gray, Lim and Xiao highlight that following the Asian crisis, an approach of analysing sovereign risk by assessing the instability of the sector balance sheets (corporate, financial and public sector) was effective. Shocks to interest rates, exchange rates, or market sentiment bring about deterioration in the value of a sector's assets compared to its liabilities

lead to a reduction of its net worth leading to insolvency in extreme circumstances. In these extreme conditions, risk is transferred across sectors causing a widespread distress.

Gapen, Gray, Lim and Xiao (2008) state 'Risk transfer can be "bottom-up" from the corporate sector to the banking system and ultimately to the sovereign balance sheet, as was the case during the Asian crisis, or it can be "top-down," as was seen more recently in Latin America.'

The Contingent Claims Approach (CCA) highlights this relationship; it uses the basic structure of the balance sheet, incorporating market information to derive a forward looking assessment of sovereign risk. Under CCA Sovereign distress is a function of sovereign assets, asset volatility, and leverage (contractual obligations).

- Government assets comprise claims on FX reserves, public sector assets, the present value of future cash flows (taxes and such similar revenues which flow from the private sector).

- Asset volatility relates to uncertainty of the value of future assets. (Note that the value of assets is determined at the micro level).

- Liabilities comprise of Government obligation, generally incurred to cover government expenditure (note, debt is increasingly sourced from the private sector).

From the above, one can observe the linkage between the private sector and the government.

Gray, Merton and Bodie (2007) noted that the sectors of a national economy can be viewed as interconnected portfolios of assets, liabilities, and guarantees. Their approach measures the sensitivity of the market value of these portfolio to 'shocks' and using contingent claims analysis, quantifies sovereign credit risk and risks that are transferred from private sector to the public sector.

Allen, Rosenberg, Keller, Setser and Roubini (2002) note that a deterioration of the assets at a sector level could result in loss of confidence of the ability the economy to generate output and revenues (including foreign exchange) to meet its obligations. The impact of poor performance in the private sector leads to increased capital outflows and depleting reserves which impacts on the exchange rates, current accounts and ultimately results in a deep recession.

Krugman (1999), IMF (1998), Corsetti, Pesenti and Roubini (1999a, 1999b) highlight that balance sheet vulnerabilities of economies are driven by microeconomic distortions. These include weakly supervised and regulated financial systems, connected and directed lending, moral hazard driven by implicit and explicit government guarantees leading to over borrowing, over lending and excessive current account

deficits, and finally, fixed exchange rates that may distort external borrowing in the direction of short-term foreign currency debt.

2.3   Empirical Literature Review

Finance theory has generally assumed that government securities and more specifically the U.S. treasury bills are a strong proxy measure of risk free debt. The theory is premised on the notion that federal governments can raise taxes or print money to pay its debt obligations. The 'risk free' assumption assigned to government securities continues to draw debate, raising legitimate questions on sovereign risk and the need to refine and sharpen the definition and assessment of sovereign risk.

'Sovereign risk' can be viewed as the risk that a government may default on its debt obligations. In general, when governments have bonds that are due to mature and they don't have sufficient tax receipts on hand to repay all the debt, they re-enter the market to raise further money via a bond issuance (refinancing). However, there is an underlying risk that bond buyers may not have appetite for the specific government paper or may demand higher yields thus jeopardising the ability of the country to rise the required funding to settling maturing debt. "Refinancing risk" is the risk that a government will be unable to raise sufficient new debt in the market (i.e. at reasonable market prices and in sufficient volume) to repay upcoming bond maturities and this risk could be considered an element of sovereign risk. Sovereign risk can also be viewed from the premise that the government of a country may impose regulations, restricting the ability of the country to meet its obligations. Such regulations include a restriction on foreign currency transaction, regulatory restrictions barring rising of funds such as imposing debt ceilings. In this case sovereign risk may be viewed as an assessment of both the ability and the willingness of a country to service debt service.

A country's institutional framework and regulations directly impact on the country's ability to meet its obligation. Nippani, Liu, and Schulman (2001) highlight the impact of a country's regulation's on its ability to meet its obligations was showcased in November 1995 when the U.S. Treasury department came close to defaulting on payments on Treasury securities when the White House made a press announcement stating that a default was becoming increasingly likely after the President of the United States and the US congress failed to reach an agreement on the federal budget ceiling. The Congress refused to increase the federal debt ceiling and effectively increasing the risk that the US Treasury would be unable to raised sufficient funds to meet its debt obligations. The announcement of potential default resulted in most major credit rating agencies (Moodys, Standard & Poors, Fitch) issuing warnings of likely credit downgrades of the US' rating. The standoff further raised questions, world over, of the

USA's credibility which has long been taken for granted. Although the political standoff was resolved and the threat of default failed to materialize, the long held assumption that the US Treasury could not default on its obligations was put to test.

Nippani, Liu and Schulman (2001) noted that the US budget ceiling stand-off brought to fore the debate as to whether the ability of the Government to maintain the full faith of meetings its credit obligations could be jeopardized by policy disagreements more specifically they asked the question: could the fact that the government is restricted by debt ceilings and Congress from raising taxes lead to a reconsidering the risk-free nature of Treasury securities?

Sovereign risk has also been viewed as a yield differential between the yields of the sovereign's bond/security and a risk free asset (the British Consol yield and the US treasury securities yield have been used as a measure of risk free rates). (Christodoulaki, Cho and Fryzlewicz, 2011)

Literature in the subject of sovereign risk highlights a broad range of both quantitative and qualitative factors that influence the sovereign risk.

Christodoulaki, Cho and Fryzlewicz (2011) sought to shed light on the way historical events, including political and institutional changes determined the creditworthiness of the Greek government on the London market from the period starting with Great War until the great crash. They contend that statistical analysis showed investors reacted to news on fiscal performance and public debt developments in addition to unforeseen political events and institution reform. Their work combined historical data with statistical evidence to examine how news interacts with the capital markets to determine asset prices effectively quantifying the risk of the issuer in this case a sovereign. The analysis showed military defeat, unstable and frequent change of government, lack of access to liquidity from lending institutions (including the international capital markets, the Council of the League of Nations) and persistent monetary instability (Greek currency lost approximately 95 per cent of its pre-war value by mid-December 1926) had a negative impact Greek's default risk rose. The establishment of a coalition government (political stability) and re-established access to funds from the Council of the League of Nations had a positive impact on the creditworthiness of Greece while the establishment of a central bank de novo (central bank) and introduction of the Gold Exchange Standard did not produce any quantitative market response (the Central Bank was opened for business on 14th May 1928, two days after the drachma was stabilised). The paper also posited that announcements by governments had little or no effect on sovereign risk due to among other reasons low credibility of announcements, and that markets, in some instances, have already factored in the governments expected reaction to a crisis.

Lipson (1985) notes that the 1970s saw a significant increase in commercial borrowings by sovereigns via the Eurocurrency capital markets fuelled by among other factors the Arab oil embargo which saw the price of oil quadruple which led governments to run on budget deficits funded largely by debt. In the 1980s after the second oil crisis, a deep recession and soaring interest rates, governments were increasingly faced with unmanageable debt obligations and declining export earnings due to weak economic performance. Sovereigns, faced with the increasing risk of defaulting on its obligations, will tend to seek a restructure of the debt obligations which could be in the form of a rescheduling of the amortization schedule, requesting for balance of payment support funding from the World Bank/IMF. Lipson (1985) also notes that an early sign of stress is a build up of arrears or reluctance by funding institutions to provide rollover/ refinance maturing credits. Countries that have had their debts rescheduled include Brazil, Argentina, and Mexico among others.

Arellano and Ramanarayanan (2010) state that during market crisis, interest rates spreads rise, debt maturity shortens and the spread on the short term bonds is higher than the long-term bonds. In their paper titled "Default and the Maturity Structure in Sovereign Bonds" they note that debt crises in emerging markets is normally blamed on governments borrowing large amounts of short term debts in international capital markets which requires the government to roll-over large amounts of debt more frequently and at higher prices during periods of crisis and when external credit is restricted. Rodrik and Velasco (2003) show, using evidence from a broad set of countries, that a high level of short-term foreign debt increases the likelihood of a crisis. Broner, Lorenzoni, and Schmukler (2013), stated that emerging market governments actively shift to shorter-maturity debt in a crisis and issue long-term debt in normal times.

The Euro area sovereign crisis provides fodder for assessment of sovereign risk. The growing fiscal deficits and financial difficulties facing governments and government owned companies/agencies brought the nuances of sovereign risk to the fore. Dubai World, a state controlled company, announced in 2009 that it would not pay interest due on some of its debt estimated at US60 billion and asked creditors to restructure their debt facilities. The request for the restructure fuelled uncertainty in the market that Dubai may not be able to meet its obligations. In 2010, excessive public spending produced the first sovereign bond crisis in Europe, specifically, Greece. The Hellenic crisis, Oldani (2011) contends, was the product of years of recession, of the sluggish economic environment and poor productivity – but above all it was the product of the mismanagement of the public finance, of unsatisfactory reporting, risk management and accounting practices (Oldani 2011). The large budget deficit in some

euro zone countries brought focus to the deteriorating debt/GDP ratios which pointed to weakening fiscal environment in Spain, Ireland, Greece and Spain to mention a few. These concerns gave rise to widening of credit default swaps (CDS) prices and credit spreads for borrowing sovereigns. Gyntelberg, Hördahl (2010) note that activity in the CDS market for developed country sovereign debt increased significantly in the period leading upto, during and after the financial crisis as investors adjusted their exposure to sovereign risk. They note that the CDS market for developed countries was virtually non-existent only a few years back, when sovereign CDS were mostly on emerging market economies, but has since grown rapidly. This increase in activity resulted in significantly higher outstanding volumes of CDS contracts.

In the case of Greece, the red flag was raised when in October 2009, it became apparent that the budget deficit would be higher than expected. Greece reported that in 2009 it had run an unprecedented deficit of 15.4% of GDP and that the public debt had ratched to 126.8% (Oldani 2011).

Measure	2006	2007	2008	2009
Net borrowing (-)/ net lending (+) as % of GDP	-5.7%	-6.4%	-9.4%	-15.4%
General government consolidated gross debt as % of GDP	106.1%	105%	110.3%	126.8%

Table 1: Greece Debt Ratios

Source: Hellenic Statistical Authority/Eurostat, UniCredit Research, (accessed 8 January 2013).

These alarming statistics prompted rating agencies (Moodys , S&P) to reassess the public finance of Greece and put the borrower on credit watch for potential downgrade. All credit rating agencies eventually downgraded Greece's sovereign bonds. Following the downgrades, the credit spreads and the CDS premia increased. The rating of Greek bonds fell to BB+ in 2010, and most of the Greek debt began to sale off market, in order to avoid excessive interest payments. The yield on Greek sovereign bonds has trended upward throughout the year, and in May 2011 it was downgrade to junk security status (Oldani 2011).

Gyntelberg, Hördahl (2010) also highlight the behaviour of bank equity stock prices (primary investors in government bonds). The stock prices of major Greek banks fell significantly with rating agencies noting that the bonds which were generally used as collateral by banks were less valuable and there was a growing risk that the bonds would not be accepted as collateral specifically by the European Central Bank which was a key liquidity source.

The debate on the most effective avenues to restore the credibility and creditworthiness of sovereign nations is poised to persist into the unforeseeable future. One school of thought argues for debt forgiveness, while another calls for increased lending/ funding arguing that the additional funds could be used to power growth and eventually generate income to meet and reduce debt obligations. Baker plan of 1985 (launched in October 1985 at the International Monetary Fund/World Bank meeting in Seoul, by James Baker, United States Secretary of the Treasury, as a way to combat the international debt crisis) emphasized additional funding coupled with growth-oriented domestic policies rather than debt reduction. However, Boot and Kanatas (1995) noted that lenders have generally been reluctant to inject additional funds and prefer debt reduction / forgiveness on condition that the sovereign borrower commits to policy adjustments that reduce consumption and promote investments which it is argued would increase the revenue generating capacity of the country. Cohen and Sachs (1986) and Diwan (1990) argue that aggregate investment in export production would increase the export revenue generating capacity of a sovereign and by extension boost its debt service capability and effectively reduce the sovereign credit risk.

Integrity of data/ information, sound reporting and sound governance framework has also been proposed as important signals of the creditworthiness of a sovereign. Oldani (2011) noted that Greece joined the European Monetary Union in 2003, but deliberately carried out a series of financial operations that were not properly reported. The aim of these operations was to match European budget criteria. A comprehensive EU report on this issue (EU, 2010) uses harsh terms to describe the conduct of the Greek authorities: "deliberate misreporting", "methodological problems," "unsatisfactory technical procedures in the Greek statistical institute", "inappropriate governance", "poor cooperation and lack of clear responsibilities". The EU notes that "the most recent revisions are an illustration of the lack of quality of Greek fiscal statistics … and show that the progress in the compilation of fiscal statistics in the country, and the intense scrutiny by Eurostat since 2004, have not sufficed to bring the quality of Greek fiscal data to the level reached by other EU Member States."

Country risk has been defined by Cosset and Roy (1991) as the likelihood that a sovereign will default on its debt. Cosset and Roy (1991) sought to highlight the determinants of country risk on the basis of economic and political variables that were usually considered as key determinant of country risk ratings, in a bid to establish a predictive creditworthiness model. Feder and Ross (1982) also studied country risk, highlighting the systematic relationship between a country's risk rating and the credit pricing attached to its securities in the Euromarket.

The Euromoney credit rating score (Euromoney, 1987) assigned to a country is a weighted average of three indicators:

1) Market indicators: encompassing access to the bond markets, selldown performance (subscription success/demand for security), access to trade finance (40%).

2) Credit indicators: payment record and rescheduling difficulties (20%).

3) Analytical indicators: political risk, economic indicators and economic performance forecasts (40%).

Cosset and Roy (1991) concluded that country risk ratings respond positively to per capita income, propensity to invest, low debt levels.

Gaillard (2009) found that three variables: the default history of the sovereign issuer, the GDP per capita and the net direct debt to operating revenue ratio of the local government) explain 80% of sub-sovereign ratings. Cantor and Packer (1996) show that five variables (GDP per capita, the indicators for economic development and for sovereign default, inflation and external debt) explain 90% of the ratings issued by Standard & Poors and Moody's in 1995.

Moody's definition of sovereign default includes the following types of default events: missed or delayed disbursement of contractual payments as defined in credit agreements and distressed exchange which refers to any debt restructures aimed at avoiding default (Moodys 2011). Moody's notes that sovereign upgrades in 2007 – 2009 were driven by prospects of sustained economic growth and resilience of the financial sector, prudent fiscal and monetary policies as well as structural reforms. Ratings downgrades in Europe during the same period reflected weak potential growth prospects in the short term and deteriorating monetary indicators and credit risk.

A market based assessment of sovereign risk is via sovereign credit default swaps (CDS). A CDS is a contract between two parties whereby the buyer of protection makes periodic payments to the seller, and in return receives a contracted amount if there is a credit event (such as a default). The buyer of protection may be an investor who owns a government's bonds and, rather than selling them to the market prefers to 'hedge' the risk by buying a CDS. CDS are designed to offset risks such as defaults and bankruptcies. A protection buyer is similar to a buyer of insurance who buys protection against a future unknown event. (Colonial First State, 2010). An increase in the price of the 'protection' i.e. CDS, implies the protection seller has assessed that the probability of default has increased as hence protection cost

increases in tandem. This pattern was seen in the Greek CDS whose prices started rising as the market perceived its risk as rising.

Understanding sovereign risk is critical for policy makers/making. Weak sovereign risk rating has implications on cost of funding/ debt service, limits access to liquidity exacerbating an already perilous economic and political situation. A decision to boost the economy using public debt and such similar fiscal interventions for instance, may impact the sovereign risk of a country by fuelling concern as to the debt service capabilities of the Country.

The credit rating downgrades of several European nations in 2011/ 2012, a reflection of deteriorating risk, has resulted in material rise in the yield of bonds issued by the downgraded nations such as Greece. Investors will assess the repayment ability and factor in a default premium in the pricing thus increasing the yield on the bond and the cost of funding. In addition, certain investors are prohibited from holding sub-investment grade bonds, and hence would not participate in any capital raising carried out by the downgraded sovereign and would sell-off any sub-investment grade security that is held. The aforementioned action, would impact the psychology of other investors and increasing the probability of under subscription by investors of any securities floated by the affected country resulting in a liquidity crisis.

2.3.1   Standard and Poor's Methodology

Sovereign credit ratings are assigned by credit rating agencies such as Standard and Poor's, Moody's and Fitch. The credit rating provides an assessment of the level of risk associated with investing in a particular country and have been generally used as a grading of a country's ability to meet its financial obligations i.e. its creditworthiness.

The S&P sovereign rating criteria takes into account factors that are assessed to affect a sovereign government's willingness and ability to service its debt on time and in full. S&P's Sovereign Rating criterion (2012) has identified the following five factors as the foundation of their sovereign credit analysis:

- Institutional effectiveness and political risks, reflected in the political score: A view on effectiveness and efficiencies of government institutions and policy making process which directly impact on public finance, economic growth and response to political and economic shocks.

- Economic structure and growth prospects, reflected in the economic score: A view of a sovereign's income levels, growth prospects, and its economic diversity and volatility.

- External liquidity and international investment position, reflected in the external score: Assessment of the status of a sovereign's currency in international transactions, the sovereign's external liquidity, and its external indebtedness (including sovereign's assets and liabilities relative to the rest of the world).

- Fiscal performance and flexibility, as well as debt burden, reflected in the fiscal score: A view of the sustainability of a sovereign's deficits and its debt burden.

- Monetary flexibility, reflected in the monetary score: A view of the monetary authority's ability to use monetary policy to address domestic economic stresses, particularly through its control of money supply and domestic liquidity conditions. In addition it is a view of the credibility of monetary policy, as measured by inflation trends and the effectiveness of mechanisms for transmitting the impact of monetary policy decisions to the real economy, largely a function of the depth and diversification of the domestic financial system and capital markets.

Each of the above factors is assigned a score between 1 (strongest) and 6 (weakest) based on a set of predefined quantitative and qualitative factors. The scores form the sovereign's political and economical profile on one hand and flexibility and performance profile on the other hand. The aforementioned profiles are used to determine an 'indicative rating level' and form the basis for assigning a rating that ranges between AAA (strongest) to D (weak/ default).

With specific reference to Kenya, the table below tracks S&P's rating history of Kenya as sovereign.

Rating Date	Issuer Credit Rating	CreditWatch/ Outlook Date	Rating Action	Rating	CreditWatch/ Outlook
Foreign Long-term ratings					
08-Sep-2006	Foreign Short-Term	08-Sep-2006	New Rating	B	
08-Sep-2006	Foreign Long-Term	08-Sep-2006	New Rating, CreditWatch/ Outlook	B+	Stable
08-Sep-2006	Foreign Long-Term	02-Jan-2008	CreditWatch/ Outlook	B+	Watch Neg
04-Feb-2008	Foreign Long-Term	04-Feb-2008	Downgrade, CreditWatch/ Outlook	B	Negative
04-Feb-2008	Foreign Long-Term	10-Mar-2008	CreditWatch/ Outlook	B	Stable
04-Feb-2008	Foreign Long-Term	04-Aug-2008	CreditWatch/ Outlook	B	Positive

19-Nov-2010	Foreign Long-Term	19-Nov-2010	Upgrade, CreditWatch/ Outlook	B+	Stable
20-Dec-2012	Foreign Long-Term	20-Dec-2012	Affirmation of rating	B	Stable
Local Long-Term Ratings					
08-Sep-2006	Local Short-Term	08-Sep-2006	New Rating	B	
08-Sep-2006	Local Long-Term	08-Sep-2006	New Rating, CreditWatch/ Outlook	BB-	Stable
02-Jan-2008	Local Long-Term	02-Jan-2008	Downgrade, CreditWatch/ Outlook	B+	Watch Neg
04-Feb-2008	Local Long-Term	04-Feb-2008	Downgrade, CreditWatch/ Outlook	B	Negative
04-Feb-2008	Local Long-Term	10-Mar-2008	CreditWatch/ Outlook	B	Stable
04-Feb-2008	Local Long-Term	04-Aug-2008	CreditWatch/ Outlook	B	Positive
19-Nov-2010	Local Long-Term	19-Nov-2010	Upgrade, CreditWatch/ Outlook	B+	Stable
20-Dec-2012	Local Long-Term	20-Dec-2012	Affirmation of rating	B+	Stable

Table 2: Kenya Rating History - Standard and Poor's

Source: S&P Global Credit Portal, (accessed 26 August 2013)

S&P inaugural rating of Kenya's sovereign risk was in 2006 (Standard and Poor's, 2006). The rating was based on the economic growth prospects/ outlook and macroeconomic stability. The rating was weighed down by 'low levels of economic development with severely limited infrastructure and vulnerability to exogenous shocks.' In addition the report cited high debt levels and weak governance structure.

In August 2008, S&P revised the outlook of Kenya's rating to positive citing the execution of growth enhancing reforms, stability in the political front (following formation of the coalition government), and prudent macroeconomic policies. The report also noted the stable financial system, robust fiscal revenues and a robust debt management strategy. The areas of concern raised included a deterioration of current account deficit on account of sluggish exports and higher fuel and food prices (imports).

Kenya's rating was upgraded to B+ (stable) by S&P as at Dec 2012 (Standard and Poor's, 2012). The rating was boosted by a track record of fairly robust growth, a diversified economy, and a large and growing domestic debt market. In addition S&P looked positively at the promulgation of the new constitution as a factor reducing political risk. S&P noted that the rating was weighed down by "the

country's history of ethnic violence, low level of economic development, relatively high government debt, susceptibility to balance of payments pressures, and intermittently high inflation".

2.3.2   Fitch Sovereign Ratings Methodology

Fitch (2012), on their part describes sovereign risk as assessment of a sovereign's capacity and willingness to honor existing and future obligations. The key drivers of sovereign risk as assessed by Fitch incorporate both quantitative and qualitative factors including: Macroeconomic performance and prospects, structural features of an economy e.g. vulnerability to shocks, public finance (structure and sustainability of public debt and fiscal financing) and external financing (current account funding, capital flows, external debt (structure of private and public debt).

Sovereign creditworthiness is thus impacted by the standalone quality of the sovereign (fiscal and monetary policies) and the robustness of the economy's capacity to generate tax receipts and foreign exchange.

Fitch's Sovereign Rating Model (SRM) (Fitch 2012) is used to generate a score that is a measure of credit risk associated with the sovereign. SRM has been estimated from the application of Ordinary Least Squares (OLS) to the set of economic and financial variables (18 variables) that were found to be statistically significant (at 90% confidence). The generated score maps to a ranking ranging from AAA (best rating/ lowest risk) to D (lowest rating/ speculative high risk) (FitchRatings, 2013). Fitch's inaugural rating of Kenya was in 2007 and the table below shows the rating history.

Year	Rating	Outlook
12 Dec 2007	B+	Stable
30 Jan 2008	B+	Negative
16 Jan 2009	B+	Stable
26 August 2010	B+	Stable
12 August 2011	B+	Stable
6 August 2012	B+	Stable
2 August 2013	B+	Stable

Table 3: Kenya's Rating History: Fitch Ratings

Source: Fitch Rating Portal, (accessed 16 August 2013)

In its 2013 rating of Kenya, Fitch noted that Kenya's economic growth was subdued over the last 5 years, showed public finances weaknesses and its deteriorating competitiveness was reflected in the relatively

high current account deficit. The increased political instability (informed by violence seen in 2007) and fiscal pressure were additional negatives on its rating. However, Fitch noted positively the low volatility of Kenya's GDP, the developed domestic debt market, a diversified economy and the decline in the external debt ratios.

2.3.3 The Economist Intelligence Unit (EIU) Country Risk Model

The EIU country risk model generates a country risk score for developing and highly indebted countries. This score is indicative of the credit profile of the country from a macroeconomic and financial perspective.

The EIU methodology (EIU, 2013) assess risk from a political, economical (policy and structure) and monetary (liquidity, foreign exchange, debt) perspective. The EIU asks respective country expert a series of quantitative and qualitative questions on recent historical and expected trends (economical and political). The results are scored from low risk (A with a minimum score of 1) to highest risk (E with a maximum score of 100). The 3 major categories of risk parameters are outlined in the below.

Risk	Comment
Currency Risk	Assess the risk of devaluation and foreign exchange rate risk. In addition, it incorporates the political, economic policy, economic structure and liquidity risk factors
Sovereign Debt Risk	This score assess the extent of arrears on a country's debt obligations. The score similarly takes into account the political and economic factors that affect the Country's ability to meet its debt obligations
Banking Sector Risk	The score assess the risk of arrears on debt service obligations in the private sector as reflected on health of the private banking institutions. The assessment is focused on the general health of the banking sector and not a specific banking institutions

The risk score is derived by taking the simple average of the sovereign risk score, the currency risk score and the banking sector risk score. The graph below highlights Kenya's historical EIU risk score.

Kenya - Country Risk Score
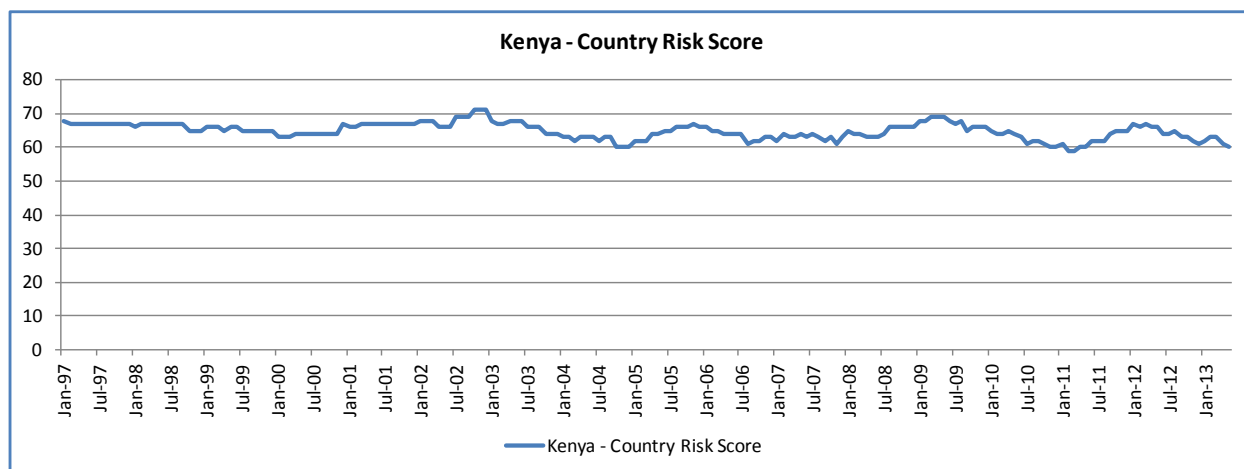
Figure 1: EIU Country Risk Score – Kenya

Source: The Economist Intelligence Unit, 28 May 2013

2.4   Chapter Summary

In this chapter, relevant literature has been summarised and key matters of interest highlighted. The chapter has highlighted what is meant by the term sovereign risk, has outlined the macro and micro approaches to measurement of sovereign risk and finally, has provided assessment of Kenya's sovereign risk as determined by the more common macro risk rating models. Chapter three will outline the research methodology.

Chapter 3: Research Methodology

3.1   Introduction

In this chapter, the research methodology used in the study is described, the conceptual framework is summarized, the data pool is specified and the approach to sample selection is articulated. In addition, the data collection processes and the data analysis undertaken is detailed.

3.2   Theoretical Framework

The theoretical framework upon which the study is based is the micro 'Bottom-up' approach to assessment of sovereign default as espoused by Altam & Rijken (2010). The supposition is that the state of the private sector reflects on the sovereign.

Altam & Rjken (2010) credit the formulation of the idea to the works Pomerleano (2008) in his study of the East Asian crisis of 1997. Pomerleano computed the average z-score of listed non-financial companies as of the end of 1996 using Altam's 1968 Z-score model and observed this score as a measure of 'financial fragility' of 8 Asian countries. The country with the lowest Z-score at the time was South Korea and later proved to have had the highest fragility to financial distress.

The Z-Metrics^{TM} Approach (2010) is similarly based on the notion that the 'health and aggregate default risk of a nation's private corporate sector' is reflective of the health and by extension the risk of the Sovereign. The approach assesses the credit risk of non-financial companies through the determination of the risk scores and associated probability of default the companies with the average measure representing the risk score and probability of default of the sovereign.

3.2.1   Specification/ Description of Model Components

The proposed methodology builds on the Z-score model (Altam, 1968).

$$Z = 1.2T_1 + 1.4T_2 + 3.3T_3 + 0.6T_4 + 0.999T_5.$$

Where

$T_1 =$ *Working Capital / Total Assets (Measures liquid assets in relation to the size of the company).*

$T_2 =$ *Retained Earnings / Total Assets (Measures profitability which reflects the company's age and earning power).*

T_3 =   *Earnings Before Interest and Taxes / Total Assets (Measures operating efficiency apart from tax and leveraging factors. It recognizes operating earnings as being important to long-term viability).*

T_4 =   *Market Value of Equity / Book Value of Total Liabilities (Adds market dimension that can show up security price fluctuation as a possible red flag).*

T_5 =   *Sales/ Total Assets. Standard measure for total asset turnover.*

Z'' score Emerging Market Score model

The above original model was modified by Altman to create the Emerging Market scoring for non-manufacturing and emerging market conditions. The model is conventionally referred to at the Z'' score EMS model (Altman, 2005):

$Z'' = 3.25 + 6.56T_1 + 3.26T_2 + 6.72T_3 + 1.05T_4$

Where

T_1 = (Current Assets − Current Liabilities) / Total Assets

T_2 = Retained Earnings / Total Assets

T_3 = Earnings Before Interest and Taxes / Total Assets

T_4 = Book Value of Equity / Total Liabilities

Discrimination Zones

Z'' > 2.60 -"Safe" Zone

$1.1 \leq Z'' \leq 2.60$ -"Grey" Zone

Z'' < 1.10 -"Distress" Zone

The Z'' score EMS model was adopted for the study and was applied to measure Kenya's sovereign risk.

The Z-Metrics Model

Altam & Rijken (2008) analysed a large sample of non-financial sector firm financial statements over a defined period. They applied a multivariate logistic regression structure to construct the model that predicts likelihood of default. The objective of the Z-Metrics model includes:

- Accurate, logical and robust credit scoring model.

- Assign point in time probability of default (PD) based on the credit score.

Logit Model Estimation: The model determines the credit score based on a standard logit-regression function form as outlined below.

a)   Credit Score

$$CS_{i,t} = \alpha + \Sigma B_j X_{i,t} + \varepsilon_{i,t}$$

Where

CS $_{i,t}$ = Z-Metrics credit score of company *i* at time *t*.

BJ = variable parameter (or weights).

X $_{i,t}$ = set of fundamental, market based and macroeconomic variables for company i quarter observations.

Ɛ $_{it}$ = error terms (assumed to be identical and independently distributed).

b)   Probability of Default

The credit score is converted into a probability of default (PD) measure using the formula:

$$PD_{i,t} = \frac{1}{1+\exp(CS_{i,t})}$$

3.3 Research Design

A quantitative research was adopted for the research given the quantitative nature of the data used for the study. Burns and Grove (1993:777, 2009) defined quantitative research as a formal, objective and systematic process to describe and test relationships and examine cause and effect interactions among variables. A quantitative research was thus considered ideal for the proposed research.

Cross sectional data and time series data was used, given the nature of the subject matter, which sought to assess the risk profile of the Kenya at defined points in time (annually) by studying a sample of corporate companies over a defined period of time, in this case a period of 7 years starting 2006 to 2012.

3.4 Population and Sample

Burns and Grove (1993) define population as all elements (individuals, objects and events) that meet the sample criteria for inclusion in a study. The study population was defined as public and private non-financial corporate enterprises operating in the Kenyan economy.

The sample was selected from the pool of non-financial public and private corporate companies operating in Kenya with the sample defined as the corporate companies that are members of the Nairobi Securities Exchange's 20 share index (NSE 20 share index). At the date of this research, the index represented 20 of the highest market capitalized companies across each industry listed in the Kenyan Securities Exchange. In addition, private corporate were included in the sample to bring the total sample size to 40 Kenyan operating non-financial corporate entities.

3.5 Data and Data Collection

The data collected comprised historical financial data over a period of 7 years; 2006 to 2012, sourced from published audited financial accounts of the selected corporate entities. The 7 year time frame was selected to match the time period Kenya's sovereign risk has been assessed using the macroeconomic approach by all the 3 risk rating agencies (S&P, Moody's and EIU). The specific data collected was:

- Assets: Current Assets and Total Assets

- Liabilities: Current Liabilities / Total Assets

- Retained Earnings

- Earnings Before Interest and Taxes

- Book Value of Equity.

This data source, audited financial statements, was considered to be robust and credible given audited financial statements are subject to standardised global definitions and measurement as well as disclosure regulations (International Financial Reporting Standards, IFRS).

3.6 Data Analysis

- The collated financial data was used to compute the financial ratios as defined by in the Z" score EMS model.

- The financial ratios were applied to calculate the Z-scores of the individual corporate entities.

- An average score (median) of the sample entities was then computed as an indicator of the score of the population and by extension the economy.

- Based on pre-specified decision rules, the economy was categorised as either being in the safe zone, grey area or distress zone.

- The Z-score was used to compute the Probability of Default (PD) for the economy at a specific point in time.

3.7   Validation and Reliability

It is noted that a key impediment to validation of probability of default models, particularly sovereign probability of default models, is the limited historical data available both in terms of historical events of default as well as forecasted data for purposes of assessing the accuracy of the models. Lopez and Saidenberg (2000) noted that credit risk models generally produce 1 forecast per year given the nature of default life cycle, that is, events of default occur sporadically and over a long horizon. Events of default are even more rate for sovereign hence there is very limited data associated with sovereign defaults. None the less, the following validity procedures were undertaken.

3.7.1   External Validity

- Empirical validation: Empirical studies were used to validation the Z" score EMS model. Literature on the applicability of the z-score model was analysed to highlight the validity of the Z-score model as analysed by the respective studies . The literature that was reviewed highlighted instance where the z-score approach has been used as a measure of sovereign risk and assessment of its predictive ability. In addition, back-testing was used to determine whether the Z-score model would have correctly assessed Kenya's sovereign risk historically.

- Statistical Tests: Various statistical tests were undertaken to determine whether the specified null hypothesis should be rejected. Correlation analysis, F-Test, Spiegelhalter Test and Somers' D tests were used for validity testing.

3.7.2   Internal Validity

Internal validity is crucial in providing comfort that the conclusions drawn from the research accurately reflect the matter being studied. Internal validation was enhanced by the type of quantitative research design adopted. The threats to the internal validity are discussed extensively in the literature on

validation (Campbell, 1969, Campbell & Stanley, 1963, Cook & Campbell, 1979). With respect to the study undertaken, the likely threats to the internal validity were identified as:

- Historical effects relating to change in the environment: This relates to the risk that events could occur at a point in time and may affect the conditions of the study and the underlying relationship if any. This risk was mitigated to an extent by the use of standardized financial information which reflects the impact of any changes in the environment thus feeding into the risk profile. For example, a shock to the economic system such a drought would be feed through the revenues reported by the corporate sector.

- Instrumentation as relates to the measurement tools used and potential for instrumental bias: This arises when the measuring instrument changes over time and hence the dependant variable change may be due to the change in the instrument rather than the independent variable. The use of standardized financial statements minimized the risk of inconsistencies in data measurement.

3.7.3   Reliability

Joppe (2000) defines reliability as: "…The extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable". In short, it speaks to the replicability and/or repeatability of results and observations.

Kirk and Miller (1986) identify three types of reliability referred to in quantitative research, which relate to: (1) the degree to which a measurement, given repeatedly, remains the same (2) the stability of a measurement over time, and (3) the similarity of measurements within a given time period.

Reliability was enhanced by:

- Well defined model both in terms of definition of parameters and interpretation of results.

- The standardized definitions of the parameter and measurement.

- Validation of both the model and the output of the model i.e. model results.

3.8   Chapter Summary

The chapter has described the research methodology adopted for the study: the theoretical framework and the measurement model were articulated, the population and the sample were identified, and the

relevant data and data collection approach were specified as was the data analysis to be carried out. Finally, the validation processes has outlined. Chapter four will discuss the results and findings of the study.

Chapter 4: Results and Findings

4.1 Introduction

This chapter presents the results of the study including the validity tests as outlined in the research methodology in Chapter 3. In this chapter, Kenya's historical Z-scores and associated probability of default are calculated and the results validated. Based on the findings, conclusions are drawn as to whether the micro based Z-score model is an appropriate measurement tool for Kenya's sovereign risk.

4.2 Kenya's Z-score and probability of default

A total of 40 public and private non-financial sector corporations were selected for the study. The table below highlights the composition of the sample.

Sector	Public	Private	No. of Corporation
Agriculture	8	1	9
Commercial and Services	7	1	8
Telecommunication and Technology	2	0	2
Automobile and Accessories	3	0	3
Manufacturing and Allied	7	2	9
Construction and Allied	5	0	5
Energy and Petroleum	4	0	4
Total	**36**	**4**	**40**

Table 4: Sample Description**.**

7 years of financial data for the period 2006 to 2012 of the selected corporations was sourced from the annual published financial statements of the respective entities. The relevant financial statement variables were identified and the following point in time financial ratios were computed:

- Liquidity ratio: Working Capital (Current Assets-Current Liabilities)/ Total Assets

- Profitability ratio: Retained Earnings / Total Assets

- Operating Efficiency: Earnings Before Interest Taxes / Total Assets

- Leverage: Total Net Worth / Total Liabilities

The Z-score

As described in the research methodology section, the Z-scores of the selected corporate entities were computed and the summary Z- score statistics of each of the entities are presented in the table below.

		Z-score						
Entity	Sector	2006	2007	2008	2009	2010	2011	2012
KenolKobil Ltd	Energy and Petroleum	6.48	6.71	6.44	6.17	6.81	6.01	5.79
Total Kenya Ltd	Energy and Petroleum	5.35	5.96	5.95	4.63	5.12	4.19	5.99
KenGen Ltd	Energy and Petroleum	7.17	7.31	7.40	7.16	6.68	54.79	47.38
Kenya Power & Lighting Co Ltd	Energy and Petroleum	5.73	4.87	4.76	4.90	4.69	4.86	4.47
Athi River Mining Ord 5.00	Construction and Allied	4.84	5.92	5.55	4.86	8.76	8.87	5.13
Bamburi Cement Ltd Ord 5.00	Construction and Allied	9.89	10.20	8.11	10.32	9.36	11.11	9.94
Crown Berger Ltd 0rd 5.00	Construction and Allied	7.44	7.72	6.44	6.93	7.40	7.77	8.37
E.A.Cables Ltd Ord 0.50	Construction and Allied	7.84	7.38	8.32	10.34	10.05	6.47	6.68
E.A.Portland Cement Ltd	Construction and Allied	6.02	6.30	6.65	6.92	5.74	5.67	4.23
British American Tobacco Kenya Ltd Ord 10.00	Manufacturing and Allied	7.39	6.67	6.47	6.04	6.79	7.62	8.60
Carbacid Investments Ltd Ord 5.00	Manufacturing and Allied	14.19	14.98	14.86	15.88	17.74	16.90	13.27
East African Breweries Ltd Ord 2.00	Manufacturing and Allied	12.27	10.49	10.27	10.06	9.04	7.01	6.11
Mumias Sugar Co. Ltd Ord 2.00	Manufacturing and Allied	8.96	9.38	7.41	6.57	8.06	7.92	6.49
Unga Group Ltd Ord 5.00	Manufacturing and Allied	7.28	8.47	8.67	8.04	9.67	10.03	9.40
Eveready East Africa Ltd Ord.1.00	Manufacturing and Allied	9.13	7.31	7.27	6.76	6.30	4.07	5.53
Private Company 1	Manufacturing and Allied	2.34	3.34	3.28	4.82	5.55	5.85	6.00
Bidco Oil Refineries	Manufacturing and Allied	7.57	4.99	3.66	4.63	4.55	6.00	7.91
Private Company 2	Manufacturing and Allied	5.69	6.59	7.50	9.56	8.92	8.40	6.62
Car and General (K) Ltd	Automobile and Accessories	7.17	6.89	6.72	6.53	6.87	5.84	6.10
CMC Holdings Ltd	Automobile and Accessories	4.36	7.48	7.39	7.15	6.80	6.23	7.49
Sameer Africa Ltd	Automobile and Accessories	7.33	8.54	9.80	11.23	11.02	10.67	10.51
AccessKenya Group Ltd	Telecommunication and Technology	9.58	12.90	7.95	5.46	3.64	4.87	5.60
Safaricom Ltd	Telecommunication and Technology	7.41	8.15	7.04	6.01	7.15	6.81	6.60
Express Ltd	Commercial and Services	9.30	6.04	2.26	2.62	2.45	0.53	2.95
Kenya Airways Ltd	Commercial and Services	5.26	5.56	5.86	4.49	5.68	5.17	4.67
Nation Media Group	Commercial and Services	9.60	9.79	10.27	9.50	9.45	11.77	11.64
Standard Group Ltd	Commercial and Services	7.04	6.16	6.35	6.24	6.76	5.95	6.55
TPS Eastern Africa (Serena) Ltd	Commercial and Services	5.92	6.78	5.50	6.47	4.14	6.52	6.10
Scangroup Ltd	Commercial and Services	8.31	7.61	9.13	10.86	7.67	9.00	9.51
Uchumi Supermarket Ltd	Commercial and Services	-7.40	-2.38	-2.26	0.60	5.85	6.05	5.12
Private Company 3	Commercial and Services	5.30	3.35	3.71	4.33	4.31	4.67	4.53
Kapchorua Tea Co. Ltd	Agriculture	8.17	7.95	7.09	8.03	8.15	9.15	9.71
Kakuzi	Agriculture	5.64	7.44	7.62	8.87	9.40	10.06	11.97
Limuru Tea Co. Ltd	Agriculture	6.46	6.08	11.23	13.00	15.90	14.38	13.92
Private Company 4	Agriculture	5.85	5.19	4.49	4.92	5.04	3.76	5.68
Kenya Tea Development Authority	Agriculture	10.41	9.68	8.73	7.78	9.61	9.63	9.10
Rea Vipingo Plantations Ltd	Agriculture	7.98	8.19	7.57	9.54	7.13	10.16	11.37
Sasini Ltd	Agriculture	10.82	9.41	9.63	7.24	7.83	9.22	8.48
Williamson Tea Kenya Ltd	Agriculture	8.77	8.90	7.99	8.22	7.00	7.12	9.76
Count (sample size)		40	40	40	40	40	40	40
Average		7.10	7.24	6.91	7.16	7.29	8.50	8.54
Median		7.31	7.31	7.18	6.84	6.93	6.91	6.61
Minimum		-7.40	-2.38	-2.26	0.60	-1.51	-1.27	2.95
Maximum		14.19	14.98	14.86	15.88	17.74	54.79	47.38
Standard Deviation		3.25	2.75	2.82	2.92	3.24	8.20	6.81

Table 5: Z-scores (Source: Author's computation)

The z-score results is interpreted as follows

Z" > 2.60 -"Safe" Zone (reflected by uncolored cells)

1.1 ≤ Z" ≤ 2.60 -"Grey" Zone (reflected by grey colored cells)

Z" < 1.10 -"Distress" Zone (reflected by red colored cells)

From the table above, the results show

- Only 3 corporations showed z-scores that indicated 'distress' or 'grey' during the period under review.

- The median z-score is used to avoid problems caused by outliers.

- The median Z-score declines year on year for the period reviewed. Although this average is within the 'safe-zone', it is observed that the declining score is indicative of an increase in the risk profile over time.

Probability of Default

Based in the computed Z-score (CS), the probability of default for each corporation was computed by application of the PD equation:

$$PD_{i,t} = \frac{1}{1+\exp\left(CS_{i,t}\right)}$$

Entity	Computed Probability of Default						
	2006	2007	2008	2009	2010	2011	2012
KenolKobil Ltd	0.00153	0.00121	0.00159	0.00210	0.00110	0.00244	0.00306
Total Kenya Ltd	0.00474	0.00257	0.00259	0.00962	0.00596	0.01497	0.00250
KenGen Ltd	0.00077	0.00067	0.00061	0.00077	0.00125	0.00000	0.00000
Kenya Power & Lighting Co Ltd	0.00323	0.00765	0.00851	0.00738	0.00909	0.00772	0.01136
Athi River Mining Ord 5.00	0.00785	0.00267	0.00389	0.00766	0.00016	0.00014	0.00587
Bamburi Cement Ltd Ord 5.00	0.00005	0.00004	0.00030	0.00003	0.00009	0.00001	0.00005
Crown Berger Ltd 0rd 5.00	0.00059	0.00044	0.00159	0.00098	0.00061	0.00042	0.00023
E.A.Cables Ltd Ord 0.50	0.00040	0.00063	0.00024	0.00003	0.00004	0.00155	0.00126
E.A.Portland Cement Ltd	0.00243	0.00183	0.00129	0.00099	0.00322	0.00344	0.01434
British American Tobacco Kenya Ltd Ord 10.00	0.00062	0.00126	0.00154	0.00238	0.00113	0.00049	0.00018
Carbacid Investments Ltd Ord 5.00	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
East African Breweries Ltd Ord 2.00	0.00000	0.00003	0.00003	0.00004	0.00012	0.00091	0.00223
Mumias Sugar Co. Ltd Ord 2.00	0.00013	0.00008	0.00061	0.00139	0.00032	0.00036	0.00152
Unga Group Ltd Ord 5.00	0.00069	0.00021	0.00017	0.00032	0.00006	0.00004	0.00008
Eveready East Africa Ltd Ord.1.00	0.00011	0.00067	0.00070	0.00116	0.00184	0.01684	0.00396
Private Company 1	0.08826	0.03420	0.03619	0.00802	0.00388	0.00287	0.00246
Bidco Oil Refineries	0.00052	0.00679	0.02509	0.00964	0.01044	0.00246	0.00037
Private Company 2	0.00336	0.00138	0.00055	0.00007	0.00013	0.00022	0.00133
Car and General (K) Ltd	0.00077	0.00102	0.00121	0.00146	0.00104	0.00291	0.00224
CMC Holdings Ltd	0.01263	0.00057	0.00062	0.00078	0.00112	0.00197	0.00056
Sameer Africa Ltd	0.00065	0.00020	0.00006	0.00001	0.00002	0.00002	0.00003
AccessKenya Group Ltd	0.00007	0.00000	0.00035	0.00425	0.02556	0.00762	0.00370
Safaricom Ltd	0.00060	0.00029	0.00088	0.00245	0.00078	0.00110	0.00136
Express Ltd	0.00009	0.00238	0.09412	0.06761	0.07938	0.37072	0.04953
Kenya Airways Ltd	0.00519	0.00385	0.00286	0.01108	0.00341	0.00567	0.00932
Nation Media Group	0.00007	0.00006	0.00003	0.00007	0.00008	0.00001	0.00001
Standard Group Ltd	0.00088	0.00211	0.00174	0.00195	0.00116	0.00259	0.00142
TPS Eastern Africa (Serena) Ltd	0.00268	0.00114	0.00408	0.00155	0.01570	0.00147	0.00224
Scangroup Ltd	0.00025	0.00049	0.00011	0.00002	0.00047	0.00012	0.00007
Uchumi Supermarket Ltd	0.99939	0.91544	0.90529	0.35372	0.00289	0.00236	0.00592
Private Company 3	0.00498	0.03378	0.02379	0.01294	0.01332	0.00929	0.01068
Kapchorua Tea Co. Ltd	0.00028	0.00035	0.00083	0.00033	0.00029	0.00011	0.00006
Kakuzi	0.00354	0.00059	0.00049	0.00014	0.00008	0.00004	0.00001
Limuru Tea Co. Ltd	0.00156	0.00229	0.00001	0.00000	0.00000	0.00000	0.00000
Private Company 4	0.00286	0.00551	0.01112	0.00727	0.00641	0.02276	0.00341
Kenya Tea Development Authority	0.00003	0.00006	0.00016	0.00042	0.00007	0.00007	0.00011
Rea Vipingo Plantations Ltd	0.00034	0.00028	0.00052	0.00007	0.00080	0.00004	0.00001
Sasini Ltd	0.00002	0.00008	0.00007	0.00071	0.00040	0.00010	0.00021
Williamson Tea Kenya Ltd	0.00016	0.00014	0.00034	0.00027	0.00091	0.00081	0.00006
Count (sample size)	48	48	48	48	48	48	48
Average	0.10745	0.10496	0.10771	0.09541	0.10443	0.10971	0.08633
Median	**0.00120**	**0.00124**	**0.00142**	**0.00175**	**0.00114**	**0.00216**	**0.00212**
Minimum	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Maximum	0.99939	0.91544	0.90529	0.50000	0.81941	0.78116	0.50000
Standard Deviation	0.23	0.22	0.22	0.19	0.21	0.21	0.19

Table 6: PD Estimates

Source: Author's own computation

The individual PDs and the median PDs for the sample of non-financial corporation were determined for each of the years under review as highlighted in the table above. The average PD for the sample was determined and is the inferred PD for the sovereign. The median was used to eradicate problems caused by outliers.

From the PD estimate table above and with specific reference to the median, it was observed that:

- The PD (the risk measure) is low, below 1% indicative of a low probability of default.

- The increase in PD year on year is consistent with the declining Z-score. As noted earlier, the increase in PD is indicative of an increase in the risk ranking.

4.3   Validation

Lopez and Saidenberg (2002) highlighted the main challenges in conducting model validation of credit risk models. As noted earlier, firstly there is a dearth of large numbers of observed credit losses over an extended period of time given events of default have historically been uncommon occurrences. Secondly, there are no prescribed statistical methods for use to evaluate the risk model's forecasts.

The aforementioned weaknesses notwithstanding, the study used the available data to validate / back-test the results.

4.3.1   Empirical Validation - Literature

Altman (2005) used the Z-score model to assess Mexico's PD during the period 1994 (period when Mexico faced the peso crisis) to 1996. The Z-score model highlighted the difficult economic environment and predicted / signalled the deteriorating credit quality in 1995 and the subsequent recovery in 1996.

4.3.2   Statistical Test:

a.   Correlation: Kenya's Z-score and the EIU risk score.

The consistency of the risk score measure using the Z-score model was compared to risk score generated by the EIU risk score model , a macro based approach sovereign risk measurement.

The correlation between the EIU risk score and the Z-score was computed to analyse the correlation between the two variables. It is noted that in this study, the correlation measure did not seek to measure 'causation' between the two variables but an assessment of the extent to which the two variables move in tandem, trend in the same direction.

The table below and graph show the correlation between the EIU Risk score risk and the micro approach based Z-score.

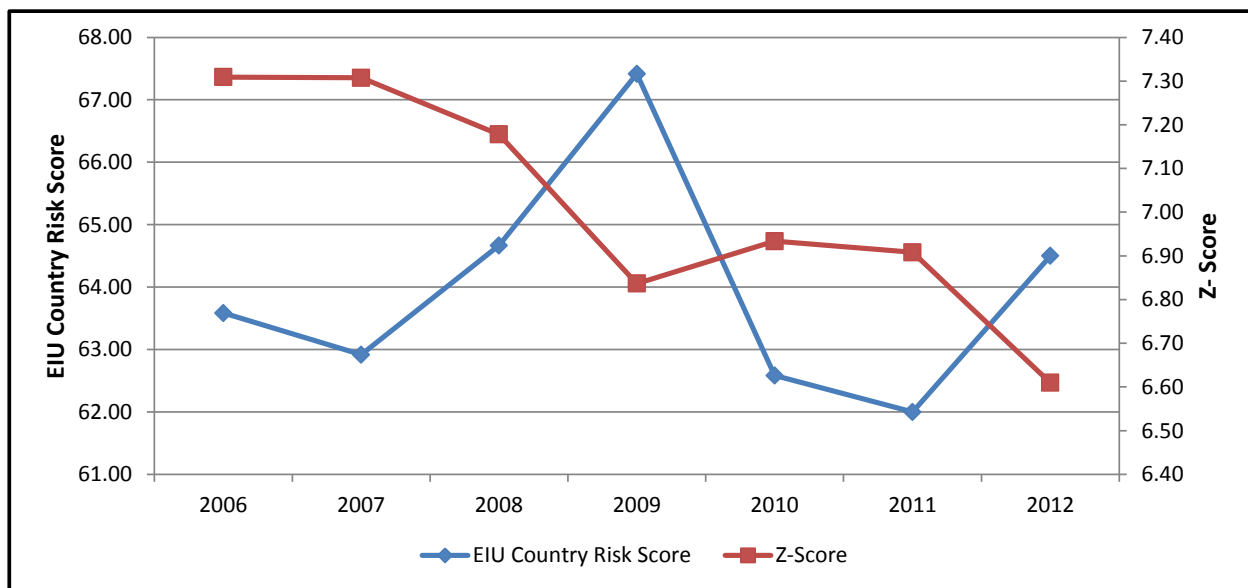| Correlation Matrix		
	EIU Risk Score	**Z- Score**
EIU Risk Score	1.0000	-0.2855
Z-Score	-0.2855	1.0000

Table 7: EIU, Z- Score Correlation Matrix

Source: Author's own computation.

Figure 2: Z- Score vs EIU risk score chart

Source: PD: Author's own computation, EIU score: EIU Country Risk Service (2013)

The correlation between the EIU risk score and the EIU risk score is negative, indicative that the micro Z-Score and the macro based EIU risk score have historically tended to move in a 'contra direction' . The correlation of -0.285, a correlation below ±1 is interpreted as a weak linear relation i.e. a change in one risk measure hasn't historically seen a shift in the other measure by a similar multiple.

b. **Correlation: Z-score PD relative to S&P PD**

The correlation statistics measures the degree / extent of strength of the relationship between two variables. A correlation co-efficient would range between +1 and -1 with values of +1 indicative of a perfect positive correlation, a value of -1 indicative of a perfect negative correlation while a value of 0 would be indicative of no relationship between the variables.

Each S&P rating classifications is associated with a PD range. In other words, the S&P rating is a reflection of a specified PD. The table below outlines the 1 year PD associated with each rating level.

S&P Rating and PD Mapping Table		
S&P Rating	1 year PD (%)	
	Min	Max
A-	0.00%	0.51%
BBB+	0.51%	0.71%
BBB	0.71%	0.91%
BBB-	0.91%	1.15%
BB+	1.15%	1.48%
BB	1.48%	2.11%
BB-	2.11%	2.97%
B+	2.97%	4.09%
B	4.09%	5.80%
B-	5.80%	7.68%
CCC/C	7.68%	100.00%

Table 8: S&P PD Scale

Source: Standard and Poor's Modelling, Credit Risk Tracker Greece (2008)

The historical PDs as generated by the Z-score model were compared to the historical PDs associated with historical S&P ratings of Kenya. The comparison is summarised in the table below.

Kenya's Historical Rating and PD Comparison

Year	Actual S&P Rating	S&P PD Range		Z-score PD	Mapped S&P Rating
		Min	Max		
2006	BB-	2.11%	2.97%	0.12%	A-
2007	BB-	2.11%	2.97%	0.12%	A-
2008	B+ / B	4.09%	5.80%	0.14%	A-
2009	B	4.09%	5.80%	0.18%	A-
2010	B+	2.97%	4.09%	0.11%	A-
2011	B+	2.97%	4.09%	0.22%	A-
2012	B+	2.97%	4.09%	0.21%	A-
Max S&P PD Pearson Correlation Co-efficient (r)				27%	
Min s&P PD Pearson Correlation Co-efficient (r)				30%	

Table 9: Kenya's Historical S&P, Z-Score PD comparison

Source: Standard and Poor's Modelling, Credit Risk Tracker Greece (2008) and Author's own computation.

The above comparison highlights the discrepancies and low albeit positive correlation between the S&P and Z-score PD ascribed to Kenya. It would be concluded, from the above comparison, that the Z-score model would have historically, generally ascribed a LOWER PD to Kenya, hence a HIGHER rating than the S&P rating.

The table below highlights the correlation between S&P PD and the Z-score PD which indicates that although there is a positive correlation, it is weak.

Pairwise Correlation Matrix		
	S&P PD	Z-Score PD
S&P PD	1.000000	0.273632
Z-Score PD	0.273632	1.000000

R^2 can be computed as the square of the Pearson correlation co-efficient between the observed and modeled values (in this case S&P PD and the z-score PD respectively). In this case, R^2 is an indication of the extent to which the S&P PD and the Z-score PD move relative to each other. The table below is a summary of the results.

```
View Proc Object  Print Name Freeze  Estimate Forecast Stats Resids

Dependent Variable: SPPDRANGE
Method: Least Squares
Date: 09/03/14   Time: 16:46
Sample: 2006 2012
Included observations: 7

   Variable      Coefficient   Std. Error   t-Statistic    Prob.

      C            0.030604     0.019400     1.577524      0.1755
   ZSCOREPD        0.306897     0.482439     0.636137      0.5527

R-squared          0.074874    Mean dependent var      0.042586
Adjusted R-squared -0.110151   S.D. dependent var      0.011661
S.E. of regression 0.012286    Akaike info criterion   -5.725761
Sum squared resid  0.000755    Schwarz criterion       -5.741215
Log likelihood     22.04016    F-statistic             0.404671
Durbin-Watson stat 1.256993    Prob(F-statistic)       0.552662
```

- R-squared: In the this research R-squared was used a measure of how well Kenya's PD results generated the Z-score model are replicated in 'observed' outcomes as represented by the S&P PD ascribed to Kenya over the period under study (7 years). Given the low R-Square value, it is inferred that the Z-score results don't replicate the S&P observed outcomes.

- Likelihood Ratio, D: The likelihood ratio test is a statistical test used to compare the fit of two models, one of which (the null model) is a special case of the other (the alternative model).

H_0: $\theta = \theta_0$

H_0: $\theta \neq \theta_0$

Where θ is a vector of values from the null model (in this case S&P PDs) and θ_0 is a different vector of values to that of θ_0 (in this case the Z-score PDs). D is approximately distributed by the $\chi 2$ distribution with the degrees of freedom equal to the number of independent unknown parameters in the likelihood model. If D is greater than the chi2 statistic with the appropriate degrees of freedom, the null hypothesis is rejected.

With a degree of freedom of 6 (given by (2-1)*(7-1)) the significance level is 12.592 at a significance level of 5%.

Decision: We reject H_0 because 22.04016 is greater than 12.592 at 5% significance level.

c. F-Test - Two Sample Variance

The F-test was used to test the null hypothesis that the variances of the two PD samples are equal.

H_0: $\sigma_1^2 = \sigma_2^2$
H_1: $\sigma_1^2 \neq \sigma_2^2$

A two tailed F-test was undertaken and the results are summarised in the table below.

Sample Size	7.00	7.00
Mean	0.04	0.00
Standard Deviation	0.01	0.00
Variance	0.00010	0.00000
df	6.00	6.00
Test	Two tail test	
Confidence level (2 tail)	0.05	
Critical F-Value	5.82	
F-Stat	0.00000	

The decision Matrix indicates that if F-Stat > F Critical two-tail, we reject the null hypothesis and where if F-Stat < F Critical we accept the null hypothesis.

Given, F-Stat (0.00) is less than F-critical (5.82) we accept the null hypothesis. The variances of the two samples are statistically equal.

d. Somers' D

Somers' D is an ordinal measure of association introduced by Somers in 1962. It provides a measure of rank correlation of observed variables and the predicted variables thus indicating the fit of the model.

Given a data set of probability pairs (X_i, Y_i) and $(X_J$ and $Y_J)$, Somers' D is defined as the ratio

$DYX = \tau XY / \tau XX$

i.e the difference between the two corresponding probabilities, given that one X–value is known to be larger than or different from the other X–value .

The rank correlation between the PDs generated by the Z-score and S&P are reflected in the graph below which infers little fit between the two data sets.
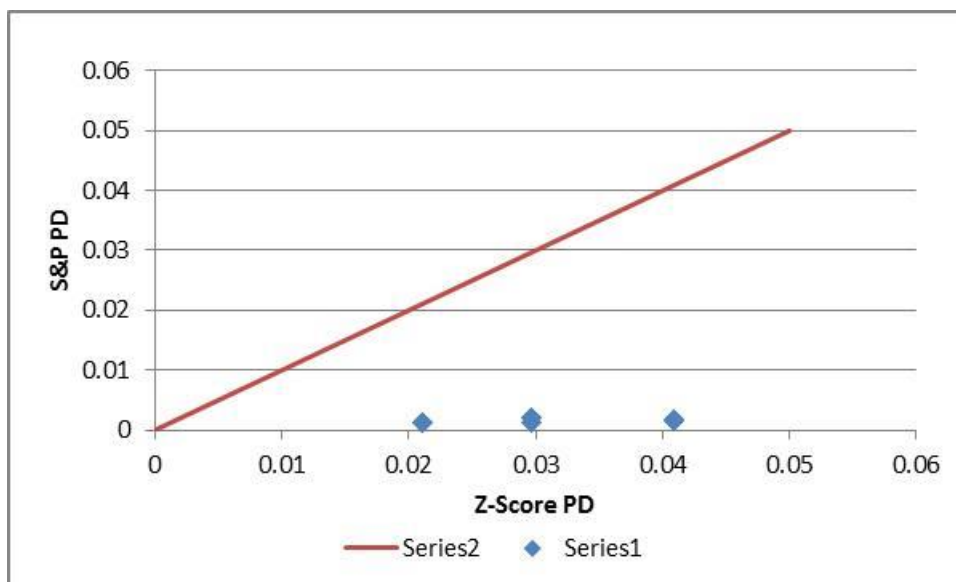
Figure 3: Somer's D graph

Source: Author's own computation

Where:

Series 1: The mapping of the Z-score PD relative to the S&P PDs

Series 2: The perfect fit line.

Applying the Z-score and S&P generated PDs, the Somers' D was computed to be 25%. A low Somer's D value (i.e. tending to zero), indicates a weak association between the two samples. On this basis, the study concludes that the rank correlation between S&P PDs and the Z-score derived PDs is low.

e. **Spiegelhalter Test**

The Spiegelhalter Test is a statistical test reflecting the quality of a rating model and is based on the mean square error. Spiegelhalter tests whether the observed MSE differs significantly from the expected / projected value (Erlenmaier, 2011). The guideline for interpretation is that a low MSE is an indication of a well performing rating model.

$$MSE = \frac{1}{N} \sum_{i=1}^{N} (RIPD_i - PD_i)^2$$

Where:

N= the number of observations

$RIPD_i$ = Ratings Implied Probability of Default (projected probability of default)

PD_i = the calibrated observation $_i$.

The following hypothesis was tested.

H_0 : MSE = EMSE

H_1 : MSE ≠ EMSE

The table below is a summary of the results and based on the low MSE score, we conclude that the Z-score model is well performing.

Year	S&P PD	Z-Score PD	$(RIPD - PD)^2$
2006	0.03	0.00	0.000585
2007	0.03	0.00	0.000584
2008	0.05	0.00	0.002307
2009	0.05	0.00	0.002275
2010	0.04	0.00	0.001167
2011	0.04	0.00	0.001098
2012	0.04	0.00	0.001101
Sum			**0.009117**
N			**7**
MSE			**0.00130239**

Figure 4: Mean Square Errors table.

Source: Author's own computation

4.3.3 Historical Default events

The graph below highlights the incidences of Sovereign default by Kenya over the period 1963 - 2009 as depicted in the findings of Reinhart & Ragoff (2009)
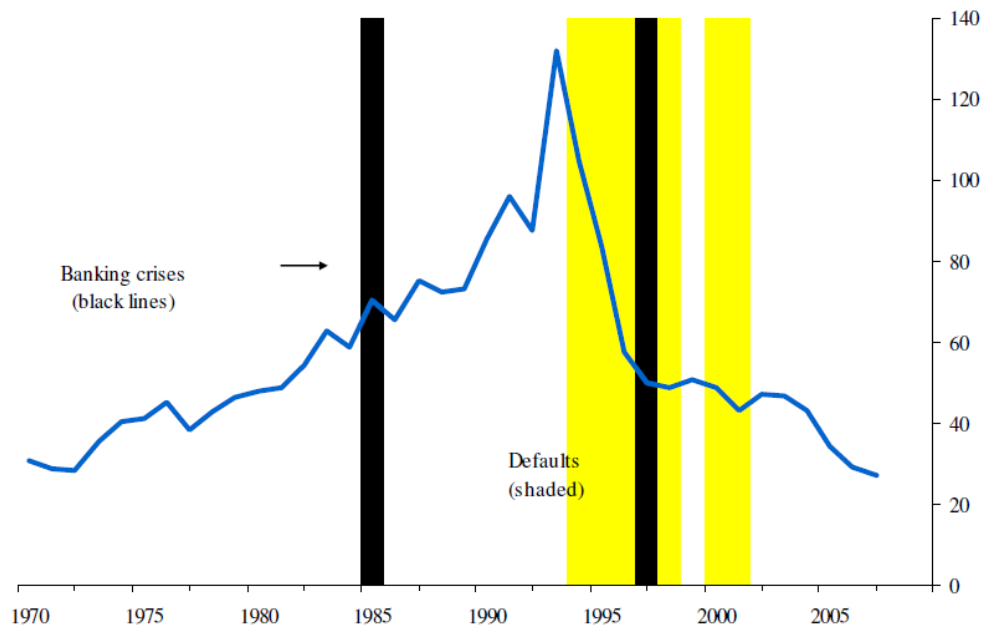

Figure 5: Kenya's Historical Incidences of Sovereign Default

Source: Reinhart and Rogoff (2009) and sources cited therein

The table below is a summary of events of defaults registered by Kenya.

External Default date	Duration (in Years)	Domestic Default date	Dates of IMF programs
1994-1998	5	Nil	1975, 1977-1980, 1982-1983, 1985, 1988(2), 1989, 1993, 1996, 2000, 2003.
2000 - 2001	2		

Table 10: Kenya's Historical Incidences of Sovereign Default

Source: Reinhart and Rogoff (2009) and sources cited therein

From the above findings, it is noted that:

- Kenya has only recorded 2 episodes of default; 1994 and 2000 although the duration of default spanned more than 1 year in each instance as highlighted in Table 7.

- 1994 – Paris Club Agreement on Debt Restructure: Certain Government of Kenya debts and debts guaranteed (Kenya Airways debt) by the Government of Kenya were restructured and payment rescheduled following default on repayment. The defaults were partly the result of devaluation of the shilling and the global recession in the airline industry in the 1990s.

- 2000: Bilateral debt with the Paris Club was rescheduled. The rescheduling was preceded by severe drought in 1999 into 2000, strained relationship with IMF and other international agencies including suspension of financial support, slow growth

- The number of years Kenya has been in default over the 47 years to 2009 is 7 representing 14.9% years on default during the period.

4.4   Discussion of Results

4.4.1   Kenya's sovereign risk as measured using Z'' score EMS model

The micro based bottom-up Z'' score EMS model was used to calculate Kenya's historical annual sovereign risk (risk score and PD) over the period 2006 to 2012.

- The Z-score ranged between 6.61 to 7.01 and are indicative of low risk. Kenya's economy would have historically been classified as being in the safe zone with a low probability of financial distress in the 12 month immediate future.

- Similarly, the PDs over the period 2006 to 2012 was in all cases less than 1% on average (median average) indicative of a low probability of default.

4.4.2   Validation.

The validation exercise undertaken provides the premise for the assessment as to whether the Z'' score EMS model, a micro based approach, can used to measure Kenya's sovereign risk.

- Validation based on empirical studies: Back testing of the outputs generated by the Z-score model to actual historical events were consistent. The Z-score and the resultant probability of default all pointed to low sovereign risk (high Z-score all which fall within the 'safe' zone) and a low probability of default respectively. The results are consistent with actual historical occurrences; no events of default were registered in the period reviewed of 2006 to 2012.

Similarly, literature review shows that the z-score model has been used to assess sovereign risk with adjustment to model parameters to reflect the conditions of the specific economies that are being assessed.

- Statistical Validation: The negative or weak correlation indicates that the micro approach using the Z-score model would have resulted in assessments that contradicted the results of the macro based approaches; EIU and S&P. This is interpreted to mean that two measurement approaches would have resulted in conflicting assessments of the trend of the sovereign risk. The Somer's D measure similarly indicates a weak association between the micro and macro measurement approaches.

In conclusion, the validation processes highlights that the Z" score EMS model in its current formulation will not robustly measure Kenya's sovereign risk. However, the literature review on the model indicates that the model may be used following adjustments of the parameters to reflect the Kenyan operating environment.

4.4.3 Adaptability of the z-score model.

As noted earlier, the Z-score model can be modified to suit the characteristics of and reflect the economy to which it is being applied.

- Co-efficients: As has been done for other economies, the Z-score model can be modified to update the co-efficients values associated with each variable (financial ratios) to reflect Kenya's environment. Modification of the z-score was carried out for Mexico (Altman, Hartzell, and Peck , 1995), Argentina (Sandin & Porporato, 2007) and other emerging markets.

- Increase sample size: The value ascribed to the corporates listed on the NSE account for less than 40% of the overall GDP as highlighted in the table below.

Year	2009	2010	2011	2012
Market Cap of listed Companies / GDP	35%	44.6%	29.7%	36.7%

Table 11: Market Cap Listed Companies / GDP

Source: World Bank Website http://data.worldbank.org/indicator/CM.MKT.LCAP.GD.ZS

Given the representation level, an increase in the data pool by way of incorporation of private companies may result in improved representation of the economy.

4.5   Chapter Summary

The chapter summarised the results of the data analysis, presented the Z-score computations for each of the corporate entities that made up the sample together with their corresponding probability of defaults and finally inferred the sovereign Z-score and PD using the median of the aforementioned measures. The key findings and results of the validation were also articulated.

Chapter 5 will provide a summary of the study, implications of the findings and make recommendations for further study areas on the subject matter.

Chapter 5: Conclusion

5.1 Introduction

This chapter shall summarize the study that was undertaken and summarize the key findings in relation to the research objectives and questions. The implications of the findings are highlighted and recommendations of areas for further studies noted.

5.2 Summary of Study

The study sought to assess Kenya's sovereign risk, specifically the study sought to:

- Measure Kenya's sovereign risk using the Z-score model, a micro measurement approach,

- Assess whether the Z-score model is a suitable tool for the measurement of Kenya's sovereign risk.

- Identify whether the Z-score model could be adapted to suit Kenya's environment.

A quantitative statistical methodology was adopted which entailed collection of financial quantitative data from corporate entities operating in Kenya. The target sample was identified as corporate entities listed on the Nairobi Securities Exchange and where available, data from private companies. Data from a sample comprising 40 companies was collected and analysed with relevant financial ratios, Z-scores and probability of default measures computed. In addition, the results were validated using empirical analysis and statistical tests.

The findings of the study provided answers to the key research questions as follows:

- Kenya's sovereign risk as measured using the z-score model is above 2.60 which categorize Kenya as being in the 'safe zone' indicative of a low probability of default. Kenya's low probability of default based on the z-score is consistent with sovereign risk ratings ascribed to Kenya by Moody's (2013) which rated Kenya B indicative of moderate risk with low probability of default. Standard and Poor's rated Kenya B+ as at 2012. Standard and Poor's (2012) notes that a rating of B+ is indicative of an obligor who has the capacity to meet its financial commitment on its obligations. International Monetary Fund (2013) similarly noted that Kenya's risk of external debt distress remains low.

- To assess whether the micro based z-score model was suitable for the measurement of Kenya's sovereign risk, we validated the risk scores as generated by using both empirical information

and statistical tests. The results indicate that the micro based Z-score model would result in inconsistent measure of Kenya's sovereign risk relative to conventional macro based approaches to measuring sovereign risk specifically EIU and S&P.

- With regards to the question of whether there is a provision for the recalibration of the Z-score model in order to adapt the z-score model to the Kenyan environment, it was established that the co-efficients of the z-score model can be modified to suite Kenya. Recalibration of the Z-score model has been done for other economies such as Mexico and Argentina. Altman (2005) outlines the procedure adopted to modify the z-score model to reflect local data. Altman (2005) contends that generic model is applicable in most environment given the fundamentals of corporate insolvency remain applicable in every market with the difference reflected in hurdle levels that signal default / distress.

5.3   Limitations of the Study

The following were identified as limitations of the study:

- The Z-score model was developed using a sample from developed and emerging markets with no African or Kenyan operating entity included in the sample. The difference in the dynamics of the market may not be reflected in the proposed model and may hypothetically under state the measure based on the assumption that African economies are generally considered to be more risky that developed economies. This is mitigated to some extent by the standardised definitions of the parameters used in the research as defined by global accounting policies and procedures (International Financial Reporting Standard, IFRS) however the risk is not completely mitigated.

- Data history: Access to data history going back very long time periods may be limited or difficult to obtain. For purposes of computing the z-score, the data was limited to publicly available information, impacting on the sample size and by extension its assessment as being representative of the broader economy.

  The limited historical data similarly impacted on the validation of the proposed model. As noted by Lopez and Saidenberg (2000), the absence of a large pool of data, limits the ability to validate credit risk model's forecasted loss distributions with actual credit losses observed over multiple credit cycles which may limit their application.

5.4   Implication

The results of the study have the following implications:

- Private sector support: Policy prescribed for the private sector should seek to boost profitability, output and boost the networth of the private entities. The implication of a strong private sector is an expanded revenue pool for the payment of taxes, a growth in the workforce, a reduction in unemployment rate and a boost to GDP. In addition, well performing private sector will likely result in lower private debt defaults and by extension a more stable financial sector due to fewer non-performing loans.

  The micro approach brings focus to policy prescriptions that reduce vulnerability of the private sector as was noted by Allen, Rosenberg, Keller, Setser & Roubini (2002). They noted that attention should particularly be paid to financial variables that could weaken balance sheets to the point of mass default across the economy. Altman & Rijken (2010) note that policy makers should not penalize the private sector especially during recession periods as this could further exacerbate the already vulnerable economy.

- Interest and Foreign currency (FX) policies: Interest rates impact on the debt service ability of corporate entities as well as their investment decisions. Both the FX rate as well as access to FX also has defining impact on the private sector performance affecting profitability and capabilities to meet obligation particularly where obligations are denominated in foreign currency. Policies may prescribed to reduce exposure to FX associated risk for example some economies such as Uganda, Ghana, have imposed policies that restrict borrowing in foreign currency to mitigate balance sheet currency mismatches.

- Sovereign Risk assessment and model development: Whereas historically, the macro approach has been favoured in assessing sovereign risk, the study shows that in managing sovereign risk, attention should be given to the health and performance of the private sector. Pomerleano's (1999) study of the Asian crisis found that there were significant problems in Asia at the micro level at the time of the Asia crisis. The deteriorating risk profile of the studied Asian economies would have been signalled using the Z-score model.

  However, as noted in the study, the standard Z-score model would need to be adapted for Kenya. Firstly, to facilitate the re-calibration of the z-score model, financial data and associated information on corporate events of default needs to be gathered. Following the recalibration,

availability and access to timely financial information on the private sector would be useful for timely early warning indicator of potential weaknesses in the economy as signalled by the health of the private sector.

- Policy limitation: The policy options and the extent to which the Government can effectively intervene in the private sector are limited. The capitalist economic policy adopted by Kenya restrains government interference in the private sector. In addition there is a moral hazard of a government intervening to support or bail out the private investor.

5.5 Recommendations for Further Studies.

The following areas have been identified for further research.

- Validation of the z-score model using Credit Default Swaps (CDS): The Kenyan sovereign bond issues in 2014 have placed Kenya's sovereign profile on the international financial / capital markets. As a result of this participation, the market will quantify Kenya's sovereign risk by way of assigning a premium for buying protection against credit loss in the form of a Credit Default Swap (CDS). A CDS is a financial instrument that in effect provides 'insurance or credit protection' against default. The CDS premium reflects the inherent risk of the bond issuer as priced by the market.

  An area for further research would be to analyse the extent to which the sovereign risk score as determined by the z-score correlates with the risk as measured by CDS. This analysis would further assess the robustness of the z-score model as an instrument for assessment of sovereign risk.

- Sovereign risk implication on fiscal policy: The interplay between the sovereign risk rankings and fiscal policy is another area for further research. For instance, do austerity programmes exacerbate sovereign risk? Studying the relationships is of interest as it will shade light to the cause and effect dynamics between the two matters and therefor provide policy makers a framework for outlining fiscal strategy in a way that support favourable sovereign risk ranking which is critical for a conducive economic, social and political environment.

- Monetary Policy and Sovereign risk: The bottom-up approach for assessing sovereign risk is premised on the assumption that sovereign risk is a reflection of the general health of the private sector. Policy makers may thus impact the risk profile of the sovereign through the private sector. Interest rates are the medium through which monetary policy can be transmitted

to impact investment and by extension GDP (IS –LM model) as well as manage inflation. An area for further study would be the relationship between Interest rates and the sovereign risk with a focus on whether interest rates can be used by Central Banks to impact the sovereign risk level.

- Sovereign risk and Stability of Domestic Banking: By virtue of having a significant portion of their assets in the nature of Government bonds, the domestic banking sector is likely to be impacted by an increase in a sovereign's risk profile. For instance, the value of these assets (bonds) are likely to significantly decline, the Sovereign issuer is likely to push for an extension of tenor which could have an impact on Asset Liability mismatches which could lead to liquidity crunch, and at the extreme, a loss of confidence in the banking sector could result in a banking / financial crisis (Beim and Calamiris, 2002, Sturzenegger and Zettelmeyer, 2006). An area of further study is the relationship between Sovereign risk and the health of the banking sector. Kaminsky and Reinhart (1999) assessed the probability of a banking crisis occurring in period t conditional on a debt default in period t-1. If the probability is high and the relationship is found to be significant, appropriate policy around banking regulations such as minimum capital adequacy ratios and restriction on direct exposure to sovereign debt by banks can be formulated.

5.6   Chapter Summary

This chapter provided a recap of the study undertaken, the findings of the analysis, and limitations of the study as well as the implications of the study. The chapter concludes with recommendations of areas for further research.

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