UNIVERSITY OF NAIROBI
SCHOOL OF MATHEMATICS

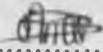# APPLICATION OF CREDIT DEFAULT SWAPS TO COMMERCIAL BANKS

BY:
CYNTHIA AMAI IKAMARI
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A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT OF THE MASTER OF SCIENCE DEGREE IN ACTUARIAL SCIENCE
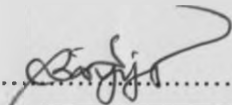
November 2012

DECLARATION

I hereby declare that this research project is my original work and has not been presented in any other learning institution for academic award or otherwise.

Signature: ....   Date: ....19/11/2012.............................

Cynthia Amai Ikamari

This research work was submitted for examination with my approval as the university supervisor.

Signature: ....   Date: ...19.11.2012............

Dr. Joseph Ivivi Mwaniki

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ABSTRACT

Commercial banks contribute significantly to the growth of a nation's economy. The profitability of commercial banks is largely attributed to the interest charged on loans they advance to their customers. If these loans are defaulted, banks face the risk of collapsing and the entire economy will be threatened.

Banks use credit derivatives to protect themselves against credit risk arising from loan defaulters. Loan defaulting has been and continues to be a cause of financial distress in the banking sector both locally as well as globally. More efficient approaches of managing credit risk need to be looked into. In this study, the application of credit default swaps as a credit risk management tool in the banking sector is looked at. Credit default swaps are shown to effectively transfer risk from commercial banks to insurance companies.

Data relating to loan facilities sought by individual companies was collected from a local commercial bank. Additional data relating to treasury and corporate bonds was collected from the Nairobi Stock Exchange. Data was analyzed using the Hull-White Model of credit default swap valuation.

The study shows that commercial banks are able to manage their credit risk efficiently using credit default swaps. From the data analysis, the results show that by paying a premium of 513 basis points per year for a credit default swap contract, a potential loss of up to Kshs. 17,291,275.61 is avoided. This shows that by using credit derivatives, the profitability of a commercial bank is increased as large sums of money that would otherwise have been lost to loan defaulters is put into other income generating activities.

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LIST OF ACRONYMS

ISDA- International Swaps and Derivatives Association

CDS-Credit Default Swap

CBK- Central Bank of Kenya

CDO- Collateralized Debt Obligation

NSE-Nairobi Stock Exchange

BBA-British Bankers Association

SPV-Special Purpose Vehicle

TRS-Total Return Swap

OTC-Over the Counter

BISTRO-Broad Index Securitizes Trust Offering

PV-Present Value

CHAPTER ONE: INTRODUCTION

1.0 Background of the study

Commercial banks play an important role in the growth of a nation's economy. Through provision of credit facilities, commercial banks lend money to businessmen and companies who in turn engage in income generating activities. These income generating activities contribute to the overall growth of an economy.

However, in periods of rising inflation rates as witnessed in Kenya in 2011, commercial banks incur huge losses as a result of loan defaulters. Inflation rates have a direct impact on the interest rates charged by commercial banks. An increase in the rate of inflation causes an increase in interest rates. Due to an increase in interest of loans taken by customers, some customers are unprepared to meet the additional costs which results in a loan default.

This has resulted in financial distress in the banking sector prompting the need for effective credit risk management. Credit risk can be seen as an investor's risk of a loss arising from a borrower who does not make payments as promised subjecting the investor to a financial loss.

In the past, bank failures have often arisen from excessive credit exposure to particular borrowers or groups of borrowers. With proper monitoring of such borrowers and with adequate information, banks are able to determine the probability of default arising from each borrower. An appropriate method of credit risk management can then be applied to minimize the occurrence of loan default. A sound credit risk management framework is very important for banks so as to maximize their profits and reduce the risk of insolvency.

Initially, credit was one of the major components of business risk for which no tailored risk-management products existed. Credit risk management for the loan portfolio manager meant a strategy of portfolio diversification with an occasional sale of positions in the secondary market.

Commercial banks either carried open exposure to key customers' accounts receivable or purchased insurance. These strategies are inefficient because they do not separate the management of credit risk from the asset with which the risk is associated.

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The use of credit derivative is one of the approaches that can be utilized in credit risk management. Other credit risk management approaches include loan sales and securitization. A typical loan sale is the simplest credit transfer mechanism through which the loan originator sells all or part of the payments from the underlying loan to a third party. Securitization is the process of transferring loans to a third party through the issuance of new securities whose cash flows are collateralized by the original loan pool.

A credit derivative can be seen as a privately held negotiable bilateral contract that allows a user to manage his exposure to credit risk. Credit Derivatives were launched as risk mitigating instruments in 1991 by Merrill Lynch. They provide banks with an approach which does not require them to adjust their loan portfolio. Credit Derivatives allow the lending bank to:

➢ Transfer Credit Risk and free up the capital to be used in other opportunities
➢ Diversify Credit Risk
➢ Maintain Client Relationships
➢ Construct and manage a credit risk portfolio as per its risk preference

According to Hirtle (2007), the development of credit derivatives is an important innovation and the latest of a series of innovations such as loan sales in the 1980s and securitizations in the 1990s that have had a significant impact on the nature and operations of the credit market. The most popular credit derivative product is the credit default swap.

The need of a risk management tool that did not interfere with important customer relationships aided in the growth of the credit derivatives market. Unlike the case of loan assignment through a secondary loan market which requires borrower notification, in credit derivatives the reference entity, whose credit risk is being transferred, need neither be a party to nor aware of a credit derivative transaction. This confidentiality enables commercial banks to manage credit risks discreetly without having a negative effect on the customer relationships.

Hirtle (2009) explores whether the use of credit derivatives is associated with an increase in bank credit supply and evidence does support the greater use of credit derivatives associated with greater supply of credit especially for large term loans. An increase in credit supply means that

more company and individuals are able to access credit facilities leading to overall growth of a nation's economy.

The credit derivatives market is a fast growing segment of global derivatives as an increasing number of financial institutions realize the role they play in credit risk management. In 1996, the market in credit derivatives was about $40 billion of notional amount globally. By the end of 2002, it was approximately $2 trillion. Credit derivatives currently form about 2% of the total derivative market.

The growth in credit default swaps can be traced back to the mid 1990's. During this period, J.P. Morgan's books were loaded with billions of dollars in loans to corporations and foreign governments. According to the federal law, Morgan had to keep huge amounts of capital in reserve in case any of the loans issued was defaulted. It is this reason that prompted J.P Morgan to create a device that would protect it if those loans defaulted and free up the capital in reserves. This marked the origin of modern credit default swaps.

Early trades in CDS were carried out by Bankers Trust in 1991. Then after J.P Morgan who is attributed to being one of the pioneers in credit derivative work developed the modern CDS in 1994. In 1997, JP Morgan developed a securitization vehicle known as BISTRO which is viewed to be one of the most innovative financial structures. BISTRO uses credit default swaps to clean up a bank's balance sheet. It used securitization to split up the credit risk into pieces which smaller investors found more absorbable as compared to very high credit risk.

The team at J.P Morgan included British economist Blythe Masters who helped to pioneer a new approach to off-loan risk from the bank's balance sheet reducing its capital reserves. This in turn results in free money to invest in credit derivatives and other products.

1.1 Statement of the Problem

With the increasing pace of infrastructure development and the growth of business opportunities globally, an increasing number of individuals and companies are accessing credit facilities in order to engage in these activities. Commercial banks are engaged in provision of credit facilities which expose them to credit risk.

In countries experiencing fluctuations in inflation rates such as Kenya, there is an increase in credit risk. Inflation rates in Kenya have been fluctuating for the past five years. According to the Kenya Financial Stability Report 2011, overall inflation averaged 7.99% in 2011 as compared to 5.6% in 2010, indicating a significant increase in the rate of inflation in 2011.

Inflation rates have a direct impact on interest rates charged by commercial banks. The CBK base rate rose to a high of 16.5% in November 2011 from 11% which resulted in a significant increase in the number of loan defaulters. In order to increase their profitability and manage risk more effectively, commercial banks need to invest in credit derivative products such as credit default swaps.

1.2 Objectives of the Study

General Objective

The broad objective of this study is to investigate whether credit default swaps are a useful tool in credit risk management in commercial banks. The study investigates whether the transfer of credit risk from commercial banks to insurance companies through the use of credit default swaps is an effective tool in credit risk management.

Specific Objectives

The specific objectives of the study include;

i)   To investigate whether credit derivatives play a role in increasing the overall profitability of commercial banks.

ii)   To determine whether the use of credit derivatives is associated with an increase in credit supply. In emerging economies, an increase in credit supply enables more individuals and companies to access credit facilities which results in an increase in the rate of growth of such economies.

iii)   To determine the probability of default on a loan issued by a commercial bank.

1.3 Significance of the Study

The study explores the application of credit derivatives to the banking sector in a period of fluctuating interest rates in developing countries such as Kenya. In particular the use of credit default swaps is investigated.

Through the study, it is determined whether credit default swaps have any impact on the credit risk of a particular commercial bank. Knowledge of the impact of credit default swaps have on credit risk helps the banking sector to be able to determine whether they can issue loans with a higher degree of credit risk. Loans with a higher degree of risk earn more interest as compared to loans with a lower degree of risk this therefore has an effect on the profitability of banks.

Knowledge on the impact of credit default swaps on loan defaulters also helps to determine whether money should be held in bank reserves to cater for loan defaulters or whether this money should be channeled into other activities such as improvement of banking services, loans and other banking facilities. This will contribute to the level of efficiency of commercial banks.

The study also helps to determine whether the use of credit default swaps has an impact on a bank's credit supply. The level of credit supply has an impact on the number of companies and individuals who can access credit facilities, an increase in credit supply means more individuals and companies can access credit facilities resulting to overall growth of a nation's economy and vice versa.

CHAPTER TWO: LITERATURE REVIEW

This chapter will review the concept of credit derivatives giving descriptions of some of the credit derivative products. The section also looks at some of the existing work done in this area, the credit derivative market as well as challenges facing the market.

2.0 The concept of Credit Derivatives

A derivative is a financial contract whose value is determined by an underlying asset. Credit derivatives can be seen as instruments that seek to trade in credit risk. The underlying instruments on which credit derivatives are written are typically corporate bonds.

There are many different types of credit derivative products falling into two fundamental categories based on the specific risk being transferred;

> ➢ single name credit derivatives
>
> ➢ multi name credit derivatives

Single name credit derivatives are based on the default risk of one particular borrower thus they offer protection against the default risk of one particular borrower. Examples are credit linked notes, total return swaps, credit default swaps and asset swaps. The credit default swap is the most widely used credit derivative which has been promoted on the basis that it is a risk management tool.

Multi name credit derivatives are based on defaults of one or more borrowers from a group of borrowers. They reference the correlation between the credit risks of various companies. Examples are CDOs.

Credit Derivative products include;

i)   credit linked note

ii)   credit default swap

iii)   Collateralized Debt Obligation

iv)   Total return swap

2.0.1 Credit linked notes

They are defined for an investor who wants to sell protection through a cash instrument. It is issued by a SPV offering investors periodic payments plus the par value of the reference entity at maturity, unless default occurs. The special purpose vehicle also enters into a credit default swap with a third party which pays the SPV an annual fee.

This annual fee provides higher return to investors to compensate for the credit risk involved. In the event of default, the investors receive a portion of the par value based on the recovery rate, and the SPV pays the third party the par value minus the recovery rate.

2.0.2 Credit Default Swaps

The most fundamental credit derivative is the credit default swap. Credit default swaps can be thought of as insurance against the default of some underlying instrument, or as a put option on the underlying instrument. It is a contract that provides insurance against the risk of default by a particular company or individual. In addition, according to Minton, Stulz and Williamson (2009) credit default swaps are also held for dealer activities, market participants use CDS to engage in arbitrage opportunities between markets.

In a credit default swap, the party buying credit protection makes periodic premium payments to the protection seller. The party selling credit protection makes no payments unless a specified reference entity experiences a credit event such as a default. The reference entity can be an individual, corporation or government. It provides insurance to the buyer against a credit event. A credit event includes;

   i)   Failure to pay an outstanding amount
   ii)   Bankruptcy of reference entity
   iii)   Restructuring which refers to actions such as coupon reduction or maturity extension undertaken in lieu of default.
   iv)   repudiation or moratorium provides for compensation after specified actions of a government reference entity
   v)   Obligation Acceleration

vi)   obligation default, which refer to technical defaults such as violation of a bond
         covenant

The buyer of the insurance obtains the right to sell a particular bond issued by the company for its par value when a credit event occurs. A bond is a form of securitized debt which matures at a specified date in the future, pays interest periodically in the form of coupon payments, and repays its face value at maturity.

The bond is known as a reference obligation and the total par value of the bond that can be sold is known as the swap's notional principal. A swap refers to an over-the counter financial derivative in which two parties enter into an agreement to exchange a series of cash flows based on the value of an underlying asset but that underlying asset is not directly traded.

Credit Default Swaps are mainly traded bilaterally in non-regulated, OTC markets.

Credit Default Swap
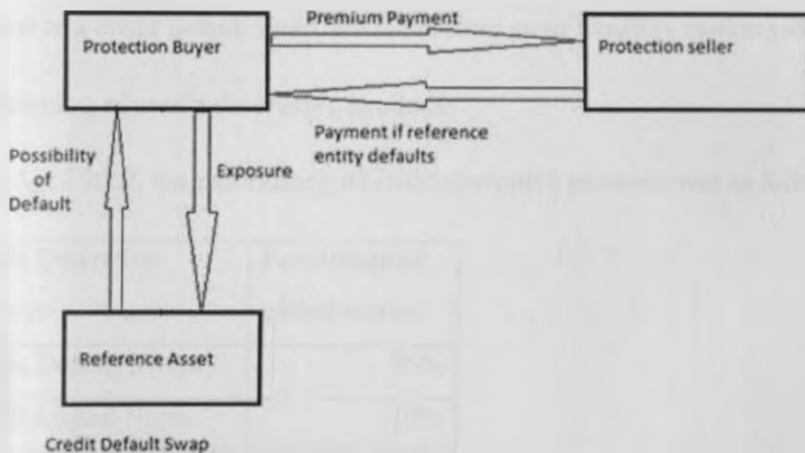
The premiums of the credit default swap, commonly known as CDS spread are determined by the market's view of how likely it is that default will occur before the CDS matures. Time to default is a random variable which characterizes the term structure of credit risk and affects the price of credit derivative products.

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2.0.3 Collateralized Debt Obligation

They are the most popular multi name credit derivative. It is an instrument with securitized portfolios of defaultable assets such as loans, bonds and credit default swaps (Schonbucher, 2003). Here, the portfolio of debt instrument is specified and a complex structure is created where the cash flows from the portfolio are channeled to different categories of investors.

The investor faces credit risk based on the pool of underlying bonds or loans. A CDO is a pool of assets packaged into one portfolio, and then that portfolio is split up into sections, each corresponding to a different level of loss which provides the investor with some flexibility in choosing the amount of loss or credit to which they are willing to be exposed.

2.0.4 Total Return Swaps

It is a credit derivative intended to protect against depreciation of an asset. The total return from one asset or a group of assets is traded for the total return of another group of assets. The swap exchange is a combination of an underlying asset and an interest rate swap. In a TRS agreement, one party receives the total return, or the generated income from the asset plus any capital gains, while the other party receives payments based on a set rate as part of the interest rate swap. In contrast to a credit default swap, the total return swap transfers market risk along with credit risk.

Partitioning of credit derivative products

As at April 2002, the partitioning of credit derivative products was as follows

Credit Derivative Product	Percentage in global market
Credit Default Swaps	85%
Credit Linked Notes	10%
Other Products	5%

Partitioning of credit derivative products

■ Credit Default Swaps   ■ Credit Linked Notes   ■ Other Products

5%

10%

85%
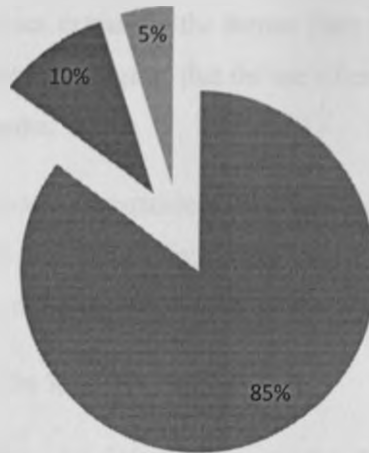
An Investigation on the use of Credit Derivatives in Managing Risk

Duffee and Zhou (2001) carried out a study on the use of credit derivatives in particular credit default swaps in banks. The study investigates whether credit derivatives are beneficial for the banks because they are theoretically more flexible products for transmission of credit risk as compared to loan sales. They used a theoretical analysis modeling the effects of the introduction of credit derivatives market on banks.

The study focused on small and medium-sized bank loans for which asymmetric information concerns outweigh reputation concerns of the lending bank. Asymmetric information refers to a situation where there is imperfect knowledge. In particular, it occurs where one party has different information to another for instance, banks know more about their loans than do outsiders.

The paper argues that credit derivatives flexibility in repackaging risks can, in some circumstances allow banks to trade previously untradeable risks. Depending on the nature of a bank's private information about a loan, the uncertainty in a loan's payoff potentially can be decomposed into a component for which the bank's information advantage is relatively small and a component for which the bank's informational advantage is relatively large. The bank can use a credit derivative contract to transfer the former risks to outsiders while retaining the latter risks at the bank. This reasoning suggests that the use of credit derivatives to fine-tune credit risk management can benefit banks.

The study by Duffee and Zhou also considers the effect that a credit derivatives market has on the loan sales market. In the paper, the effect of the introduction of the credit derivatives market is studied considering two variables;

i)   Previous use of the loan sale market

ii)   whether the asymmetric information associated with bank loans is primarily a moral-hazard problem or an adverse-selection problem

Their results found that for the specific case where before the introduction of these new products, the sale of loans was not used for credit risk transfer, then the emergence of these new products would be beneficial for banks because it would allow the distribution of risk. However, they found that the introduction of a credit-derivatives market is not necessarily desirable because it can cause other markets for loan-risk sharing such as loan sales to break down.

They also found that the value of the credit derivatives market depends on whether the asymmetric information is primarily a moral- hazard problem or an adverse-selection problem. Adverse selection refers to a situation where the borrower knows more about his creditworthiness than the lender, giving the borrower an undue advantage, which the lender can offset by limiting his exposure to the borrower. Moral hazard refers to a situation where the borrower takes undue risk against the money borrowed, thereby putting the lender's money at risk.

If the asymmetric information is one of a moral hazard, the bank is better off with credit derivatives, but if the problem is one of adverse-selection, the net effect is to leave the bank worse off.

An Investigation of the use of credit derivatives by banks to hedge loans

Minton, Stulz and Williamson (2009) investigate the validity of the view that credit derivatives make banks sounder. They found that the largest sector of the credit derivatives market is the credit default swap market. This paper examines the use of credit derivatives by US bank holding companies with assets in excess of one billion dollars from 1999 to 2005.

The sample of banks is constructed using the Federal Reserve Bank of Chicago Bank Holding Company database. With the available data, it was determined that the best proxy for whether a bank uses credit derivatives to hedge its loan portfolio is whether the bank is a net buyer of credit protection. In 2005, the last year in the sample, 16 of the 23 banks using credit derivatives (4.05% of the banks in 2005) are net buyers of credit protection.

The study examines the extent to which the use of credit derivatives to hedge loans can be predicted using existing theories about why firms hedge. Hedging is a strategy employed by financial markets to reduce risk by making a transaction in one market to protect itself against a loss in another. Credit Derivatives are used in hedging.

Hedging theories typically predict that firms with a greater probability of costly distress are more likely to hedge. If higher profitability is associated with a lower probability of financial distress, then the likelihood of a bank using credit derivatives to hedge should be lower for more profitable firms. Using probit regression analysis, the study finds this to be the case.

The paper finds that use of other derivatives such as of interest rate derivatives and an increase in bank size is positively and significantly associated with the likelihood of use of credit derivatives. From these findings, it follows that the use of credit derivatives is consistent with the predictions of hedging theories.

They also investigate whether the likelihood of hedging with credit derivatives is related to the type of loans a bank makes. It is found that banks are more likely to be net buyers of credit protection if they have more commercial and industrial loans in their portfolio.

The use of other credit risk management approaches such as securitizing loans or selling loans increases the likelihood of the bank buying credit protection. The study also found that the use of credit derivatives by banks to hedge loans is limited because of adverse selection and moral hazard problems and because of the inability of banks to use hedge accounting when hedging with credit derivatives.

In conclusion, the study found that credit derivatives can only make banks and the financial system sounder if they create few risks for banks when the banks take positions in them.

2.1 The credit derivative market

Credit Derivatives at Citibank

As part of its 2010 financial statements, Citibank reported that it uses credit derivatives to help mitigate credit risk in its corporate and consumer loan portfolios. The company either purchases or writes credit protection on behalf of its clients and for hedging of their own accounts.

Citibank uses several valuation techniques such as discounted cash flows, Black-Scholes option pricing model and Monte Carlo simulation to accurately value its credit derivatives. As a measure of risk control, Citibank actively monitors the credit risk of its counterparties in the credit derivatives contract

Credit Derivatives at Bank of America

In its 2010 financial statement, the Bank of America states that the bank actively manages credit risk of both funded and unfunded lending commitment through credit derivatives. The Bank of America simultaneously purchases and sells credit protection to obtain the desired level of credit exposure.

The bank actively monitors and manages credit risk exposure in its credit derivative contracts and maintains collateral agreements to cover its gross receivables from counterparties. For this purpose, the corporation records the counterparty credit risk valuations on derivative assets.

Credit Derivatives in the Argentina Debt Crisis

A temporary prohibition of activity on all external debt effective immediately was publicly announced by the interim president of Argentina Adolfo Rodriguez on December 23, 2001. The unanimous consensus in the dealer community was to consider that the temporary prohibition constitutes a credit event. Consequently all the credit derivatives that include this credit event were triggered. The possibility to deliver Argentina Bonds maturing in April 2008 and April 2018 was challenged on the basis that these bonds had no coupon due in the next three years. However, they were subsequently accepted as deliverable bonds.

According to the Deusche Bank, 95% of the default swaps had been settled by mid-February 2002. The total amount of Argentina credit protection in the market was estimated around USD 10 BN notional outstanding covering hundred of trades. This corresponds to a contingent payment of US 7 BN from the protection buyers to the protection sellers.

The Argentina default which is the largest emerging market bond default provided the key opportunity to evaluate the performance of the credit derivatives market. The smoothness of the settlement process and the absence of legal disputes have shown the relative maturity of the credit derivatives market

2.2 Challenges facing the development of Credit Derivatives market

To begin with, the existence of counterparty risk, which is the possibility that the seller of the credit default swap does not meet the terms of the agreement in the event of a credit event is one of the challenges facing the credit derivatives market. This tend to reduce the premiums charged on credit derivative swaps. The provision of financial guarantees from third-party entities which will reimburse any losses incurred is one approach to mitigating counterparty risk.

The poor transparency in CDS markets is also a challenge facing the development of the credit derivatives market. Buyers of CDS do not normally have access to information about buying or selling prices. Instead the price of each transaction is agreed directly with the issuer in question. Moreover, in spite of the fact that there are several private suppliers of trading prices and volumes, they rarely provide information on actual transactions but rather provide average values published with a certain time lag. Poor transparency makes it difficult to make trading decisions and increases search costs.

Initially, lack of standardized documentation relating to credit derivatives slowed down the development of the market. However, the International Swaps and Derivatives Association facilitated the trading in credit default swap through coming up with standard documentation which were published in 1999. Currently, the documentation used in majority of credit derivative transaction is based on the documents and definitions provided by the International Swaps and Derivatives Association.

The short history on credit derivatives and the lack of quantitative data as noted by Shao Yeager (2007) have also impeded the implementation of the credit derivatives market.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

This study is mainly concerned with examining the application of credit default swaps in commercial banks.

The methodology used values a credit default swap when the payoff is contingent on default by a single reference entity and there is no counterparty of default risk.

3.1 Pricing and Valuation of Credit Default Swaps

The valuation of a credit default swap is a two step procedure;

i)   Bonds issued by the reference entity or a company with the same risk of default as the reference entity are used to estimate the risk-neutral probability of the reference entity defaulting at different times in future.

ii)   The present value of the expected payments made by the buyer of the credit default swap contract and the present value of the expected payoffs are then calculated.

3.2 Hull-White (2000) Model

In this approach, it is assumed that there is no risk free arbitrage. Hull and White use treasury bonds as the risk free rate. This model can be implemented based on observable market data. There are two approaches to this model;

➢ The Hull-White standard intensity pricing approach

➢ The Hull-White approximate pricing approach

3.2.1 Hull-White intensity Model Valuation

Assumptions;

i)   Default events, treasury rates and the recovery rates are all mutually independent

ii) Claim made in the event of a default is the face value plus the accrued interest

iii) The recovery rate is independent of the default time and hence it takes on the same value regardless of the time a default occurs. The recovery rate measures the extent to which the market value of an obligation may be recovered if the borrower defaults.

The notional principal is one currency unit.

Let

T: maturity of the credit default swap

p(t): risk neutral probability of default at any given point of time t as determined in time zero

π : risk neutral probability of no credit event occurring between time zero and time T

R : expected recovery rate of a reference entity

u(t) : present value of payments at the rate of one currency unit per year on payment dates between time zero and time t

e(t) : present value of an accrual payment with a payment date immediately preceding time t.

v(t) : present value of one currency unit received at time t

w : total payments per year made by a credit default swap buyer. The payments last until maturity T or until a credit event occurs, whichever occurs sooner.

A(t) : time t accrued interest on the reference obligation.

s : value of w that causes the credit default swap to have a value of zero.

From all payment streams involved in a credit default swap, the present value of the expected payoffs is given by

$$\int_0^T [1 - R - A(t)R]p(t)v(t)dt \tag{3.1}$$

The present value of the expected payments is given by

$$w\int_0^T p(t)[u(t) + e(t)]dt + w\pi u(T) \tag{3.2}$$

Subtracting the present value of the expected payoffs from the present value of the expected payments;

$$\int_0^T [1 - R - A(t)R]p(t)v(t)dt \quad - \quad w\int_0^T p(t)[u(t) + e(t)]dt - w\pi u(T)$$

The fair spread of the credit default swap, s, is the value of w that makes this expression equal to zero that is

$$\int_0^T [1 - R - A(t)R]p(t)v(t)dt \quad - \quad w\int_0^T p(t)[u(t) + e(t)]dt - w\pi u(T) = 0$$

This implies that

$$w\int_0^T p(t)[u(t) + e(t)]dt + w\pi u(T) \; = \; \int_0^T [1 - R - A(t)R]p(t)v(t)dt$$

Solving for w;

$$w\left(\int_0^T p(t)[u(t) + e(t)]dt + \pi u(T)\right) \; = \; \int_0^T [1 - R - A(t)R]p(t)v(t)dt$$

$$w = \frac{\int_0^T [1 - R - A(t)R]p(t)v(t)dt}{\int_0^T p(t)[u(t) + e(t)]dt + \pi u(T)}$$

Thus;

$$s = \frac{\int_0^T [1 - R - A(t)R]p(t)v(t)dt}{\int_0^T p(t)[u(t) + e(t)]dt + \pi u(T)} \tag{3.3}$$

The spread s represents the total sum of payments per year for a newly issued credit default swap as a relative of the swap's notional principal.

Discrete case

The risk neutral probability of no credit event, π can be computed as follows;

$$\pi = \sum_{t=1}^{T} p(t)$$

If a default occurs at time t (t<T), the present value of the payments made by the protection buyer is given by

$$w[u(t) + e(t)]$$

If no default occurs, the present value of the payments is given by

$$w[u(t)]$$

Hence, the expected present value of the payments is given by

$$\sum_{t=1}^{T} p(t)[u(t) + e(t)] + w\pi u(T) \tag{3.4}$$

The risk neutral expected payoff from a credit default swap is

$$1 - [1 + A(t)]\bar{R} = 1 - \bar{R} - A(t)\bar{R}$$

The present value of the expected payoff given from the credit default swap then becomes

$$\sum_{t=1}^{T} [1 - \bar{R} - A(t)\bar{R}]p(t)v(t) \tag{3.5}$$

The value of a credit default swap is the expected payoff in case of a default minus the payments already made, that is

$$[1 - \bar{R} - A(t)\bar{R}]p(t)v(t) = wp(T)[u(t) + e(t)] - \pi w u(T)$$

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The credit default swap spread is the value of w that makes the expression above equals to zero, the equation is given as

$$s = \frac{\sum_{t=1}^{T}[1 - \bar{R} - A(t)\bar{R}]p(t)v(t)}{p(T)[u(t) + e(t)] - \pi u(T)} \qquad (3.6)$$

The equation above gives the total payments over a year expressed in percentage of the face value for a newly issued credit default swap.

3.2.2 Hull-White Approximate Valuation

A portfolio consisting of a Credit Default Swap and an underlying bond of the same obligor both having maturity T, should be risk-free. It should therefore have the same payoff as a treasury bond with maturity T.

For simplicity, assume that the treasury curve is flat and that interest rates are constant, a simple no-arbitrage argument then results in the spread

$s^* =$ maturity T corporate bond yield – maturity T treasury bond yield

This is usually an overestimate of the true spread s (Hull and White, 2000). However, we are able to close most of the gap between s^* and s.

Let

$A^*(t)$: is the time t accrued interest as a percentage of the face value on a T year par yield bond that is issued at time zero by the reference entity with the same payment dates as the swap

$a^*(t)$: is the average value for $A^*(t)$, 0<t<T

This yields an approximate formula for s where

$$s = \frac{s^*(1 - R - aR)}{(1 - R)(1 + a^*)} \qquad (3.7)$$

Assumption;

Default probabilities, interest rates and recovery rates are independent.

3.3 Estimation of Default Probabilities

The valuation of a credit default swap requires estimates of the risk neutral probability that the reference entity will default at different future times. The prices of bonds issued by the reference entity provide the main source of data for the estimation. If we assume that the only reason a corporate bond sells for less than a similar Treasury bond is the possibility of default, it follows that:

Present Value of Cost of Default

= Present Value of Treasury Bond − Present Value of Corporate Bond

By using this relationship to calculate the present value of the cost of defaults on a range of different bonds issued by the reference entity, and making an assumption about the recovery rates, we can estimate the probability of the corporation defaulting at different future times.

If the reference entity has issued relatively few actively traded bonds, we can use bonds issued by another corporation that is considered to have the same risk of default as the reference entity.

Suppose that an n-year zero-coupon treasury bond with a face value of X yields a% and a similar n-year zero coupon bond issued by a corporation yields b%. Both rates are expressed with continuous compounding.

The present value of the treasury bond is;

$$Xe^{-a\% \times n}$$

The present value of the corporate bond is;

$$Xe^{-b\% \times n}$$

The present value of the cost of default is given by;

$$Xe^{-a\% \times n}$$

Define the risk neutral probability of default during the n year life of the bond as p. Assuming there are no recoveries in the event of a default, the impact of a default is to create a loss of X at

the end of the n years. The expected loss from defaults in a risk neutral world is Xp and the present value of the expected loss is;

$$Xpe^{-a\%\times n}$$

It follows that

$$Xpe^{-a\%\times n} = Xe^{-a\%\times n} - Xe^{-b\%\times n}$$

Challenges of calculating default probabilities using this approach;

i)   Recovery rate is generally different from zero
ii)   Most corporate bonds are not zero coupon bonds

Estimating Default probabilities at Discrete times

This analysis can be used together with alternative assumptions about the claim amount.

Consider a case where a set of N bonds that are either issued by the reference entity or issued by another corporation that is considered to have the same risk of default as the reference entity is chosen. Defaults can happen on any of the bond maturity dates.

Suppose that the maturity of the ith bond is t_i with $t_1 < t_2 < t_3 < \ldots < t_N$

Define;

B_j : Price of the bond today

G_j : Price of the jth bond today if there were no probability of default

$F_j(t)$: Forward price of the jth bond for a forward contract maturing at time t assuming the bond is default-free ($t < t_j$)

v(t) : Present value of one currency unit received at time t with certainty

$C_j(t)$: Claim made by holders of the jth bond if there is a default at time t ($t < t_j$)

$R_j(t)$: Recovery rate for holders of the jth bond in the event of a default at time t

   ($t < t_j$)

α_{ij} : Present value of the loss, relative to the value the bond would have if there were no possibility of default, from a default on the jth bond at time t_i

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p_i : The risk-neutral probability of default at time t_i

In Hull and White's model, the Treasury bond is used as a proxy of default-free bond which implies G_j is the price of a treasury bond

Assume that interest rates are deterministic and that both recovery rates and claim amounts are known with certainty.

Because interest rates are deterministic, the price at time t of the no-default value of the jth bond is $F_j(t)$.

If there is a default at time t, the bondholder makes a recovery at rate $R_j(t)$ on a claim of $C_j(t)$. It follows that

$$\alpha_{ij} = v(t_i)[\, F_j(t_i) - R_j(t_i)C_j(t_i)]$$

There is a probability, p_i of the loss α_{ij} being incurred.

The total present value of the losses on the jth bond is, therefore, given by:

$$G_j - B_j = \sum_{i=1}^{j} p_i\, \alpha_{ij}$$

This equation allows the p's to be determined inductively:

$$p_j = \frac{(G_j - B_j - \sum_{i=1}^{j-1} p_i\, \alpha_{ij})}{\alpha_{jj}} \qquad (3.8)$$

3.4 The payoff from a Credit Default Swap

The payoff from a CDS in the event of a default at time t is usually the face value of the reference obligation minus its market value just after time t. Using the best claim amount assumption, the market value of the reference obligation just after default is the recovery rate times the sum of its face value and accrued interest.

This means that the payoff from a typical CDS is

$$L - RL[1 + A(t)] = L[1 - R - A(t)]$$

Where

L is the face value

R is the recovery rate

A(t) is the accrued interest at the time of default

The shortfall of the model used is that the independence assumption of interest rate, default probabilities and recovery rates are unlikely to be true in practice, for example, high interest rates cause companies to experience financial difficulties resulting in an increase in the probability of default.

The regular quarterly, semiannual ,or annual payments from the buyer of protection to the seller of protection cease when there is a credit event. However, because these payments are made in arrears, a final accrual payment by the buyer is usually required.

The total amount paid per year, as a percent of the notional principal, to buy protection is known as the CDS spread. It may also be seen as the price for the default protection, measured in basis points which is one hundredth of a percentage point (0.01%) of the notional value.

Mid-market CDS spreads on individual reference entities can be calculated from the default probability estimates.

Multiplication of the CDS spread with the notional value and day count convention, gives the periodic premium payment of the protection buyer to the protection seller.

Model's Precondition

In order to validate the model, certain preconditions have to be satisfied;

i)   The probability function from the equation

$$p_j = \frac{(G_j - B_j - \sum_{i=1}^{j-1} p_i \, \alpha_{ij})}{\alpha_{jj}}$$

must be greater than zero, that is

$$p_j \alpha_{jj} = G_j - B_j - \sum_{i=1}^{j-1} p_i \, \alpha_{ij}$$

$$B_j = G_j - \sum_{i=1}^{j-1} p_i \, \alpha_{ij} - p_j \alpha_{jj}$$

This implies that for p_j to be greater than zero,

$$B_j \leq G_j - \sum_{i=1}^{j-1} p_i \, \alpha_{ij} \tag{3.9}$$

ii)   The cumulative probability needs to be less than one, that is

$$p_j (t_j - t_{j-1}) = 1 - \sum_{i=1}^{j-1} p_i (t_i - t_{i-1})$$

From the equation (8) and (9) above, we get the following result

$$B_j \geq G_j - \sum_{i=1}^{j-1} p_i \, \alpha_{ij} - \frac{\alpha_{jj}}{t_j - t_{j-1}} \left(1 - \sum_{i=1}^{j-1} p_i (t_i - t_{i-1}) \right) \tag{3.10}$$

This equation suggests that that there is a boundary where the yield can move within.

Once the recovery rate is set, the last two equations can be used to validate if the bond yields are applicable on the chosen recovery rate.

CHAPTER FOUR: DATA ANALYSIS AND RESULTS

From the credit default swap valuation method described above, this study analyses data by applying the Hull and White model with a discrete framework.

Data was obtained from a selected local commercial bank. The period of investigation was the year 2005 to 2011 inclusive. The data relates to loan facilities sought by individual companies.

In addition, more data was obtained from the NSE relating to treasury bonds as well as corporate bonds. The corporate bonds were issued by companies which were considered to have the same risk of default as the company which had sought the loan facility.

This data was however modified to fit the purpose of the study. Redundant information not required for this study was eliminated and inconsistencies in the observed values were also identified and corrected.

4.0 Probability of Default estimation

The probability of default is calculated from the NSE data. The treasury bond coupon rate is taken to be the risk free rate. The five year treasury bonds are selected for data analysis.

We begin by calculating the face value of each of the five year treasury bonds from its previous price, days to maturity and the coupon rates. For example, for FXD 4/2008/5Yr, the face value is given by

$$99.7518 \times e^{\left(\frac{342}{365} \times 0.095\right)} = 109.04$$

We assume that there are 365 days in a year.

An average of the face value and interest rate of the five year treasury bonds is then calculated. The average face value is found to be 120.17 while the interest rate is 8.957%

The present value of the five year treasury bonds is then calculated as follows;

$$120.17 \times e^{-(0.08957 \times 5)} = 76.79$$

The five year corporate bonds chosen for use in this study were issued by company which was considered to have the same risk of default as the company that had sought the loan facility.

The same approach used in finding the present value of the treasury bond is applied to finding the present value of the corporate bond. For example for the FXD (Safaricom Ltd) 2009/5Yr, the face value is calculated as follows;

$$100 \times e^{\left(\frac{720}{365} \times 0.1225\right)} = 127.33$$

An average of the face value and interest rate of the five year corporate bonds is then calculated. The average face value is found to be 114.616 while the interest rate is 10%

The present value of the five year treasury bonds is then calculated;

$$114.616 \times e^{-(0.1 \times 5)} = 69.52$$

The cost of default is then given by

$$114.616 \times e^{-(0.08957 \times 5)} = 73.24$$

The probability of default is then found by solving for the value of p in the equation

$$73.24p = 76.79 - 69.52$$

$$73.24p = 7.27$$

$$p = 0.0993$$

The same approach is repeated for each of the n years. From the data, the probability of a reference entity defaulting during a year conditional on no earlier default is then calculated to be 7.92%.

The table below shows survival probabilities and default probabilities for each of the five years

Table 1.0: Default and Survival Probabilities

Time (years)	Default probability	Survival probability
1	0.0993	0.9007
2	0.0893	0.9107
3	0.0793	0.9207
4	0.0691	0.9309
5	0.0588	0.9412

From the Treasury bond and corporate bond values in the data, the probability in the first year is calculated to be 0.0993. The probability that a default will not occur in the first year is given by

$$1-0.0993=0.9007$$

The same concept is applied to derive the probability of survival for the remaining years.

Assumptions;

i)   The defaults always happen halfway through a year

ii)   Payments on the credit default swap are made once a year, at the end of each year

iii)   Risk-free interest rate is 5% per annum with continuous compounding

iv)   Recovery rate is 40%

v)   Payments are made at the rate of s per year

vi)   The notional principal is Ksh. 1

4.1 Present Value of Expected Payments

Table 1.1: Present Value of Expected Payments

Time (years)	Survival probability	Expected payment	Discount factor	PV of expected payment
1	0.9007	0.9007s	0.9512	0.8568s
2	0.9107	0.9107s	0.9048	0.824s
3	0.9207	0.9207s	0.8607	0.7925s
4	0.9309	0.9309s	0.8187	0.7622s
5	0.9412	0.9412s	0.7788	0.733s
Total				3.9684s

Table 1.1 illustrates the calculation of the present value of the expected payments made on the credit default swap.

During the second year, there is a 0.9107 probability that the second payment of s is made. The expected payment is therefore 0.9107s and the present value is given by

$$0.9107s \times e^{-0.05 \times 2} = 0.824s$$

The same approach is used to calculate the expected payment for the remaining years. The total present value of the expected payments is 3.9684s

4.2 Present Value of expected payoffs

Table 1.2: Present Value of Expected Payoffs

Time (years)	Default probability	Recovery Rate	Expected payoff	Discount factor	PV of expected payoff
0.5	0.0993	0.4	0.0596	0.9753	0.0581
1.5	0.0893	0.4	0.0536	0.9277	0.0497
2.5	0.0793	0.4	0.0476	0.8825	0.0420
3.5	0.0691	0.4	0.0415	0.8395	0.0348
4.5	0.0588	0.4	0.0353	0.7985	0.0282
Total					0.2128

Table 1.2 shows the calculation of the present value of the expected payoff. In the second year, there is a 0.0893 probability if a payoff is made halfway through the second year.

The expected payoff at this time is given by

$$0.0893 \times (1-0.4) = 0.0536$$

The present value of the expected value of the payoff is

$$0.0536 \times e^{-0.05 \times 1.5} = 0.0497$$

The total present value of the expected value of the payoffs is 0.2128

4.3 Present Value of accrual payment

Table 1.3: Present Value of Accrual Payments

Time (years)	Default probability	Expected accrual payment	Discount factor	PV of expected accrual payment
0.5	0.0993	0.0496s	0.9753	0.0484s
1.5	0.0893	0.0447s	0.9277	0.0414s
2.5	0.0793	0.0396s	0.8825	0.035s
3.5	0.0691	0.0346s	0.8395	0.029s
4.5	0.0588	0.0294s	0.7985	0.0235s
Total				0.1773s

Payment is made halfway through the year

Table 1.3 looks at the accrual payment made in the event of a default.

In year two, there is a 0.0893 probability that there will be a final accrual payment halfway through the second year.

The accrual payment is 0.5s since the payment is made halfway through the year. The expected accrual payment at this time is given by

$$0.0893 \times 0.5 \times s = 0.0447s$$

The present value is

$$0.0447s \times e^{-0.05 \times 1.5} = 0.0414s$$

The total present value of the expected accrual payments is 0.1773s.

From Tables 1.1 and 1.3, the present value of the expected payments is

$$3.9684s + 0.1773s = 4.1457s$$

Equating expected payoffs to expected payments;

From Table 1.2, the present value of the expected payoff is 0.2128. Equating the two gives

$$4.1457s = 0.2128$$

$$s = 0.0513 \text{ per annum}$$

4.4 Expected loss from loan defaulters

From the data relating to a local commercial bank, the expected loss is calculated by multiplying the probability of default by the outstanding loan amount. The recovery rate which is assumed to be 40% is taken into consideration.

For the example, for the loan facility with amount in arrears of Kshs. 30,828,576.50, the expected loss is calculated as follows;

$$30,828,576.50 \times (1 - 0.4) \times 0.0792 = 1,464,973.96$$

The same approach is applied to each of the outstanding loan amounts. The total expected amount is then calculated to be Kshs. 17,291,275.61

4.5 Results

From the data analysis, the mid-market CDS spread for the 1-year deal we have considered should be 0.0513 times the principal or 513 basis points per year.

From data from the local commercial bank, an average payment of Kshs.17,291,275.61 is expected to be made as a result of loan defaulters.

The risk neutral probability of default using the Hull White Model is found to be 7.92%

CHAPTER FIVE: CONCLUSION

It is clear from the results that commercial banks should participate in the credit default swap market. The study shows that by paying a premium of 513 basis points per year, the bank is able to avoid a potential loss of up to Kshs. 17,291,275.61. This improves the financial stability of banks and also leads to an increase in profitability as funds that would have been utilized to pay defaulted loans are put to other activities that enhance the banks operations.

On average, the risk neutral probability of default using the Hull White's model is found to be 7.92%. This means that there is a 7.92% chance that a company taking a loan facility from a commercial bank will default on its payments. The bank should therefore take this into consideration when issuing a loan facility.

With the transfer of credit risk to insurance companies through the use of credit default swaps, commercial banks are able to issue loans with a higher credit risk than they would have been able to issue in the absence of CDS. This generates higher interest and fee income resulting to increased profitability in commercial banks.

From the study, it is clear that credit risk management through credit derivatives is a worthwhile venture to expertise and put in more resources to enhance and improve the performance of the banking sector.

Through purchase of a credit default swap, commercial banks no longer have an incentive to monitor loans since the credit risk is transferred to an insurance company. This improves the bank operations as the resources and time invested in monitoring loans is transferred to other aspects of the bank's operations.

This study has shown that the banking operations will improve considerably through the use of credit default swaps as a risk management tool. With improvement in banking operations, a nation's economy will also improve considerably as more individuals and companies are able to access credit facilities.

CHAPTER SIX: RECOMMENDATIONS

Commercial banks should invest in credit default swaps to manage credit risk. This study has shown that credit default swaps are an effective tool in credit risk management. Through paying a small premium to an insurance company, banks are able to protect themselves from huge losses incurred as a result of loan defaulters.

Commercial banks that buy credit protection save capital and thus should be able to make loans at rates that are below the rates offered by competitors who do not utilize credit derivatives. Credit Default swaps enable banks to transfer credit risk away from the lenders hence they should charge a lower loan rate to the borrowers.

Commercial banks should invest in training their staff on credit default swaps so as to facilitate their incorporation into the bank's credit risk management framework. This will increase the pace of growth of CDS.

The study also recommends that further research should be done in valuation of the probability of default of loans since the Hull's Model used in this study does not consider the interest earned by corporate bonds.

REFERENCES

1. Bernadette A. Minton, Rene Stulz and Rohan Williamson, "How much do banks use credit derivatives to hedge loans?", Journal of Financial Services Research, Vol. 35, No. 1, pp. 1-31, 2009.

2. Beverly Hirtle, "Credit Derivatives and Bank Credit Supply", Federal Reserve Bank of New York Staff Report, 276, February 2007.

3. British Bankers Association, "Credit Derivatives Report 2006", 2006.

4. Choudry Moorad, "An Introduction to credit derivatives", 1st Edition, 2004.

5. Darrell Duffie and Kenneth J. Singleton, "Modeling the Term Structure of Defaultable Bonds" Vol.12, Issue 4, 1999.

6. Gregory R. Duffee and Chunsheng Zhou, "Credit derivatives in banking: Useful tools for managing risk?", Journal of Monetary Economics 48, 2001.

7. John C. Hull, "Options, Futures, and other derivatives", 7th Edition, 2009.

8. John C. Hull and Alan D. White, "Valuing Credit Default Swaps I: No Counterparty Default Risk" Journal of Derivatives, Vol. 8, No. 1, pp. 29-40, 2000.

APPENDICES

APPENDIX 1

	BONDS LISTED AT THE NAIROBI SECURITIES EXCHANGE							13-Nov-12
Issue No.	Issue Date	Maturity Date	Days to Maturity	Issued Value in millions	Coupon Rate	Coupon (%)	Previous Price (%)	Total Value Traded (kshs)
GOVERNMENT OF KENYA FIXED RATE TREASURY BONDS								22-Oct-12
ONE YEAR BOND								
FXD1/2011/1Yr	26-Dec-11	24-Dec-12	41	11,104.21	Fixed	21.408	101.5670	
FXD1/2012/1Yr	30-Jan-12	28-Jan-13	76	14,942.35	Fixed	21.082	103.2135	
FXD2/2012/1Yr	27-Feb-12	25-Feb-13	104	10,516.25	Fixed	18.030	102.8210	
FXD3/2012/1Yr	26-Mar-12	25-Mar-13	132	15,038.39	Fixed	16.432	102.2404	
TWO YEAR BONDS								
FXD 4/2010/2Yr	27-Dec-10	24-Dec-12	41	8,947.01	Fixed	4.5860	96.2708	
FXD 1/2011/2Yr	28-Feb-11	25-Feb-13	104	14,269.92	Fixed	5.2840	98.4161	
FXD 2/2011/2Yr	25-Apr-11	22-Apr-13	160	6,695.71	Fixed	7.4390	98.4489	
FXD 3/2011/2Yr	26-Sep-11	23-Sep-13	314	10,000.00	Fixed	10.500	84.5111	
FXD 4/2011/2Yr	28-Nov-11	25-Nov-13	377	9,980.05	Fixed	22.844	111.5477	
FXD 1/2012/2Yr	30-Apr-12	28-Apr-14	531	6,468.64	Fixed	13.826	102.4926	
FXD 2/2012/2Yr	27-Aug-12	25-Aug-14	650	16,312.35	Fixed	11.114	101.0905	
FIVE YEAR BONDS								
FXD 1/2008/5Yr	28-Jan-08	21-Jan-13	69	5,530.85	Fixed	9.5000	98.9973	
FXD 2/2008/5Yr	28-Apr-08	22-Apr-13	160	4,095.80	Fixed	9.5000	99.8690	
FXD 3/2008/5Yr	25-Aug-08	19-Aug-13	279	14,809.15	Fixed	9.5000	99.1998	
FXD 4/2008/5Yr	27-Oct-08	21-Oct-13	342	10,007.50	Fixed	9.5000	99.7518	
FXD 1/2009/5Yr	21-Sep-09	15-Sep-14	1,400	9,751.41	Fixed	9.5000	97.7962	
FXD 1/2010/5Yr	24-May-10	18-May-15	916	11,998.76	Fixed	6.9510	90.0941	
FXD 2/2010/5Yr	30-Nov-10	23-Nov-15	1,105	11,970.90	Fixed	6.6710	95.6243	

FXD 1/2011/5Yr	31-Jan-11	25-Jan-16	1,168	11,272.90	Fixed	7 6360	90 3110	
FXD 1/2012/5Yr	28-May-12	22-May-17	1,651	7,460.91	Fixed	11 8550	105 5959	120,000,000
SIX YEAR BONDS								
FXD 2/2006/6Yr	27-Nov-06	19-Nov-12	6	5,767.45	Fixed	11 5000	100.6070	
FXD 1/2007/6Yr	30-Apr-07	22-Apr-13	160	5,948.00	Fixed	11.5000	100.5350	
SEVEN YEAR BONDS								
FXD 2/2006/7Yr	25-Dec-06	16-Dec-13	398	2,317.95	Fixed	12.0000	101.4670	
FXD 1/2006/7Yr	30-Jan-06	21-Jan-13	69	3,236.00	Fixed	13.2500	100.3732	
FXD 1/2007/7Yr	30-Jul-07	21-Jul-14	615	8,269.85	Fixed	9.7500	98.5462	
EIGHT YEAR BONDS								
FXD1/2006/8Yr	27-Feb-06	17-Feb-14	461	3,318.80	Fixed	13.2500	101.2072	
FXD1/2007/8Yr	26-Feb-07	16-Feb-15	825	2,656.90	Fixed	12.7500	106.3129	
NINE YEAR BONDS								
FXD 1/2006/9Yr	24-Apr-06	13-Apr-15	881	3,060.25	Fixed	13.5000	108.3461	
TEN YEAR BONDS								
FXD 1/2003/10Yr	23-Jun-03	10-Jun-13	209	2,704.80	Fixed	13.2500	103.2351	
FXD 2/2003/10Yr	25-Aug-03	12-Aug-13	272	6,352.87	Fixed	8.5000	99.7265	
FXD 1/2006/10Yr	27-Mar-06	14-Mar-16	1,217	3,451.05	Fixed	14.0000	109.1333	
FXD 2/2006/10Yr	29-May-06	16-May-16	1,280	5,028.10	Fixed	14.0000	108.6537	
FXD 1/2007/10Yr	29-Oct-07	16-Oct-17	1,798	9,308.80	Fixed	10.7500	95.3731	
FXD 1/2008/10Yr	29-Oct-07	16-Oct-17	1,798	2,992.75	Fixed	10.7500	101.8612	
FXD 2/2008/10Yr	28-Jul-08	16-Jul-18	2,071	13,504.70	Fixed	10.7500	92.9311	
FXD 3/2008/10Yr	29-Sep-08	28-Sep-18	2,145	4,151.60	Fixed	10.7500	97.6518	
FXD 1/2009/10Yr	27-Sep-09	15-Apr-19	2,344	4,966.85	Fixed	10.7500	102.0784	
FXD 1/2010/10Yr	26-Apr-10	13-Apr-20	3,350	5,895.64	Fixed	8.7900	107.7673	
FXD 2/2010/10Yr	1-Nov-10	19-Oct-20	2,897	14,462.47	Fixed	9.3070	93.5722	
FXD 1/2012/10Yr	25-Jun-12	13-Jun-22	3,499	5,043.74	Fixed	12.7050	117.9089	
ELEVEN YEAR BONDS								
FXD1/2006/11Yr	25-Sep-06	11-Sep-17	1,763	4,031.40	Fixed	13.7500	105.1918	

TWELVE YEAR BONDS								
FXD1/2006/12Yr	28-Aug-06	13-Aug-18	2,099	3,900.95	Fixed	14.0000	107.3074	
FXD1/2007/12Yr	28-May-07	13-May-19	2,372	4,864.60	Fixed	13.0000	106.7678	
FIFTEEN YEAR BONDS								
FXD1/2007/15Yr	26-Mar-07	7-Mar-22	3,401	3,654.60	Fixed	14.5000	108.8250	
FXD2/2007/15Yr	25-Jun-07	6-Jun-22	3,492	7,236.95	Fixed	13.5000	113.9766	
FXD3/2007/15Yr	26-Nov-07	7-Nov-22	3,646	18,030.20	Fixed	12.5000	97.7534	
FXD1/2008/15Yr	31-Mar-08	13-Mar-23	4,731	7,380.90	Fixed	12.5000	107.8561	
FXD1/2009/15Yr	26-Oct-09	7-Oct-24	4,346	9,420.45	Fixed	12.5000	107.2666	
FXD1/2010/15Yr	29-Mar-10	10-Mar-25	4,500	10,419.88	Fixed	10.2500	87.6674	
FXD2/2010/15Yr	25-Apr-11	8-Dec-25	4,773	4,787.10	Fixed	9.0000	75.5605	
FXD1/2012/15Yr	24-Sep-12	6-Sep-27	5,410	19,526.31	Fixed	11.0000	92.7220	200,000,000
TWENTY YEAR BOND								
FXD1/2008/20Yr	30-Jun-08	5-Jun-28	5,683	20,360.95	Fixed	13.7500	108.4602	
FXD1/2011/20Yr	30-May-11	5-May-31	6,747	6,010.63	Fixed	10.0000	79.1041	
TWENTY FIVE YEAR BOND								
FXD1/2010/25Yr	28-Jun-10	28-May-35	8,231	14,953.06	Fixed	11.2500	90.5942	
THIRTY YEAR BOND								
SDB 1/2011/30Yr	28-Feb-11	21-Jan-41	10,296	10,041.55	Fixed	12.0000	85.9796	
INFRASTRUCTURE BONDS								
IFB 1/2009/12Yr	23-Feb-09	8-Feb-21	3,009	19,726.85	Fixed	12.5000	105.1600	
IFB 2/2009/12Yr	7-Dec-09	22-Nov-21	3,296	18,897.65	Fixed	12.0000	99.0480	20,000,000
IFB 1/2010/8Yr	1-Mar-10	19-Feb-18	1,924	16,908.05	Fixed	9.7500	101.3649	
IFB 2/2010/9Yr	31-Aug-10	19-Sep-19	2,501	30,590.12	Fixed	6.0000	83.6373	
IFB 1/2011/12Yr	3-Oct-11	18-Sep-23	3,961	11,625.75	Fixed	12.0000	110.8067	250,000,000
IFB 1/2011/12Yr	3-Oct-11	18-Sep-23	3,961	11,625.75	Fixed	12.0000	110.8067	500,000,000
IFB 1/2011/12Yr	3-Oct-11	18-Sep-23	3,961	11,625.75	Fixed	12.0000	110.8067	300,000,000
IFB 1/2011/12Yr	3-Oct-11	18-Sep-23	3,961	11,625.75	Fixed	12.0000	110.8067	300,000,000

IFB 1/2011/12Yr	3-Oct-11	18-Sep-23	3,961	11,625.75	Fixed	12.0000	110.8067	200,000,000
IFB 1/2011/12Yr	3-Oct-11	18-Sep-23	3,961	11,625.75	Fixed	12.0000	110.8067	200,000,000
BONDS SELL/BUY BACK TRANSACTIONS								
CORPORATE BONDS			DTC					
CONSOLIDATED BANK OF KENYA LTD MEDIUM TERM NOTE PROGRAMME								
CON.BD-FXD(SN)/2012/7Yr	30-Jul-12	24-Jul-19	2,444	1,480.60	FIXED	13.25%	100.0000	
CON.BD-FXD(SBN)/2012/7Yr	30-Jul-12	22-Jul-19	2,442	196,500	FIXED	13.60%		
CON.BD-FR(SN)/2012/7Yr	30-Jul-12	22-Jul-19	2,442	1.0	T.B (182) + 2%			
SHELTER AFRIQUE MEDIUM TERM NOTES								
FR 1 /2011/3Yr	11-Jul-11	7-Jul-14	601	1,416.79	T.B (182) + 1.50%		94.7582	
FXD /2011/3Yr	11-Jul-11	7-Jul-14	601	1,083.21	FIXED		94.7582	
PTA BANK LTD FLOATING RATE BOND								
FR(MTN)/2007/7Yr	15-Oct-07	31-Oct-14	717	600	T.B.+1.00%		100.0000	
BARCLAYS BANK MEDIUM TERM FLOATING RATE NOTES								
FR (MTN)/2007/7Yr	19-Nov-07	19-Nov-14	736	1,500	T.B.+0.6%		90.3789	
FXD (MTN)/2008/7Yr	14-Jul-08	14-Jul-15	973	1,300	FIXED	8.70%	100.0376	1,000,000
FR (MTN)/2008/7Yr	14-Jul-08	14-Jul-15	973	0.700	T.B (182) + 1%			
MRM								
FR (MRM) 2008/8Yr	27-Oct-08	17-Oct-16	1,434	621.50	T.B.+1.75%		100.0000	
FXD (MRM) 2008/8Yr	27-Oct-08	17-Oct-16	1,434	1,378.50	FIXED	13.00	100.0000	

CFC STANBIC BANK SENIOR & SUBORDINATED BOND ISSUE								
FR (CFC Stanbic) 2009/7Yr	7-Jul-09	7-Jul-16	1,332	97.91	T.B (182) + 1.75%			
FXD (CFC Stanbic) 2009/7Yr	7-Jul-09	7-Jul-16	1,332	2,402.09	FIXED	12.50	98.3077	
FXD2 (CFC Stanbic) 2010/4Yr	27-Dec-10	22-Dec-14	769	2,500.00	FIXED	7.25	88.4609	
KENGEN PUBLIC INFRASTRUCTURE BOND OFFER 2019								
FXIB 1/2009/10Yr	2-Nov-09	31-Oct-19	2,543	25,000.00	FIXED	12.50	90.9846	
SAFARICOM LTD DOMESTIC MEDIUM TERM NOTE								
FR (Safaricom Ltd) 2009/5Yr	2-Nov-09	3-Nov-14	720	463.40	T.B (182) + 1.85%		100.0000	
FXD (Safaricom Ltd) 2009/5Yr	2-Nov-09	3-Nov-14	720	7,049.60	FIXED	12.25	100.0000	
FXD2 (Safaricom Ltd) 2009/5Yr	2-Nov-09	3-Nov-14	720	5,000.00	FIXED	7.75	99.9958	
HOUSING FINANCE MEDIUM TERM NOTE								
FR (HFCK) 2010/7Yr	26-Oct-10	2-Oct-17	1,784	1,166.50	T.B (182) + 3.00%			
FXD (HFCK) 2010/7Yr	26-Oct-10	2-Oct-17	1,784	5,864.40	FIXED	8.50	100.0000	
	FTSE NSE Bond Index - Base Date 01-Jan-2012 = 100				**Turnover in Bonds.**			
	Up 0.101 points to close at 94.048				**Today**	**Previous**	**Previous**	