

MICROSTRUCTURE ELEMENTS OF THE BONDS MARKET IN KENYA

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Abstract

Mobilizing long term capital is a challenge in Africa with small capita market. Although the evidence that long term finance influences economic growth saw a wave of capital market reform in Mid-1990s, stock markets are yet to make significant contribution to growth financing. Majority of the bonds market are in their infant stage offering minimal alternative source of financing. Kenya's experience is no exceptional. It has a youthful bonds market with handful corporate bonds listed and yet to evolve long term maturity. With the emphasis on private-sector led growth and the increasing focus on PPP as an alternative to providing public services, it means that developing the capital market is very vital.

This paper focuses on Kenya bonds market. It analysis's the microstructure characteristics of they bonds market and looks at the factors influencing these characteristics. It is hypothesized that a market that exhibits high liquidity, high efficiency and low volatility is more preferred as it facilitates participation by firms and investors. Such characteristics reflect on the soundness of the institutional structures and the policy environment. It is also hypothesized that growth of Treasury bond market is a prerequisite for development of corporate bonds market.

Our results show that the bonds market has weak microstructure characteristics. These characteristics though differ across the treasury and corporate bonds and also across the maturities. Treasury bonds market is more liquid with higher traded value and more traded days as compared to the corporate bonds market. However, the corporate bond market is less volatile which is comparable to the short end of the treasury bonds. The treasury bonds returns have a higher volatility for the longer tenors than the short tenor. This may explain the preference for short tenor bonds than the longer tenor bonds. In explaining this we found that there are various institutional gaps with for example no credit rating agencies, primary dealers and underwriting services. The listing requirements have seen some interested companies fail to list. There is no benchmarking yield curve and although the market has a Central Depository and Settlement Corporation (CDSC) guarantee funds, the establishment of sinking fund is crucial in securitization. Further there is no single model for determining prices of bonds. Thus to make the market work, it is crucial to address the institutional structures.

Table of Contents

Abstract.....	ii
Abbreviations.....	iii
1. Introduction.....	1
2. Bonds market in Kenya.....	1
2.1 Introduction.....	1
2.2 Importance of the bonds market.....	5
2.3 Trading system.....	7
2.4 Regulatory framework.....	9
2.5 Policy issue.....	10
3. A brief literature review.....	11
3.1 Introduction.....	11
3.2 Liquidity.....	11
3.3 Efficiency.....	13
3.4 Volatility.....	14
3. Methodology.....	16
4.1 Empirical framework.....	16
4.2 Variable definition.....	17
4.3 Data and sample.....	18
4. Empirical results.....	19
Summary statistics.....	19
Liquidity analysis.....	20
Market efficiency.....	23
Volatility analysis.....	26
6. Conclusion.....	29
Data collection problems.....	29
7. Policy recommendations.....	30
References.....	32
Appendix.....	34

Abbreviations

APD - Average Per Deal

CBK – Central Bank of Kenya

CDS - Central Depository System

CMA - Capital Markets Authority

EADB - East African Development Bank

FISB-Fixed Income Securities Board

GDP - Gross Domestic Product

MRM - Mabati Rolling Mills

NSE - Nairobi Stock Exchange

REPO - Repurchase Orders

1 Introduction

Financing development is a challenge facing many emerging markets and constraining their ability to implement the set development objectives. Although Africa is experiencing financial sector development, the diversity of financing instruments is very narrow and among the long term financing options. While 1990s saw a wave of capital market reform, a lot of emphasis was on the stock market with very minimal effort put on the bonds market. This saw substantial development of stock markets with new stock exchanges being established, regulatory systems strengthened and trading system rejuvenated. However, in most cases this has not attracted a significant number of listings. There are very few fully fledged bonds markets. In most cases, bonds are traded in the stock exchange with a dominance of the government bonds. Corporate bonds are almost non-existence.

Bonds market is an alternative vehicle for mobilizing finance for both the government and the private sector in financing long-term projects such as housing and infrastructure development in addition to financing the government deficit. The development of bonds market is seen to play a crucial role in promoting partnerships in the development process between the government and the private sector. Successful development of bonds market though requires a developed money market, favourable macroeconomic policies, significant market participation, appropriate trading system and sound legal and regulatory framework. Experience also shows that development of government bonds market is crucial in paving way for development of the corporate bonds market. In the development process of bonds market, it is expected that at the initial stage a lot of effort is given to strengthen and develop the short end of the market including transparency in securities operations and instrument design. After, focus moves to upgrading the trading facilities and the settlement process and the market regulations.

In the Kenyan context, various changes have been instituted including the establishment of a fixed income securities trading segment at the stock exchange, tax incentives and other factors that reduce the transaction costs, diversification of the maturities especially for the treasury bonds and the modernization of the trading system especially for the treasury bonds. It is also important to note the deliberate effort that the government took in boosting development of the bonds market in 2001. The question is with all these

developments, has the bonds market microstructure been strengthened? A market that is characterized by high liquidity, efficiency and with minimal transaction costs and volatility is desirable in the growth process. These are indicators that the market will play a significant role in financing development.

Institutional development is indicated as a major factor that determines development of the market microstructure. Policy makers and market administrators can influence investment strategies of the investors through their choice of institutional set up. Market microstructure determines the type of information available to market participants, the manner in which incoming orders to buy and/or sell are matched and surveillance of the market. As such, institutional set up defines the microstructure characteristics of the market including liquidity, efficiency, trading costs and volatility.

This study attempts to analyze the microstructure characteristics of the bonds market in Kenya, to see the implications of the various efforts being put on development of the market.

2 Bonds Market in Kenya

2.1 Introduction

The Kenyan bonds market traces its origin back to the 1980s when the Government of Kenya first launched a bid to use treasury bonds as a source of funds to finance government deficit. Similarly, the first corporate bond was issued on 8th November 1996 by the East African Development Bank (EADB), which issued a multi-lateral bond. The Kenyan bonds market experienced a turn around in 2001 however, when the government re-launched treasury bonds. In both cases, the rates applicable were floating rates pegged to the 91-day Treasury bill rates. Faulu Kenya, a microfinance institution listed a medium term bond in 11th April 2005. The bonds market has been relatively more active after 2001 and an increased number of bonds issues have been made. By end of 2005, there were 65 Treasury bonds (Floating Rate, Special and Fixed Rate Bonds) and five corporate bonds listed on the NSE. There has been a tremendous market gain in terms of the size of the bond market as indicated in Table 1. Total bond value has increased from just over Kshs. 0.8 billion in 1996, to over 186 billion in 2003, with the coupon rate in the market ranging between 8% and 14%.

2.1.1 Treasury bonds

In Kenya, the objective of government has been to maintain stability in Treasury securities interest rates, lengthen the average maturity of the domestic debt through sustained efforts to restructure the debt away from the short tenor Treasury bills to longer tenor Treasury bonds and develop a yield curve to provide a basis for pricing corporate bonds. Following the introduction by the government of long tenor Treasury bonds (7, 8, 9 and 10 year) since March 2003, the average maturity of domestic debt lengthened to 2 years and 2 months at the end of June 2004 from 1 year and 7 months in June 2003. Consequently, the stock of Treasury bills (including repos) declined as a percentage of domestic debt to 32.5% in June 2004 from 35.6% in June 2003, while the stock of Treasury bonds increased to 61.6% in June 2004 from 55.8% in June 2003, as shown in table 2, reflecting the continued interest by the Government of Kenya in domestic debt restructuring with a bias towards Treasury bonds.

The share of Treasury bonds of 5 years tenor and above in the total outstanding bonds increased to 42.2% at the end of June 2004 from 25.7% at the end of June 2003, while that of the 10-year bonds increased from 1.7% of the outstanding bonds in June 2003 to 4.6% in June 2004. The Government faces a challenge however, of sustaining this achievement and extending the maturity profile further in order to diversify its fixed income portfolio away from short-term to long-term instruments. The significant role played by the banking sector as the leading investors in holding outstanding stock of Treasury bonds should be recognized as should be that played by “others”, insurance companies, parastatals and building societies in that order. Together, these investors indirectly help government achieve its fiscal objectives, which is why their interests should be protected.

2.1.2 Corporate bonds

Kenya’s corporate bonds market has always had a lower trading activity compared to the Treasury bond market³. Since the inception of this market in 1996 there has only been five corporate organizations that have listed their bonds in this market. The growth of this market has been hindered by a number factors, among them, information asymmetry

³ See table 1 for details.

among potential issuers, a high and unstable interest rate regime, lack of a yield curve to price long term instruments and the crowding out effect of the government's domestic debt.

Added to the foregoing, is the characteristic of the dominance of institutional investors in this market as shown in table 4, who prefer a strategy to buy and hold the issued bonds. These investors who include, Banks, Insurance companies, Fund Managers and Investment companies account for approximately 97% of the total bondholding whereas, individuals account for about 3% of the total corporate bondholding in Kenya.

2.2 Importance of the bonds market to the Kenyan Economy

There exists a direct relationship between fiscal deficit and significant issuances of government debt securities; the development of the bond market is inextricably linked to the direction and management of fiscal policy. The extent to which fiscal spending is financed through the sale of government bonds in open competitive markets, and the degree to which this sustains a critical level of supply of government debt securities have important implications for the development of a country's economy.

Similarly, a domestic corporate bond market helps corporations reduce their financing costs in two ways. First, through disintermediation, by allowing corporations through bond issuance to borrow directly from investors, bypassing the major intermediary role of a commercial bank and second, by structuring their asset and liability profiles in such a way as to reduce maturity risk and currency mismatch in their books of accounts. Although corporations still go through underwriters, brokers and dealers to raise debt finance, competition among these intermediaries is more intense compared to that between commercial banks, pushing down their intermediation costs. As a result, borrowing firms enjoy a lower cost of debt financing.

The bond market belongs to the larger financial services sector, which in 2003 contributed at least 10% to total GDP. The Kenya Government issues bonds majorly to finance domestic debt borrowing, which is part of a general objective of financing public debt. Kenya's public debt stood at Ksh. 709.7 billion at the end of June 2004. Out of the outstanding public debt, Ksh. 306.2 billion or 43.2% was domestic. The share of domestic debt in GDP stood at 26.4% in June 2004. Overall, the ratio of total public debt

to GDP was at 61.2% in June 2004. Domestic debt was majorly financed through the sale of Treasury bonds to commercial banks and the non-banks (61.6%), and through utilization of the overdraft facility at the Central Bank of Kenya.

In addition to them being traded, bonds may also be used as collateral (through lien creation) against borrowings before maturity date, or be transferred to others. The corporate bond market statistics show a positive contribution to GDP albeit, at a lower level. As at June 2003 for instance, corporate bonds worth 7.35 billion were outstanding. Institutional investors who have a tendency to buy and hold to maturity dominate the corporate bonds market.

2.3 Trading system

Bonds trading at the NSE follow a call auction system to determine the bond price. In a call auction, the orders are accumulated periodically and are matched at a specific time at the price, which results in maximum trading volume. In most cases, this price is the average price between ask and bid price. Additionally, given that NSE's bond market does not have market makers, it is order driven and this according to Madhavan (2001) reduces efficiency as compared to if it were a quote driven market. The main order type used at the NSE in trading in bonds is the limit order. In this type of order, the broker is instructed to buy or sell a security at a specific price (or better).

The secondary market for Treasury and corporate bonds in Kenya is Trading at the NSE takes place through licensed stockbrokers who act as intermediaries playing the agent role. For a transaction to take place in the case of treasury bonds, a prospective investor must have a Central Depository System (CDS) account, which is a central facility at Central Bank for holding securities by book entry without the necessity of certificates. It is a requirement of Central Bank that all investors have a CDS account for them to purchase Government bonds. New investors are required to complete CDS account opening cards before making their accounts fully operational. No fee is charged to open this account. Additionally, an investor requires only one CDS account, which is to be used for all investment in Government securities. When applying to hold or sell bonds, investors apply on a prescribed application form which requires information on the issue

number, face value, offer payment for every Kshs. 100, desired rate to maturity (% rate), duration, name of the prospective investor and CDS account number.

Bonds in the Kenyan bond market are traded on a separate board known as the Fixed Income Securities Board (FISB). Specific rules that govern trading in bonds on the board are followed to ensure an orderly trading process at the NSE. To start with, bids and offers of bonds are displayed on the Fixed Income Securities board in the order in which they are called. Also, bids and offers are first matched on the basis of best price and second, on the first come first served basis.

To trade, bids and offers must be equal and for at least 50% of the value on offer, for the matching to take place. No bidding spreads or forced transactions are allowed at the exchange. Also, it is a requirement that board lots be at par and that prices be expressed as a percentage of Kshs. 100 par rounded to four decimal places. The minimum board lot is according to the rules defined as the outstanding minimum nominal value of the bond. Additionally, bonds with periodic partial principal repayments are traded at the subsequent minimum nominal value following the partial principal repayments.

In a case where the bonds bear a floating rate of interest, the daily applicable reference interest is displayed on the Fixed Income Securities Board at the start of the trading session. All bonds are according to these rules traded cum coupon up to the closure of books as communicated by the issuer for determination of entitlements. Lastly, the rules stipulate that no bond should be traded within 3 working days of the principal redemption.

A major issue of concern that would constrain the operations of the Treasury bond market is the entry requirement. The minimum face value required before one invests in bonds is Kshs. 50,000 and any additional to be invested must be in multiples of Kshs. 50,000 according to the national debt department of the central Bank of Kenya. Although those eligible to invest include individuals, corporate bodies and non-residents through authorized agents such as commercial banks, authorized stockbrokers and authorized investment advisers, individual participation is highly constrained.

Aside from trading in the organized exchange, Off-market trading in bonds (also known as Over-the Counter trading) takes place at the NSE. This market has fewer participants

than the organized exchange. It however helps institutional investors to do cross border trading and execute large blocks of trades.

2.3 Regulatory framework

Trading in bonds is governed by specific eligibility and listing rules and regulations set up by both the Nairobi Stock Exchange (NSE) and the Capital Markets Authority (CMA). In the pre-reform period (before February 2001), NSE used to have only one listing market segment with stringent eligibility and listing requirements. According to the market participants, these requirements failed not only to address the needs of small and medium-size organizations but also the special needs of institutional investors. In the post-reform era however, the NSE regulatory framework has been changed, bringing with it a subdivision of the market into four distinct market segments, each with its own eligibility and listing requirements. Also, in addition to defining the various categories of investors and addressing their needs, the post-reform NSE has defined trading lots, a feature which did not exist before the reforms were introduced.

To list at the NSE and issue bonds, a corporate organization needs to be registered under the Companies Act and be limited by shares with minimum share capital of Kshs. 50 million and net assets of Kshs 100 million or a guarantee. The bonds to be issued must be freely transferable to other parties. Additionally, at the time of issuing the bonds, the issuer must have published on a going concern basis, audited and unqualified financial statements, which must comply with International Accounting Standards (IAS). Furthermore, the issuer should not be in breach of any loan covenant in regard to maximum debt capacity and should have made profit in 2 of the last three years preceding the issue.

The organization must also be solvent and have a gearing ratio⁴ of 4:1 or less. At the date of its intention to issue bonds, the organization's three years' ratio of funds generated from operations to total debt should not be less than 40%. The corporate organization should in addition to disclosing the suitability of directors and Management to the

⁴ A gearing ratio shows the extent of indebtedness of a corporate organization, the lower the ratio the more solvent an organization is.

Exchange, present a clean certificate from the relevant regulatory authority for banking and insurance companies.

Despite all the efforts that have been made to boost trading in the bonds market and protect investors, more effort needs to be put in to attract more investors. Both the exchange and its controlling authority need to develop a reform agenda in the regulatory framework to make the market more competitive in investor attraction and boost bond market activity.*Policy issue*

The question that comes to mind when it comes to the Kenyan bond market is whether enough is being done to improve the institutional structure in the bonds market and reduce the cost of trading, reduce excess volatility and improve both efficiency and liquidity through tax incentive provision. Taxation being an added cost to trade may have been discouraging some potential investors into venturing into investment in bond markets, given the fact that these same investors pay several other fees and charges. However, a reduction in tax charged may drastically reduce the capacity of Government to introduce necessary institutional reforms aimed at boosting bond market activity. Therefore, a balance needs to be struck as concerns provision of tax incentives in the bond market to ensure that market activity is boosted while at the same time improving the institutional framework in bond markets in Kenya.

3 A brief literature review

3.1 Introduction

The viability of bond markets depends on its level of liquidity, efficiency, volatility and trading costs. Market rules and market practices governing the trading process, such as how trading orders are submitted and what trading information must be disclosed, affect the market microstructure elements. This raises the question of whether changes in institutional structure can enhance market performance by improving the microstructure elements. We look at the empirical evidence with regard to the microstructure elements.

3.2 Liquidity

Liquidity, the ability to buy or sell both quickly and without substantially moving prices, is the key to market success. As a market becomes more liquid, it encourages more

trading, which, in turn, attracts more market participants, resulting in a virtuous circle where markets become more liquid and more efficient over time.⁵ By reducing the riskiness of buying and selling bonds, liquidity makes market participation more attractive, which has a bearing both on prices and on the ability of the market to process information efficiently. Ultimately, liquidity can dictate the success of a market. Liquidity goes beyond the physical ability to trade and also includes market depth, which refers to the ability to transact at the current market price. In a deep market, even large orders can be transacted at the current price. In contrast, when market depth is lacking, the larger an order, the more price will have to adjust to fill that order.

Linking the institutional structure to liquidity, some studies have looked at the implications of trading system on liquidity. For example, Madhavan (1993) develops a theoretical framework that permits one to compare different trading structures and shows that there are differences between the equilibrium behavior of continuous and periodic auctions, and between dealer and quote-driven systems. Periodic auctions provide better price efficiency in his model, but at the expense of continuity and higher information costs. Amihud and Mendelson (1991) examine the effect of liquidity on fixed income instruments. Their results show that liquidity has an economically and statistically significant impact on required returns. As liquidity increases, required return declines.

Domowitz (2001) conducted a study to find out whether electronic trading can offer much more than just the reduction of transaction costs through the automation of trade execution and dissemination of quote information. Results showed that electronic trading systems offers strategic liquidity management. Another study looked at the relationship between market transparency and liquidity. Using empirical studies, Bloomfield and O'Hara (1999) show that low-transparency dealers are more likely to provide liquidity because of the information content of their actions in the market. However, Madhavan and Porter (2001) case study of Toronto Stock Exchange indicate that increased transparency had "detrimental effects" on liquidity. Gravelle (2001) found that fixed income markets tend to be characterized by pre-trade transparency (by requiring quotes

⁵ See Madhavan (1993) and Mendelson (1991)

from dealers) and from stock exchanges by post-trade transparency (by immediately reporting transactions).

Other studies have related liquidity to other elements of microstructure. For example, it is shown that illiquidity can itself create trading cost especially because of its interact with fundamental risk. As a result, the “trading cost view” postulates that illiquid securities must provide investors with a higher return to compensate them for their larger transaction costs, controlling for their fundamental risk Amihud and Mendelson (1986). Studies testing this hypothesis confirm a significant cross-sectional relationship between liquidity (as measured by the tightness of the bid-ask spread or trading volume) and asset returns, controlling for risk including Brennan and Subrahmanyam (1996) Chordia, Roll and Subrahmanyam (2000) Datar, Naik and Radcliffe (1998) and Elwaswapu (1997), Warga (1992), Daves and Ehrhardt (1993), Kamara (1994) and Krishnamurthy (2000).

The “liquidity view” postulates that liquidity is itself a source of risk since it changes unpredictably over time. Since investors care about returns net of trading costs, the variability of trading costs affects the trading cost of a security. Acharya and Pedersen (2004) showed that liquidity risk should be priced to the extent that it is correlated across assets with asset fundamentals. Similarly Hasbrouck and Seppi (2004) proposed a model of liquidity risk where traders have asymmetric knowledge about future liquidity so that less informed investors try to learn from current trading volume how much liquidity there may be in the future. They showed that current liquidity is a predictor of future liquidity risk and is therefore priced.

More recent literature puts forward the “risk-liquidity interaction view” which opines that both current and future liquidity alter the impact on the changes in risk on current prices and yields. This view does not emphasize on liquidity risk but rather on the interaction of liquidity and fundamental risk. Proponents of this argument including Pagano et al. (2005) contend that changes in fundamental risk affect less the price of bonds that are currently less liquid but more the prices of bonds that are more liquid. Similarly, Vayanos (2004) argues that fund managers are subject to withdrawals when their performance falls below the minimum threshold, and are therefore likely to liquidate at times of high volatility. This increases the liquidity premium at times of high volatility.

3.3 *Efficiency*

Markets are said to be efficient if they quickly and correctly incorporate information into prices. This is important because many traders are unable to devote time and resources to gathering information given the cost this portends for them, preferring instead to depend on the market itself to properly reflect all available information in prices. For these uninformed traders, a market that is inefficient is also unattractive because it means that trades may be made at unfavorable prices and if they realize that later they may be discouraged from trading. For that reason, markets that are more efficient will attract investors and this translates into increased market liquidity.

The importance of efficiency as market microstructure element was identified by Jack Treynor's short article on the Only Game in Town⁶ (written under the pseudonym of Bagehot, 1971). In this article, Treynor explained why investors as a whole lose from trading, and why informed investors win. According to him, the key is to understand the role of the dealer or market maker, who loses when trading with informed investors, but aims to more than recoup these losses through trading with uninformed investors.

Grossman and Stiglitz (1980) observed that in a world with costly information, it is impossible for markets to be informationally efficient. They resolved this paradox by drawing on Treynor's idea of assuming that the market also entertains transactions from uninformed noise traders. This focus on the way that markets function has grown into an extensive literature on the microstructure of financial markets. The Bagehot (1971) article provided an early insight into the way information is incorporated into security prices through the activities of investors, and how market structure can have an impact on the efficiency of the bond market.

The intuitive story presented by Bagehot was formalized in the price formation model presented by Kyle (1985). Kyle developed a model in which multiple orders of variable size are processed at a single price. His model had three types of traders: a single

⁶ Investors' confusion between market gains and trading gains helps explain why they continue trading even though it rarely improves their performance. Then, too, some investors reason that if trading based on random selection is as likely to prove profitable as not, trading based on any information whatever will result in performance better than neutral. The key to the fallacy in their reasoning is the market maker, who must impose a spread in order to survive.

informed trader, several competing market makers, and uninformed noise traders who transact randomly. Noise traders camouflage the activities of the informed trader, whose transactions are organized in such a way that his private information is reflected gradually in market prices. The market makers compete and therefore break even while informed transactors achieve a profit at the expense of noise traders.

Glosten and Milgrom (1985) showed that the very possibility of trading on information could be sufficient to induce a positive bid-ask spread. Building on earlier work by Copeland and Galai (1983), Glosten and Milgrom identified the element of the spread that is attributable to adverse selection. Taken together with Demsetz's (1968) order processing costs, and Ho and Stoll's (1981) measure of inventory control costs, this has provided a framework to an extent that it is now used widely for analyzing the bid-ask spread confronted by investors.

3.4 Volatility

Volatility refers to the frequency and magnitude of price movements in the market. While prices are expected to vary over time to reflect changes in relative and absolute value, the concern over volatility is that short-term price movements do not correctly reflect changes in equilibrium value. Furthermore the concern is over excess volatility, which has the potential of destabilizing the market and in the process making it less attractive to potential investors. Volatility and the other microstructure elements have a strong linkage. For instance, if markets are liquid, transaction costs will be lower, especially bid/ask spreads and, as a result, the observed sequence of trading prices will be less volatile as the natural bouncing of transactions between the bid and ask occurs over time.

The generally accepted view is that asset price volatility is caused by the arrival of new information, which results in investors wishing to adjust their portfolios (Clark, 1973). Epps and Epps (1976), in an attempt to explain volatility clustering, postulate that because information arrives at an uneven rate, volatility is also variable. They argue that, if one could replace clock time with event time, so that the time measure is stretched during periods of high information arrival and is contracted in periods of low arrival (weekends, nights, lunch-times), volatility would be much smoother.

A further observation is that the information arrival process impacts additionally on trading volume, (Karpoff 1987). This is because, to the extent that new information results in investors adjusting their portfolios, they will need to trade. The consequence is that volume and volatility will be jointly determined and will be positively correlated (Tauchen and Pitts, 1983). Volume will also tend to cluster (Lamoureux and Lastrapes 1990). In explaining persistence in volatility Gilbert (1987) uses a fundamental characteristic of financial asset trades, which is that they must all at some future date, be reversed. One cannot consume a share or a bond in the way that one consumes an apple or an orange. Positions established today will be unwound at some future date. Shocks to trading volume today will generate echoes in the future. On this view, volatility persistence is the outcome of the unwinding of positions resulting from information arrival at an earlier date.

4 Methodology

4.1 Empirical framework

The purpose of this study was to analyze the microstructure characteristics of the bonds market. The main elements considered include: liquidity, efficiency and volatility. Although literature provides more sophisticated models of carrying out the analysis, because of data constraints the study carried out a simple but informative analysis about the state of the market microstructure in the bonds market in Kenya.

a) Liquidity

To capture liquidity, the study used the traded value (which is what was available) and number of deals. If all the statistics of the outstanding value of bonds were available, the study would have used the turnover ratio. Similarly, it would have been more preferable to use the traded volumes rather than values because of the impact of price changes. The number of deals shows participation in the market while the traded volume/values show the size of transactions. Thus, we expect that the higher the number of deals, the higher the level of participation and the higher the value traded the larger the size of transactions. It is possible however; that small deals could be associated with higher traded values so that large transactions fail to capture the participation rate. In this regard

the study used the average traded value per deal to analyze the average size of each transaction.

b) Efficiency

The study looked at various aspects that have implications on the efficiency of the market. The first aspect considered was thinness of the market measured by the number of days of traded out of the ideal situation (this excludes weekends and holidays and includes all the days that the market is open for trading in the week). A thin market is said to be inefficient because of the information asymmetry. Second, it is hypothesized that when information assimilation is not an issue for the market, then the difference between the closing prices and the highest prices quoted during the day should not be significantly different. In this study we compare the closing prices with the highest quoted prices. Inefficiency is inferred when the dispersion between the two is high. An assumption is also made that the closing price that captures the information in the course of trading should be between the high and low quotations of the day. It would have been interesting to capture efficiency by looking at how the market adheres to administrative directives. For example, there are defined limits within which the current price should not exceed. With daily data it would be possible to trace the magnitude of the daily prices and calculate their dispersions. However, the study did not get access to this type of data.

c) Volatility

The study used the standard deviation and variance of bonds return to capture the volatility in the market. The standard deviation captures the direction of fluctuations while the variance captures the magnitude. The volatility is defined as:

$$\text{Volatility} = \text{std}_{t-1} \left\{ \log \left(\frac{Q_t}{Q_{t-1}} \right) \right\} = X_i - \bar{X}$$

Where, std is the standard deviation, log is the natural logarithm, Q represents price, current yield or any other variable whose volatility is being measured. X_i is the monthly observation and \bar{X} is the mean value of 12 months. Subscript $t-1$ indicates that the standard deviation is conditional on information available at time $t-1$. The variance is

defined as the square of the standard deviation. Bonds return is a sum of the current yield and capital gain or loss. Thus, the study divided the bonds returns into the two components and analyzed them separately. The idea was to capture the size of the two components in the total volatility. Further, the study captured the dispersion between the lowest and highest prices to give an indication of the price dispersions.

4.2 Variable definition

Bond return = current yield + capital gain/loss; Current yield = coupon/bond prices; Capital gain/loss = $\log(\text{bond price})_t - \log(\text{bond price})_{t-1}$; Value = traded value of bonds; Deal = number of deals struck in the period; APD = ratio of Value to Deal; Day = the number of days traded; Day* = the ratio of number of days traded to total ideal number of days; Closing = closing price in the day of trading; High = the highest price quoted in the day of trading; Low = the lowest price traded in the day of trading

4.3 Data and Sample

The study covers the period 2000-2004. This is the period when comprehensive monthly data is available as observed from the NSE's monthly bulletins. In total the study uses 1,279 treasury bonds traded value observations, 45 corporate bonds traded value observations, 60 bonds deals, 1,266 bond price and 1,093 current yield observations for treasury bonds, and 45 bond price and current yield observations for the corporate bonds. The variation in sample sizes is as a result of the way bonds data is entered at NSE; it keeps changing the style over time and there are variations in frequency of trading.

5 Empirical results

5.1 Summary statistics

Table 6 provides summary statistics for the various measures of microstructure characteristics of the bonds market. Corporate bonds have on average a lower price (102.33) than the Treasury bonds (104.75). Whereas corporate bond prices range between 99% and 109%, indicating a price dispersion of 10%, the Treasury bonds prices range between 65% and 148.5% indicating a price dispersion of 84%. The relatively higher price dispersion in Treasury bonds is indicative of higher price volatility in this

market. The distribution of prices does not follow a normal distribution as both types of bonds, have positive skew coefficients and fat tails relative to the normal distribution.

The average value of Treasury bonds traded is generally higher than the corporate bonds as can be observed from table 6. Theoretically, on average, Ksh. 91 million worth of treasury bonds and Ksh. 55 million worth of corporate bonds are turned over per day, an indication that there is more participation in the treasury bonds market. For both the corporate and treasury bonds, an average of 73 deals were struck per day, with a minimum of 18 deals and a maximum of 172 deals made. Treasury bond capital gains/losses are also generally more volatile than corporate bonds with a maximum and minimum of 0.40 and -0.429 and 0.066 and -0.088 respectively. For the current yield, volatility for corporate bonds fluctuates between a maximum and minimum of 1.42 and -1.29, whereas that for Treasury bonds fluctuates between 2.21 and -1.999, indicating that the trend has been the same, with total volatility in the treasury bonds market being higher.

5.2 *Liquidity analysis*

The liquidity of the market has been analyzed using various measures, with all of them showing that participation in the corporate bonds market is much lower relative to the treasury bonds market.

a) *Traded value*

Table 7 summarizes the traded values for the period 2000-2004. There is a general increasing tendency of traded values over the period with a drop in 2004 for both the treasury and corporate bonds. There are also notable differences across maturities for the various types of bonds. Corporate bonds show more traded value for the 4-year than any other active tenor. The 5-year tenor seconds 4-year tenor in market activity, followed by the 3-year tenor, with the 7-year tenor being the relatively least active. Over time, all the bonds indicate a higher level of trading immediately they are listed and then a drastic general decline there after.

In traded value terms, the treasury bonds market is dominated by the 2 and 3-year tenors, indicating a preference for short-term securities by Treasury bond investors. Another

indicated pattern is that, when a new treasury bond tenor is introduced in the market, it is generally not very popular as measured by the low traded value. However, over time, it is able to pick up as investors gain confidence in it. In the short-run, investors appear to be substituting one-maturity with another, as an increasing trading in one sees trading in the other decline.

Considering the monthly levels of trading, Figure 1 indicates that there is a general tendency for the value traded to decline in the first half of the year. A peak is generally achieved in the third quarter of the year while a declining tendency is experienced by the end of the fourth quarter of the calendar year, this indicates seasonality effects in bond market trading.

Comparing the corporate and treasury bonds' traded values, results show that participation in the corporate bonds market is relatively far lower (Figure 2), implying that Treasury bonds dominate Kenya's bonds market. A possible explanation for this is the relatively higher prices that treasury bonds fetch in the bonds market.

b) Trading deals

Table 8 shows that there has been an increasing number of deals in the market, an indication that participation in the market has increased over time. It also shows that the average size of deals has increased overtime from 47 in 2000 to 90 in 2004. Similarly, on average, turnover values and the average number of deals struck have increased, an indication of market deepening. This can be attributed to the increasing number of bonds listed in the market and the increasing awareness among the investors.

Figure 3 summarizes the relationship between the turnover value, number of deals struck and the average turnover value per deal. A notable observation is that participation in the bonds market is accompanied by an increasing size of the market turnover value and vice versa. There is a general increasing trend in turnover value, average turnover per deal and the number of deals as can be observed by the increase at a decreasing rate of the curves representing the trend of the three variables. There is however a drop in the turnover value, the number of deals struck and the average turnover value per deal in 2004, signaling a decline in bond market activity.

5.3 *Market efficiency*

Although both the treasury and corporate bonds share the same floor in the secondary market, their clearing and settlement systems and procedures are different. For instance, an investor in the Treasury bond market is required to have a Central Depository System (CDS) account to facilitate the immobilization bonds given that bonds are held in electronic accounts. It also facilitates faster and easier processing of transactions. The market defines the spreads within which daily prices move, which helps in controlling daily volatility of prices. Conversely, one is not required to hold a CDS account to trade in corporate bonds and this lowers the relative efficiency in trading in corporate bonds.

The first panel of table 9 reports the average price, yield and return for the corporate bonds. Generally, the 3-year bond price is higher than the rest of the active bond tenors. Similarly, the 4-year bond has a generally declining yield trend that is lower than the 3-year tenor bond. The converse is true for the 5-year bond whose yield has been generally higher than the 3-year bond. A notable feature for the 3-year bond is that it has a declining yield even as the price declines, implying that the coupon rate for this bond has gone down drastically over time. It therefore means that, in real terms, the 3-year bond is relatively more rewarding to investors.

The second panel of the same table gives the average price, yield and return for Treasury bonds. It can be observed that generally, as the tenor of the bond increases, so does its average price. On the other hand, the yield falls as the tenor of the bond increases. This could be the reason why trading activity is concentrated on lower tenor bonds. Additionally, in general, corporate bonds of the same maturity as Treasury bonds are more expensive and on average, have a higher yield. This could explain why there is lower trading activity in corporate bonds, owing to the lower risk faced in trading in Treasury bonds.

a) *Number of days of trading*

The number of days the bond is traded in the market is indicative of the thinness of the market. Treasury bonds have recorded an increasing number of times of trading relative to the corporate bonds (Table 10). As a proportion of the total number of days of trading, it increased from 68% in 2000 to 87% in 2004. This means that comparatively, corporate

bonds thinly trade in the market, an indication that on the overall, Treasury bonds are more efficiently traded than corporate bonds.

b) Information trading

In an efficient market, new information should be incorporated quickly and correctly in the price of a bond. It therefore follows that, at the close of trading, the close price should reflect all the information available to the market until the last minute of trading before the market closes. Similarly, in an efficient market the dispersion between the highest price attained and the close price should be small to reflect the fact that most of the information available to the market was impounded in prices just before the market closed. The dispersion between the highest price attained and the close price has been computed and is summarized in the table 11(a), whereas the lowest price attained and close price dispersion is reported in table 11(b). Figure 4 summarizes the relationship between the closing price and the high and low prices.

Results from the tables show that the total average dispersion of the closing price from the highest price is higher (9.02%), than the dispersion of the closing from the lowest price (6.05%). In efficiency terms, it means that information that could lead to an increase in bond price is relatively more efficiently relayed to the market than information likely to lead to the eventual reduction in bond price. Also, a high dispersion between the highest and closing price could be signaling information trading because, depending on the nature of the information, as the information is assimilated in the market, then the price at the end of the trading day may be lower or higher. For the low/close price dispersion, we find an indication of relatively lower information trading.

5.4 Volatility analysis

The bonds return volatility, which captures the capital gain/loss and current yield volatility have been separately computed to find out the contribution of the two to the total bonds market volatility.

a) Treasury bonds

Figures 6 and 7 trace the volatility of T/bonds' capital gain/loss across the various maturities. The figures show that short tenor bonds have lower volatility compared to the

long tenor bonds, in terms of both the direction and magnitude of volatility. This could explain why there is preference for the short tenor bonds relative to long tenor bonds, in Kenya's bonds market, given the minimal risk exposure.

Considering the current yield volatility, figures 8 and 9 show that the short tenor bonds again have lower volatility, which is explained by the volatility in prices given that the coupon rate is almost constant over time. Comparing the two volatilities, we find that the current yield fluctuates between 2.21 and -1.99 as compared to the capital gain/loss volatility, which fluctuates between 0.4 and -0.429. It means therefore that, current yield volatility contributes a significantly higher proportion (83.55%) to the total bonds return volatility than capital gain/loss volatility (16.45), for treasury bonds.

Considering the difference between the highest and lowest price, figure 5 and table 12 show that over time the dispersion between the two has increased. A peak is recorded in October-2003 and a declining tendency thereafter. However, the values are generally higher than they were in 2000.

b) Corporate bonds

The corporate bond market has relatively fewer observations, signaling the fact that trading it is not as active as the government bond market. The 3-year, 4-year, 5-year and 7-year corporate bond are the only active bonds, with the 3-year trading in all the years between 2000 and 2004, the 4-year trading between 2001-2003, the 5-year trading in all the years under review except 2000, and the 7-year trading in 2004 only. For capital gain/loss, the short tenor bonds show larger spikes for both the rise and fall in bond return as compared to the longer tenor bond (see Figures 10 and 11). These results are replicated by the variance, which shows higher magnitudes of fluctuations for the short-term bonds. These results are the exact opposite of the treasury bonds, which displayed higher volatility for longer tenor bonds. The higher volatility for shorter tenor bonds could be as a result of the higher competition with the 5-year tenor bonds, which are issued by three companies as compared to the 3 and 4-year, which have two companies, with higher competition leading to lower volatility.

For the current yield, Figures 12 and 13 indicate the short maturities to have relatively lower volatility than the longer maturities. Comparing the proportionate contributions of

the yield and capital gain/loss volatility, we find that current yield fluctuates between 1.42 and -1.29, whereas capital gain/loss fluctuates between 0.066 and -0.088. Results therefore show that, the current yield contributes 94.62% of the total proportion of volatility in this market, whereas, capital gain/loss contributes 5.38% of total volatility in the corporate bonds market.

In conclusion we observe that generally, current yield has a significantly higher volatility than capital gain/loss for both types of bonds. Additionally, over time, in the case of Treasury bonds, volatility has increased, while across tenors, short-term bonds have had lower volatility than long-term bonds both in the case capital gain/loss and current yield. For corporate bonds, relatively longer tenor bonds have had lower capital gain/loss volatility levels than short tenor bonds, whereas for yield, short tenor bonds have had lower volatility than longer tenor bonds. Overall, short tenor bonds have lower total volatility than long tenor bonds for both corporate bonds and government bonds.

6 Conclusion

Bond market microstructure is an important area of research, going by the attention that this area of financial economics has received hitherto. Our study analyzed the microstructure elements with the objective of seeking to understand how these elements influence bond price and ultimately, the performance of the bond market in Kenya.

On the basis of the analysis of the major microstructure elements, the study found out that they differ across bond categories. Liquidity was found to be higher in the Treasury bonds market than in the corporate bonds market. Efficiency was also found to be higher in the Treasury bonds market as compared to the corporate bonds market. However, as concerns volatility, the reverse was the case. It was found to be higher in Treasury bonds than in the corporate bonds market.

Overall, the performance in the Treasury bonds market is better than in the corporate bonds market in terms of the analyzed microstructure elements. Concerted efforts should therefore be made, to improve operations in the corporate bonds market so that it can operate optimally even as the government bonds market gets more vibrant.

7 Policy Recommendations

Given the tumultuous times that Kenya's bond market has been going through, it is only fair that urgent measures be taken to reverse the evident negative trends so that this crucial market can take its legitimate position in spurring the Kenya's financial sector to the course of rapid development. To achieve this our study recommends the following.

Greater attention to longer tenor bonds

Although evidence from the analysis done shows that short tenor bonds far outperformed long tenor bonds as measured by the microstructure elements, it is imperative that greater attention be focused on longer tenor bonds. We therefore recommend that government intensifies its efforts to diversify its fixed income securities portfolio to longer tenor bonds, given the relative success in using short-tenor bonds in financing its domestic debt. Corporate organizations should also be encouraged to launch longer tenor bonds with attractive premiums to improve bond market vibrancy.

More instruments in the Market

Some corporate organizations defend their "buy and hold policy" by arguing that there are no alternative instruments in the stock market that they could invest in, were they to sell the bonds they hold. Given the limitation of few available instruments to invest in, this contention is valid. Additional instruments in the market would therefore spur market activity and encourage market participants to change their buy and hold behavior. Such instruments are for instance REPOs and reverse REPOs, short selling, securities borrowing and lending, bond futures and options and interest rate swaps.

Automation

In the era of globalization, it can be naïve not computerize operations in virtually all information and transaction processing operations in a stock market. The NSE is semi-automated and this has to some degree affected both the liquidity and efficiency of the market. It is therefore our suggestion that computerizing all operations in the market should have been done "yesterday". This will not only improve the rate at which information is impounded in bond price but also ease order processing and also reduce the cost of trading. Trading online should also be facilitated to improve operations at the bond market.

Information Dissemination

Most of the Kenyan populace does not understand the operations of the stock market, let alone the bond market. It is the recommendation of this study that a deliberate campaign be set in motion to sensitize the public about the benefits of investing generally in the stock market and specifically in the bond market.

Reduction of the Minimum amount for investment in bonds

Retailing in bonds is an expensive undertaking that is out of reach to most potential investors. To invest in Treasury bonds for instance, one requires at least Kshs. 50,000 and this increases in multiples of Kshs. 50,000 for the investor interested in investing more. The minimum amount should therefore be reduced to an “affordable” level if the objective of improving market performance is to be met.

References

- Acharya, Viral V., and Pedersen L. H., (2004), "Asset Pricing with Liquidity Risk," *Journal of Financial Economics*, Forthcoming.
- Amihud, Y., and Mendelson H. (1986). "Asset Pricing and the Bid-Ask spread", *Journal of Financial Economics*, 17, pp.223-49.
- Amihud, Y., and Mendelson H., (1991), "Volatility, Efficiency, and Trading: Evidence From the Japanese Stock Market", *Journal of Finance*, 46, 5, pp.1765-1789.
- Bagehot, W., pseud. For Treynor J., (1971). "The Only Game in Town", *Financial Analysts Journal*, 27 (Mar/Apr), pp. 12-17.
- Bloomfield, R., and O'Hara M., (1999): "Market Transparency: Who Wins and Who Loses?", *Review of Financial Studies* 6, pp.375-404.
- Brennan, M., and Subrahmanyam A., (1996), "Market Microstructure and Asset Pricing On the Compensation for Illiquidity in Stock Returns", *Journal of Financial Economics* 41, pp. 441-464.
- Central Bank of Kenya Prospectus on Investment in Government Securities.
- Chordia, T., Roll R., and Subrahmanyam A., (2000), "Commonality in Liquidity", *Journal of Financial Economics* 56, pp.3-28.
- Clark, P.K., (1973), " A subordinated Stochastic Process Model with Finite Variance for Speculative Prices", *Econometrica*, 41, pp.1149-1168.
- Datar, V., Naik N., and Robert R. (1998), "Liquidity and stock Returns: An alternative test," *Journal of Financial Intermediation*, pp.203-219.
- Daves, Philip R., and Erhardt M., C. (1993), "Liquidity, Reconstitution, and the Value of U.S. Treasury Strips," *Journal of Finance* 48(1), pp.315-329.
- Demsetz, H., (1968). "The Cost of Trading", *Quarterly Journal of Economics*, 82, pp. 33-53.
- Domowitz, I., (2001), "Liquidity, Transaction costs and Reintermediation in Electronic Markets", paper presented at Bank of Canada conference on financial market structure and dynamics, November, Ottawa.
- Eleswarapu, V., (1997), "Cost of Transacting and Expected Returns in the Nasdaq Market," *Journal of Finance* 52, pp.2113-2128.
- Emerging Markets Committee of the International Organization of Securities Commissions, (May 2002). "The Development of Corporate Bond Markets In Emerging Market Countries".
- Epps, T., and Epps M., (1976), "The Stochastic Dependence of Security Price Changes and Transaction Volumes: Implications for the Mixture of Distributions hypothesis", *Econometrica*, 44, pp.305-321.
- Fama, E., (1991). "Efficient Capital Markets II", *Journal of Finance*, 46, pp. 1575-1617.

- Glosten, L., and Milgrom P., (1985). "Bid, Ask, and Transactions Prices in a Specialist Market with Heterogeneously Informed Traders", *Journal of Financial Economics*, 14, pp. 71-100.
- Gravelle, T., (2001). "The Market Microstructure of Dealership Equity and Government Markets," paper presented at Bank of Canada conference on financial structure and dynamics, November, Ottawa.
- Grossman, S., and Stiglitz J., (1980). "On the Impossibility of Informationally Efficient Markets", *American Economic Review*, 70, pp. 393-408.
- Hasbrouck, J., and Seppi D., (2001), "Common Factors in Prices, Order Flows, and Liquidity", *Journal of Financial Economics* 59, pp.383-411.
- Ho, T., and Hans S., (1981). "Optimal Dealer Pricing Under Transactions and Return Uncertainty", *Journal of Financial Economics*, 9, pp. 47-73.
- Kamara, A., (1994), "Liquidity, Taxes, and Short-term Treasury Yields," *Journal of Financial and Quantitative Analysis* 29(3), pp.403-417.
- Karpoff, J. M. (1987), "The Relation Between Price Changes and Trading Volume; a Survey", *Journal of Financial and Quantitative Analysis* 22, pp.109-126.
- Krishnamurthy, Arvind (2000), "The Bond/Old-Bond Spread," North-Western University Working Paper.
- Kyle, A., (1985). "Continuous Auctions and Insider Trading", *Econometrica*, 53, pp. 1315-1335.
- Lamoureux, C., and Lastrapes, W., (1990) "Heteroskedasticity in Stock Return Data: Volume Versus GARCH Effects," *Journal of Finance*, 45: pp.221-229.
- Leach, C., Madhavan, A., (1993). "Price Experimentation and Security Market Structure", *Review of Financial Studies*, 6, 375-404.
- Madhavan, A., and Porter, D., (2001). "Should Securities Markets be Transparent?" paper presented at presented at Bank of Canada conference on financial market structure and dynamics, November, Ottawa.
- Nairobi Stock Exchange Handouts on Bonds' Trading and Settlement Rules and Investor Education Prospectuses.
- Pagano, M., and Ernst-Ludwig T., (2004), "The European Bond Markets under EMU," *Oxford Review of Economic Policy* 20(4), pp.531-554.
- Sharpe, W., (1964). "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk", *Journal of Finance*, 19, pp. 425-442.
- Tauchen, G. E., and Pitts M., (1983), "The Price Variability-Volume Relationship on Speculative Markets," *Econometrica*, 51, pp.485-505.
- Vayanos, D., (2004), "Flight to Quality, Flight to Liquidity, and the Pricing of Risk," NBER Working Paper No. W10327.
- Warga, A., (1992), "Bond Return, Liquidity, and Missing Data," *Journal of Financial and Quantitative Analysis* 27, 605-617.

Fig.1 Monthly Liquidity Levels

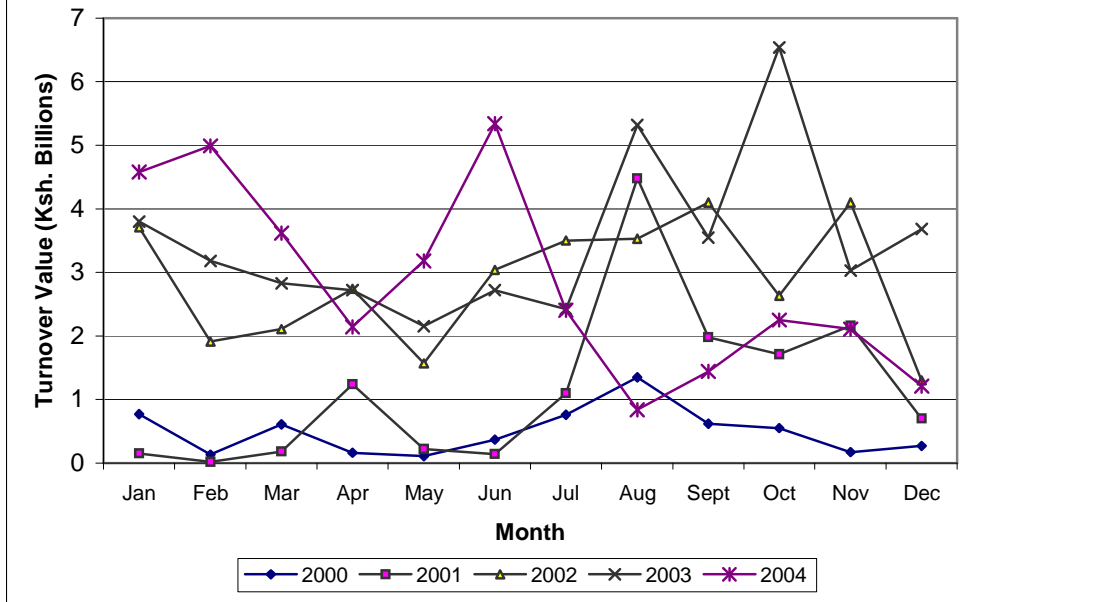
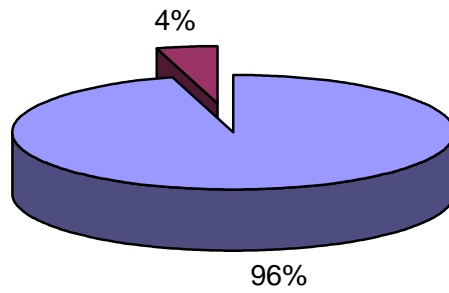


Fig. 2 Total Government and Corporate bond liquidity in Kenya (%)



■ Govt. ■ Corporate

Fig. 3 Relationship between average number of deals, APD and Turnover value across 2000-2005

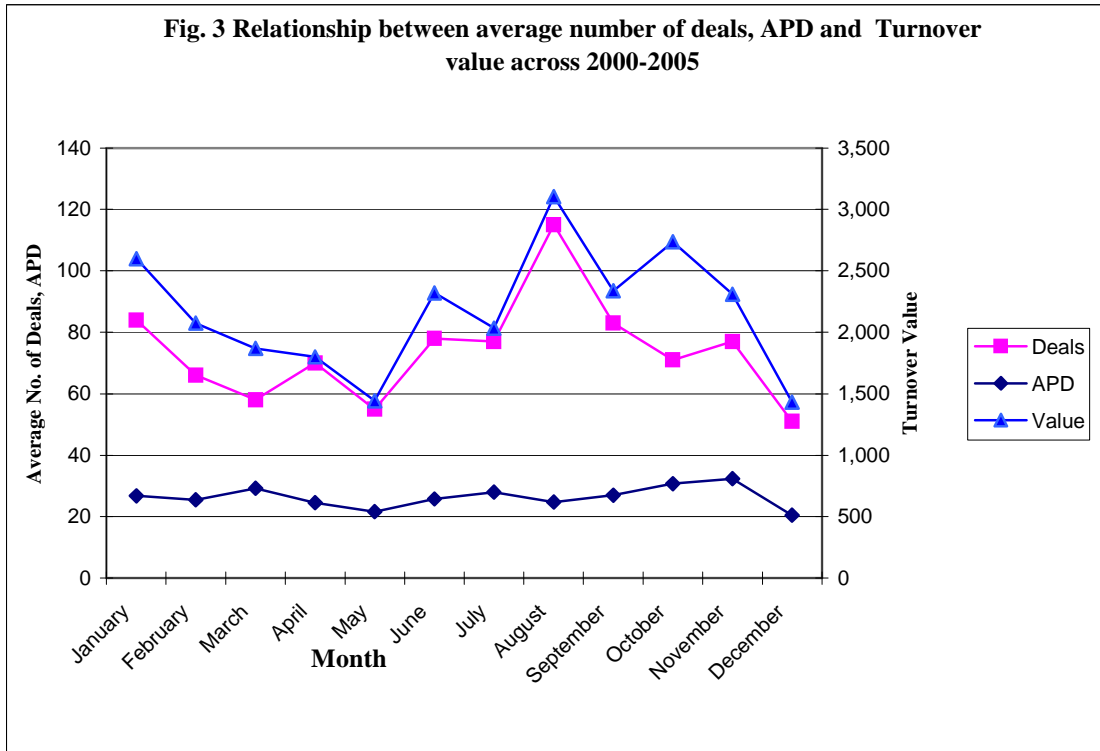


Fig. 4 Average Dispersion as Measured By High,Low and Closing Price Across 2000-2004

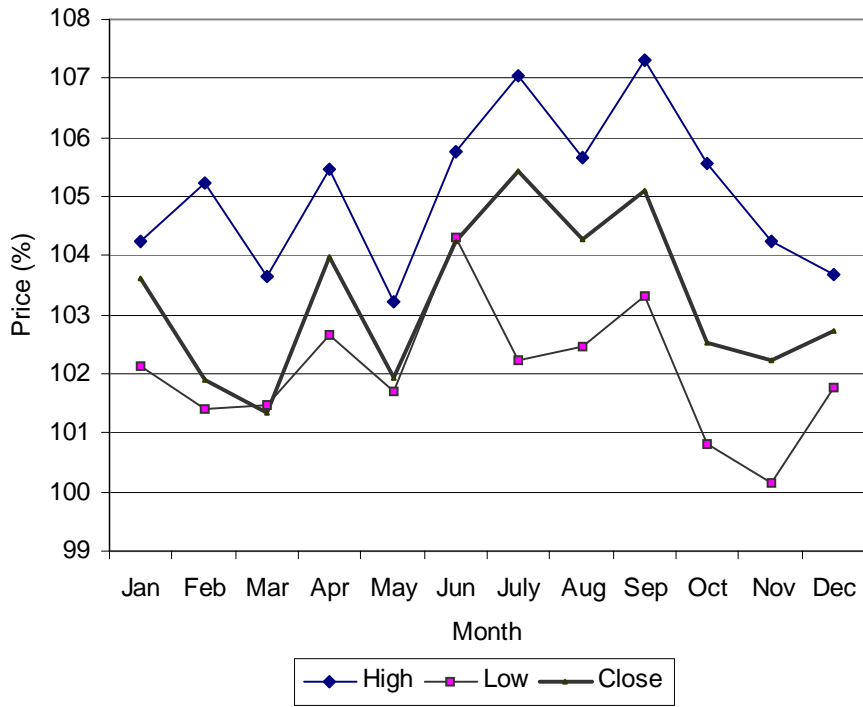


Fig.5 The relationship between the high and low prices and the dispersion

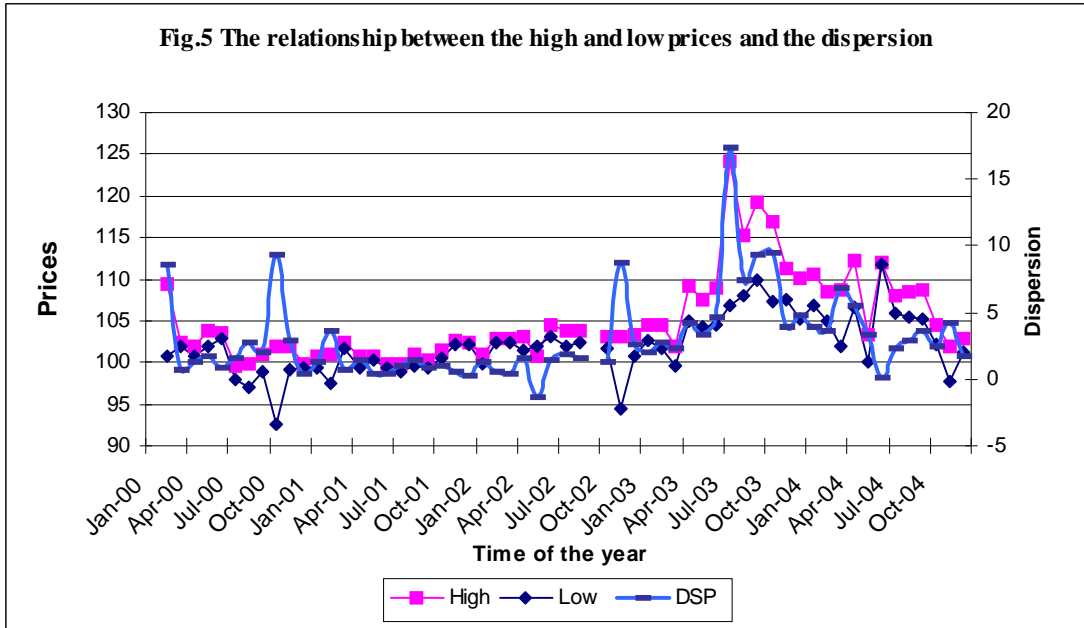


Fig. 6 Volatility for Govt. Bond Returns by Maturity and Across the Years 2000 – 2004.

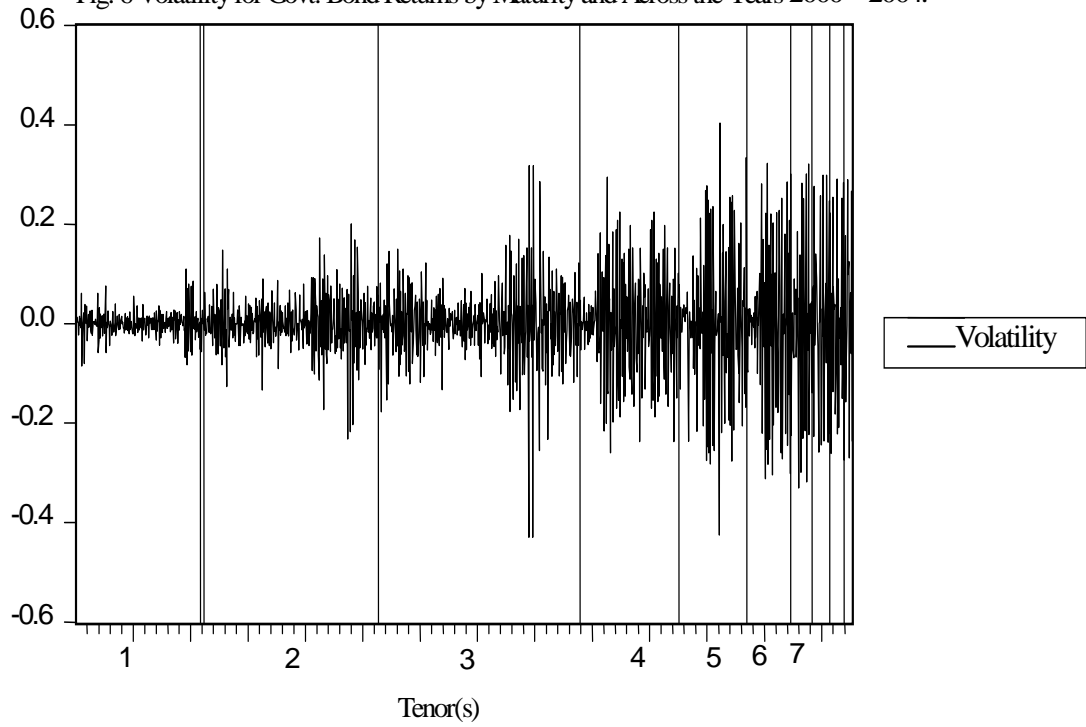


Fig. 7 Magnitude of volatility for Govt. Bond Returns by Maturity for the Years 2000-2004.

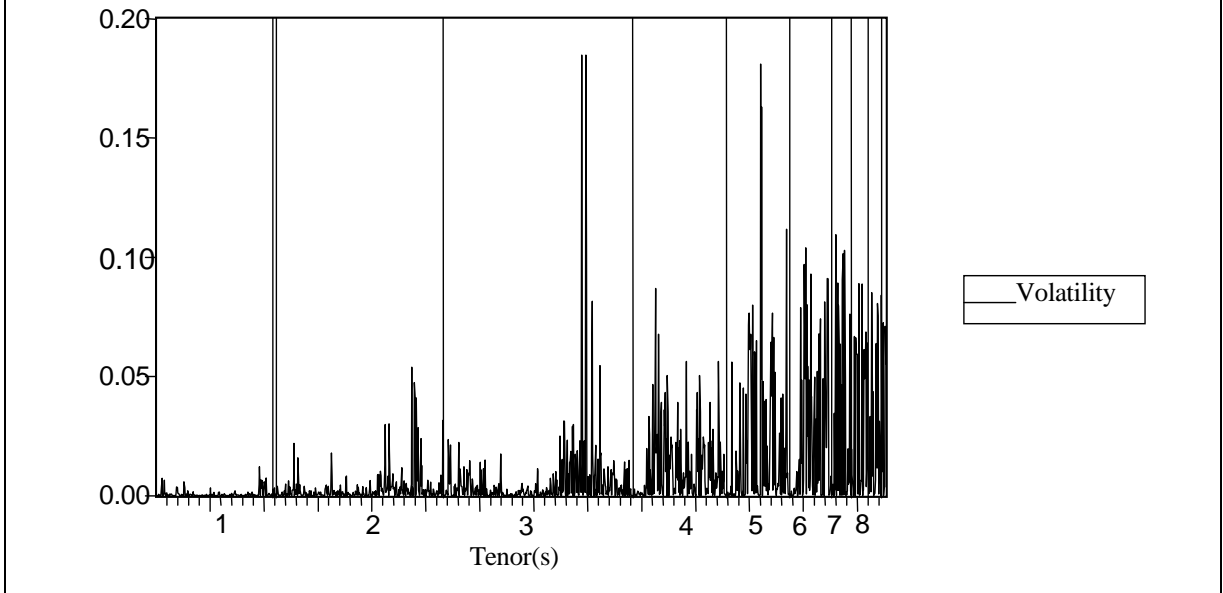
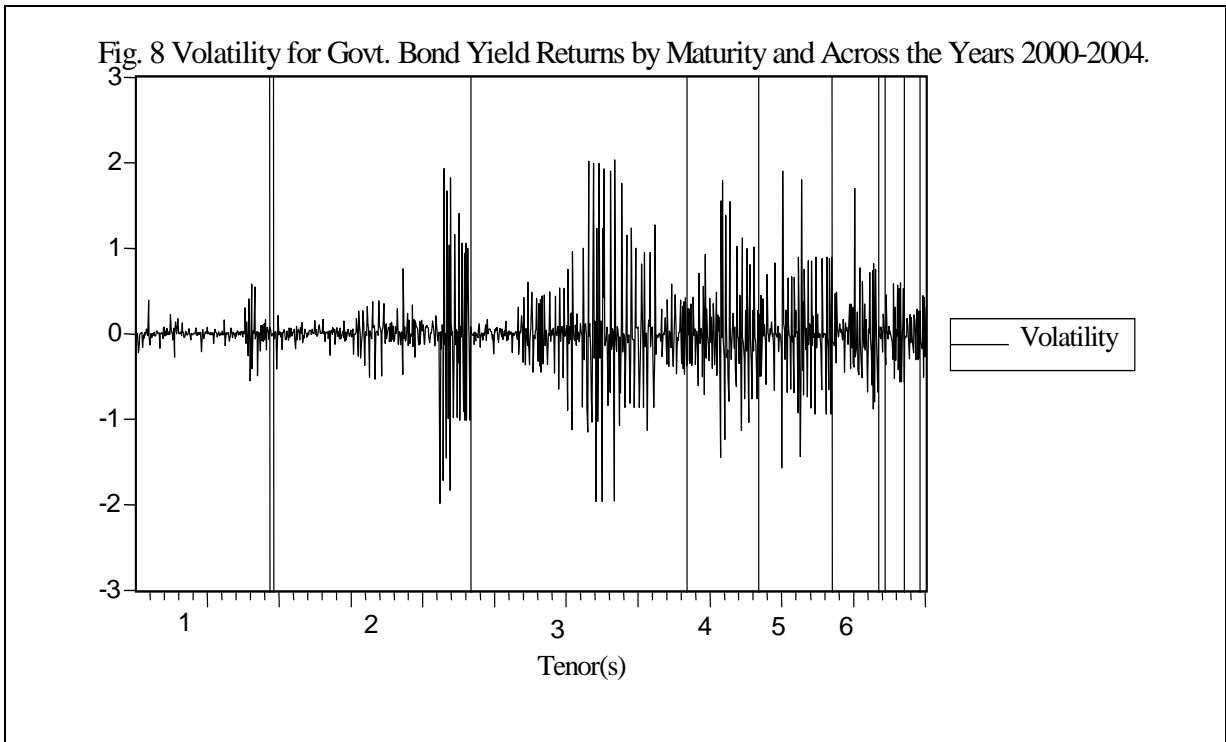


Fig. 8 Volatility for Govt. Bond Yield Returns by Maturity and Across the Years 2000-2004.



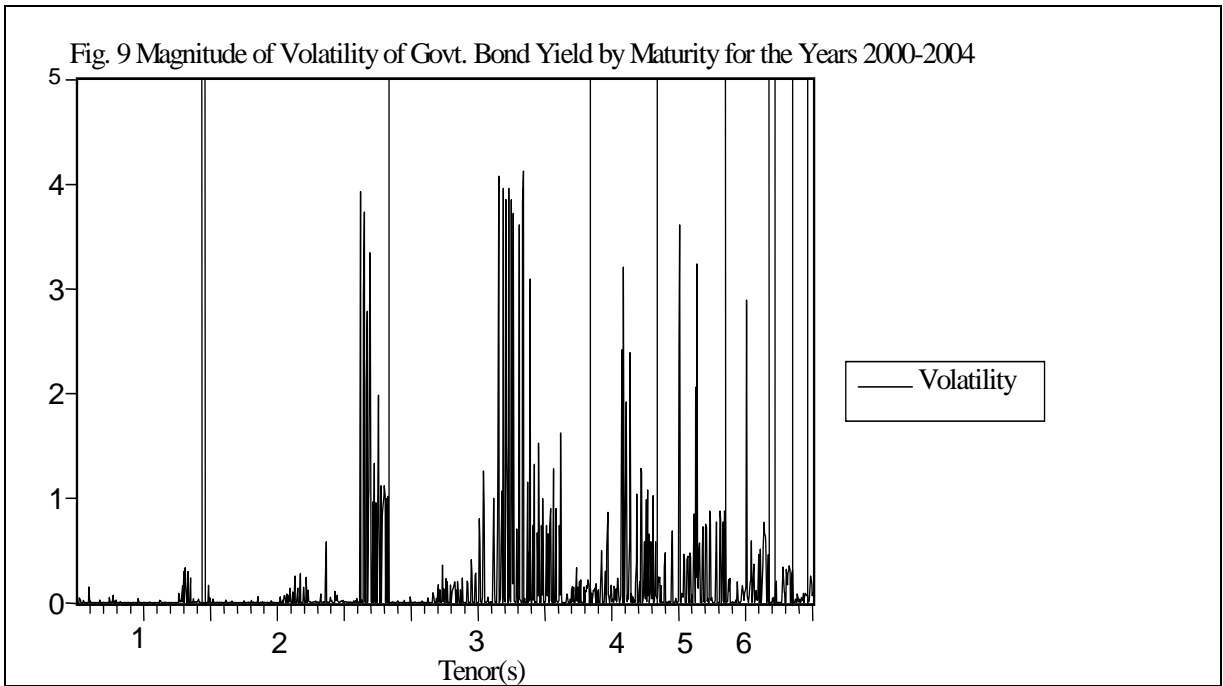


Fig. 10 Direction of volatility for Corporate bond Capital gain /loss by Tenor for Years 2000-2004

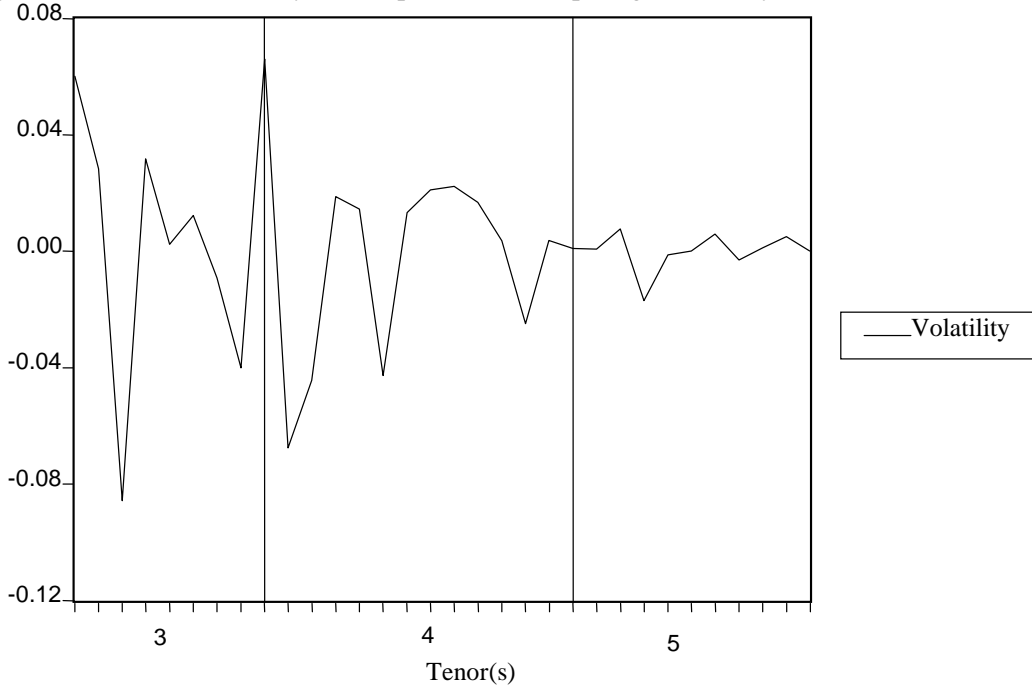


Fig. 11 Magnitude of corporate gain /loss volatility by Tenor for the years 2000-2004

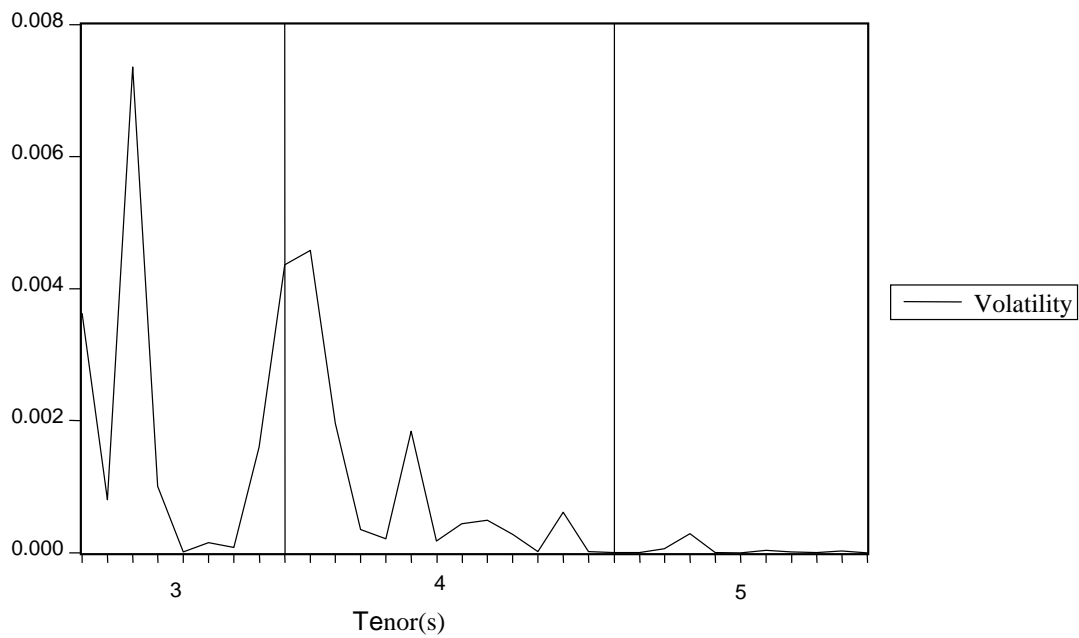
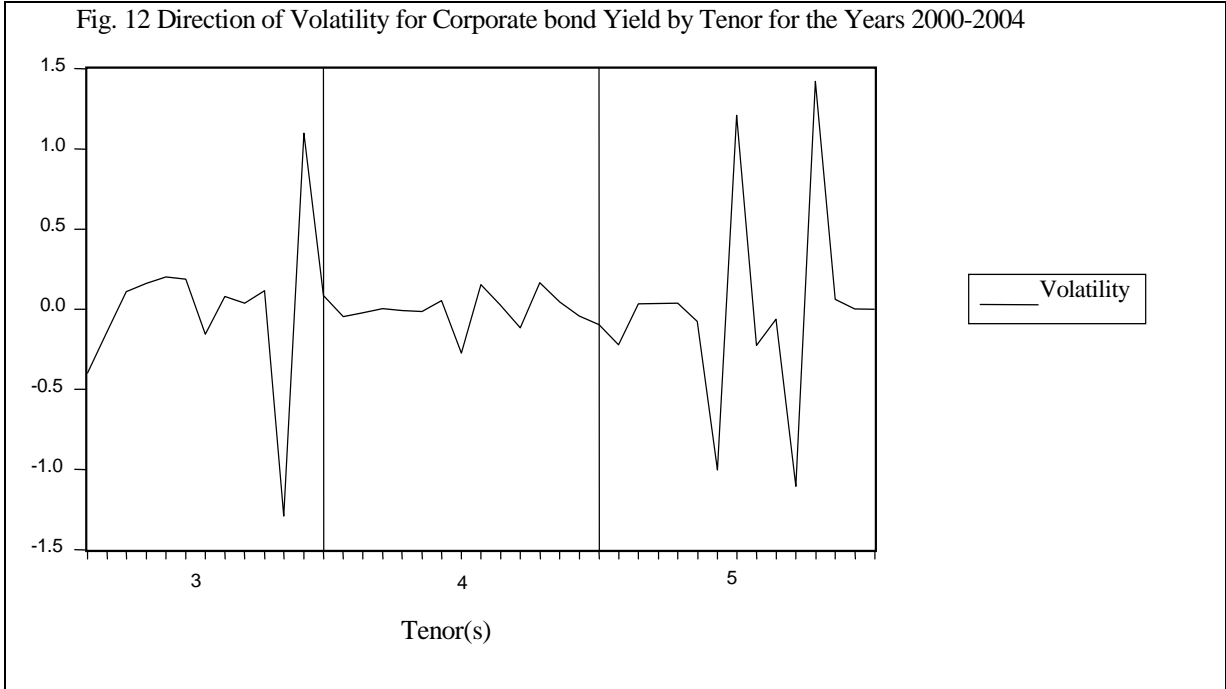


Fig. 12 Direction of Volatility for Corporate bond Yield by Tenor for the Years 2000-2004



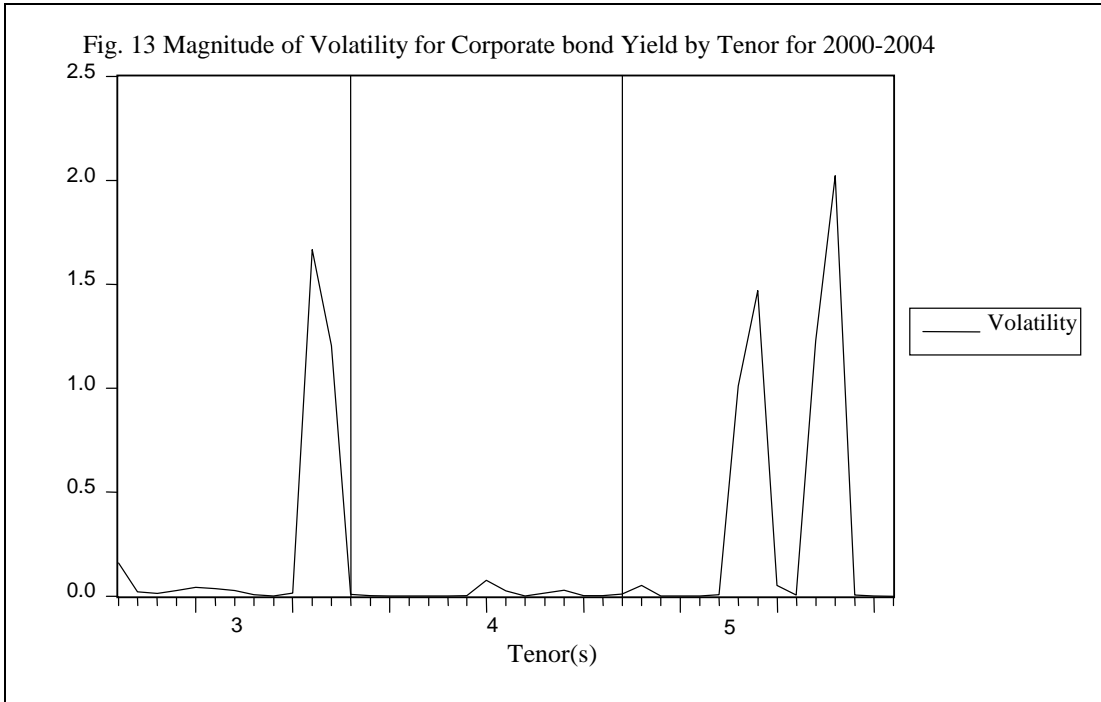


Table 1. The value (in Kshs. billions) of the Kenyan bond market (1996-2003)

Year	1996	1997	1998	1999	2000	2001	2002	2003
Government	0.0	10.6	37.8	28.4	34.1	80.3	130.5	178.4
Corporate	0.82	0.54	0.27	1.05	1.1	6.8	8.55	7.65
Total	0.82	11.14	38.07	29.45	35.2	87.1	139.05	186.05

Source: Nairobi Stock Exchange files.

Table 2. The composition of Treasury bonds in Kenya's total domestic debt (June 2000-June 2004).

	June 2000		June 2001		June 2002		June 2003		June 2004	
	Shs. bn	%	Shs. bn	%	Shs. bn	%	Shs. bn	%	Shs. bn	%
A. Government securities	190.9	92.6	199.3	94.1	226.8	96.1	278.2	96.2	289.5	94.5
<i>Of which, Treasury Bills*</i>	114.1	55.4	116.4	55.0	82.1	34.8	78.7	36.5	62.9	32.6
<i>Treasury bonds</i>	36.9	17.9	44.5	21.0	106.3	45.0	161.5	55.8	188.6	61.6
Government stock	3.0	1.5	1.5	0.7	1.5	0.6	1.1	0.4	1.1	0.4
Non-interest bearing debt	36.9	17.9	36.9	17.4	36.9	15.6	36.9	3.5	36.9	2.4
B. Others**	15.2	7.4	12.5	5.9	9.2	3.9	11.1	3.8	16.7	5.5
Total Domestic Debt (A+B)	206.1	100.0	211.8	100.0	236.0	100.0	289.3	100.0	306.2	100.0

Source: CBK monthly economic reviews, relevant months.

*Excluding Treasury bill REPOs; **Others include; overdrafts, items in transit, commercial banks advances and tax reserve certificates.

Table 3. Outstanding stock of Treasury bonds by holder in Kshs. Billions.

	June 2000		June 2001		June 2002		June 2003		June 2004	
	Shs. bn	%	Shs. bn	%	Shs. bn	%	Shs. bn	%	Shs. bn	%
Banking institutions	9.1	24.7	12.5	28.1	45.8	43.1	74.5	46.1	84.4	44.7
<i>Of which, Central bank</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Commercial banks	9.1	24.7	12.5	28.1	45.8	43.1	74.5	46.1	84.4	44.7
NBFIs	0.5	1.4	0.6	1.3	1.1	1.0	2.1	1.3	2.1	1.1
Insurance companies	0.0	0.0	9.9	22.2	15.6	14.7	21.5	13.3	26.1	13.8
Parastatals	2.4	6.5	2.5	5.6	4.4	4.1	7.3	4.5	16.6	8.8
Building Societies	0.0	0.0	0.1	0.2	1.6	1.5	2.1	1.3	2.7	1.4
Others	25.4	68.8	18.9	42.5	37.9	35.6	54	33.4	56.8	30.1
	36.9	100.0	44.5	100.0	106.4	100.0	161.5	100.0	188.62	100.0

Source: CBK monthly economic reviews, relevant months.

Table 4. Outstanding stock of corporate bonds by holder in (%)

Corporate bondholding as at Dec 31, 2001 in (%)					
Issuer	Banks	Ins. Com.	F/ man.	Inv. Co	Individuals
Shelter Afrique	23.10	15.90	0.00	61.00	0.00
*E.A.D.B	59.60	14.70	0.00	25.20	0.50
*E.A.D.B	19.10	26.40	8.60	44.10	1.80
Safaricom	58.00	4.00	31.00	3.50	0.50
Corporate bondholding as at Dec 31, 2002 in (%)					
Issuer	Banks	Ins. Com.	F/ man.	Inv. Co.	Individuals
Shelter Afrique	19.14	10.86	0.00	70.00	0.00
*E.A.D.B	46.40	6.05	5.00	40.25	2.30
*E.A.D.B	41.17	25.33	0.00	31.58	1.92
Safaricom	43.85	2.80	27.35	25.60	0.40
Corporate bondholding as at Dec 31, 2003 in (%)					
Issuer	Banks	Ins. Com.	F/ man.	Inv. Com.	Individuals
Shelter Afrique	16.50	9.00	74.50	0.00	0.00
E.A.D.B	21.50	11.05	42.95	24.50	0.00
MRM	36.42	3.00	59.95	0.63	0.00
Safaricom	45.48	2.78	51.13	0.25	0.37
Corporate bondholding as at Dec 31, 2004 in (%)					
Issuer	Banks	Ins. Com.	F/ man.	Inv. Com.	Individuals
*E.A.D.B	46.00	11.05	42.95	0.00	0.00
MRM	36.42	3.00	59.95	0.63	0.00
Safaricom	45.48	2.78	50.88	0.50	0.38
*E.A.D.B	36.25	17.50	46.25	0.00	0.00

Source: CMA annual reports and files

* Issued in two tranches, Ins. Com. – Insurance companies, F/man – Fund managers, Inv. Com - Investment companies.

Table 5. The value of Bonds, T/bills and Commercial paper as a % of GDP.

Treasury bonds						
Year	Face Value (Kshs mn.)	Amount Raised (Kshs mn.)	Subscription Level (%)	GDP (Kshs mn.)	Amount Raised as a % of GDP	
1997	15,000	15,000	100.00	623,235	2.40	
1998	29,000	28,519	98.34	694,028	4.10	
1999	29,415	24,716	84.02	743,478	3.32	
2000	47,886	28,583	59.69	799,244	3.58	
2001	78,866	69,795	88.50	878,730	7.94	
2002	85,285	94,098	110.33	962,866	9.77	
2003	95,928	94,535	98.55	1,091,640	8.66	
2004	80,500	66,091	90.41	1,223,226**	5.40	
Total	461,882	421,341	91.22	5,793,221	7.27	
Treasury bills						
Year	Face Value (Kshs mn.)	Amount Raised (Kshs mn.)	Subscription Level (%)	GDP (Kshs mn.)	Amount Raised as a % of GDP	
1997	414,000	357,700	86	623,235	57.59	
1998	351,000	382,216	108.89	694,028	55.07	
1999	396,700	370,892	106.96	743,478	49.89	
2000	415,800	372,160	89.5	799,244	46.56	
2001	432,500	386,332	89.32	878,730	43.96	
2002	298,000	367,466	123.31	962,866	38.16	
2003	246,600	382,181	154.98	1,091,640	35.00	
2004	223,500	258,255	115.55	1,223,226**	21.11	
Total	2,778,100	2,877,202	-	5,793,221	-	
Corporate bonds						
Issuer	Date of Approval	Date of Maturity	Amount Raised (Kshs mn.)	Subscription Level (%)	GDP	Amount Raised as a % of GDP
E.A.D.B	Nov-96	Nov-99	800	100	528,739	0.15
E.A.D.B	Nov-99	Nov-02	1,200	100	743,478	0.16
*Shelter Afrique	Nov-00	Nov-03	150	137.33	799,244	0.018
	Jul-01	Jul-04	200	76.50	878,730	0.022
E.A.D.B	Jun -04	Jul-06	1,500	-	1,223,226	0.12
	Mar-01	Apr-06	2,000	100	878,730	0.22
*MRM	Sep-02	Sep-06	1,000	112	962,866	0.10
*Safaricom	May-01	Sep-05	4,000	100	878,730	0.45
Total approved	-	-	10,850	-	-	-

Commercial paper				
Year	No of issues	Face Value (Kshs. mn)	GDP (Ksh. mn).	As a % of GDP
1997	1	500	623,235	0.08
1998	1	100	694,028	0.01
1999	14	8,650	743,478	1.16
2000	3	400	799,244	0.05
2001	2	700	878,730	0.07
2002	1	1,000	962,866	0.10
2003	1	200	1,091,640	0.018
2004	2	300	1,223,226**	0.024
Total	25	11,850	5,793,221	-

Source: T/bond, C/bond, Commercial paper figures from CMA reports and files; T/bill figures from CBK periodical reviews, GDP values are in nominal figures, * means issued in two tranches, ** means provisional.

Source: CMA annual reports and files

Table 6. Summary Statistics of Observations influencing Liquidity

	Mean	Median	Max	Min	Std. Dev.	Skew	Kurtosis	J-B	Prob.
Prices and yields									
Corporate Bonds									
Bond Price	102.33	101.74	109.2	99.08	2.27	0.88	3.66	5.07	0.08
Capital gain/loss	-0.0022	7.66E-05	0.0589	-0.088	0.031	-0.804	4.22	5.76	0.00
Current yield	10.61	10.66	19.58	2.97	2.65	0.48	6.62	19.91	0.00
Treasury Bonds									
Bond Price	104.75	102.3	148.5	65	9.13	1.61	7.15	1,451.6	0.00
Capital gain/loss	-0.0004	0.0002	0.4	-0.43	0.09	-0.14	6.5	644.81	0.00
Current yield	11.09	11.78	19	1.47	2.94	-1.12	4.39	320.85	0.00
Liquidity measures									
C/bonds turnover	55.52	21	381	0.000077	86.1	2.28	7.67	80.23	0.00
T/ bonds turnover	91.65	10.98	1,800	0.005	170	3.36	19.38	16,686	0.00
Deals*	73.00	71.00	172.00	18.00	36.72	0.35	2.44	1.61	0.37
Value per deal*	26.38	30.15	55.60	0.01	15.05	0.01	2.14	1.84	0.40
Capital gain/loss volatility									
Corporate bonds									
Standard deviation	5.88E-11	0.003	0.066	-0.088	0.031	-0.71	4.30	5.23	0.073
Variance	0.0009	0.0002	0.0073	0.00	0.0017	2.33	7.95	61.65	0.00
Treasury bonds									
Standard deviation	-7.99E-05	0.0004	0.4	-0.429	0.095	-0.12	6.49	643.24	0.00
Variance	0.009	0.0093	0.1847	5.28E-10	0.021	3.75	21	19,893.9	0.00
Current yield volatility									
Corporate bonds									
Std deviation	2.44E-11	0.00498	1.421	-1.29	0.479	0.312	6.29	19.17	0.00
Variance	0.225	0.009	2.02	0.00	0.52	2.26	6.65	57.58	0.00
Treasury bonds									
Std deviation	1.93E-05	0.003	2.213	-1.999	0.442	0.576	9.91	2210.5	0.00
Variance	0.195	0.0056	4.528	6.30E-08	0.583	4.68	27.11	30,170	0.00

Note: The bonds' traded value is in terms of Millions of Kenya Shillings, *Total number of deals struck and average value per deal is for both Corporate and Treasury bonds combined.

Table 7. Total bond traded values (Kshs. Millions) across maturities

	2000	2001	2002	2003	2004	Total for the period
Corporate bonds in Kshs Millions						
3-year	173.37	71.00	30.25	33.2	0.50	308.32
4-year		708.30	770.90	5.5		1,484.7
5-year		20.00	612.20	65.2	2.91	700.31
7-year					11.00	11.00
Treasury bonds in Kshs Millions						
1-year	1,900	5,400	6,780	1,160	400	15,640
1.5-year		0.2	848	5.2		853.4
2-year	2,300	4,130	7,050	13,410	6,870	29,630
3-year	1,030	3,080	7,450	12,880	6,140	30,570
4-year			1,470	2,740	4,960	9,170
5-year		3	477	3,820	6,320	10,620
6-year		800	158	3,670	2,260	6,888
7-year				1,070	2,530	3,600
8-year				2,170	1,500	3,670
9-year				670	1,500	2,170
10-year				1,200		1,200

Source: CBK and CMA bond market reviews

Table 8. Average Value Per Deal of Bonds in Kenya in Kshs. Millions (2000-2004)

Month	2000			2001			2002			2003			Value	Deals	APD
	Value	Deals	APD	Value	Deals	APD	Value	Deals	APD	Value	Deals	APD			
January	770	85	9.06	140	27	5.52	3,710	112	33.1	3,800	98	38.8	4,580	97	47.2
February	130	62	2.09	150	28	0.54	1,920	48	39.9	3,180	93	34.2	4,990	99	50.4
March	610	33	18.5	180	28	6.46	2,110	41	51.6	2,830	76	37.2	3,620	112	32.3
April	160	22	7.27	1,240	84	14.8	2,740	57	48.1	2,720	91	29.9	2,140	95	22.5
May	110	38	2.89	210	18	12	1,560	52	30.1	2,150	71	30.2	3,180	97	32.7
June	370	21	17.62	130	28	4.96	3,040	60	50.6	2,720	111	24.5	5,340	172	31
July	750	83	9.04	1,100	60	18.4	3,500	63	55.6	2,420	111	21.8	2,400	68	35.2
August	1,350	93	14.5	4,480	136	32.9	3,530	116	30.5	5,320	149	35.7	840	82	10.3
September	620	39	16	1,980	63	31.4	4,100	123	33.3	3,550	88	40.3	1,440	102	14.1
October	550	30	15.9	1,710	54	31.6	2,630	100	26.3	6,540	128	51.1	2,250	41	29
November	170	35	4.86	2,160	71	30.5	4,080	130	31.3	3,030	76	39.9	2,110	72	55
December	270	25	10.08	700	20	35	1,300	51	25.5	3,680	120	31.7	1,210	39	0.01
Average	488	47	10.65	1,181	51	18.67	2,851	79	37.99	3,495	101	34.60	2,842	90	29.97
Total	5,860	566	10.35	14,180	617	23	34,220	953	36	41,940	1,212	35	34,100	1,076	32

Value – Refers to the Bond turnover value in millions of Kenya Shillings; APD – Average value Per Deal in millions of Kenya Shillings.

Source: Computed from NSE monthly bulletins and Stock market files.

Table 9. Average Price, Current Yield and Return for Government and Corporate bonds.

	2000			2001			2002			2003			2004		
Tenor	P00	Y00	R00	P01	Y01	R01	P02	Y02	R02	P03	Y03	R03	P04	Y04	R04
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Corporate Bonds															
3	103.7	12.90	.0058	104.9	11.5	-0.011	101.2	11.35	-0.0424	102.07	5.6	0.0178	103.37	2.25	
4				100.8	12.12	-0.0223	102.65	9.27	-0.0024	100.26	2.22				
5				100.4	12.92	0.025	100.65	9.18	-0.0029	100.57	5.8	-0.00067	100.30	8.76	2.03E-03
7													100.64	7.50	0.007
Treasury bonds															
1	101.3	12.0	-0.0005	100.6	12.7		102.6	10.9	0.0007	101.6	11.3	0.0001	98.5	3.8	0.0041
1.5				102.0	11.3		102.9	14.2		105.0	13.8				
2	101.3	12.1	-0.0002	103.2	13.0	0.0006	103.3	11.3	-0.0003	104.0	11.6	-0.000235	101.5	8.2	0.0001
3	101.3	11.5	-0.0001	99.3	13.2	0.0006	102.1	10.9	0.0002	105.7	10.0	-0.0000	101.7	10.0	-0.0001
4							102.5	11.1	0.0033	106.5	10.7	-0.0009	105.2	13.0	-0.0030
5							100.3	11.4	-0.0201	111.9	11.4	0.0052	109.6	11.2	0.0011
6				101.9	11.8		102.0	10.6	-0.0005	116.6	11.4	-0.0030	108.7	10.2	-0.0072
7										115.0	12.0	-0.0099	103.5	10.19	-0.0152
8										118.4	10.9	-0.0041	108.9	8.7	0.0036
9										123.8	10.3	-0.0287	110.6	10.9	
10										115.5	10.4	-0.0127			

Note: In a case of a mean price and average yield reporting with no corresponding return, it means there was only one observation for that tenor and return could therefore not be calculated.

Table 10. Number of Days of Trading for Kenya's Corporate and Government Bonds (2000-2004)

	2000			2001			2002			2003			2004		
	Days Traded		Ideal Total	Days Traded		Ideal Total	Days Traded		Ideal Total	Days Traded		Ideal Total	Days Traded		Ideal Total
	T.B	C.B		T.B.	C.B		T.B	C.B		T.B	C.B		T.B	C.B	
January	18	2	21	10	0	23	18	3	22	20	1	21	19	1	22
February	13	1	21	11	0	20	18	3	20	19	2	20	18	0	20
March	14	0	23	8	0	22	15	1	20	19	0	20	21	0	23
April	13	0	18	12	0	19	19	3	21	20	1	21	19	0	20
May	16	0	22	9	3	19	17	1	23	20	1	21	20	0	21
June	15	1	18	9	0	21	17	1	20	19	0	21	19	0	22
July	15	1	21	15	0	22	16	4	23	19	0	23	21	1	22
August	19	0	23	16	0	23	17	2	22	20	1	21	20	1	22
September	11	0	21	14	1	20	21	3	21	20	0	22	21	1	22
October	10	1	20	15	5	22	20	2	22	21	0	22	15	0	21
November	16	0	20	21	5	22	19	3	21	18	0	19	19	0	21
December	7	1	17	7	2	18	13	1	18	19	1	20	13	1	23
Total	167	7	245	147	16	251	210	25	253	234	6	251	225	5	259
Day 2 (%)	68.2	2.0		58.6	6.4		83.0	9.9		93.2	2.4		86.9	1.2	
% of Total	96	4		90	10		89	11		97	3		98	2	

C.B – Corporate bonds; T.B – Treasury bonds

Table 11(a). The average Close/High price dispersion for 2000-2004

	2000			2001			2002			2003			2004		
	High %	Close %	DSP %	High %	Close %	DSP %	High %	Close %	DSP %	High %	Close %	DSP %	High %	Close %	DSP %
Jan	104.23	103.62	0.61	100.77	100.76	0.01	100.97	100.54	0.43	104.55	104.16	0.39	110.66	109.03	1.63
Feb	109.33	97.09	12.24	101.00	100.73	0.27	102.96	100.90	2.06	104.48	104.32	0.16	108.45	106.44	2.01
Mar	102.51	98.26	4.25	102.34	100.63	1.71	102.84	101.01	1.83	101.86	101.11	0.75	108.66	105.67	2.99
Apr	101.91	101.9	0.01	100.85	100.44	0.41	103.13	101.03	2.1	109.15	107.27	1.88	112.21	109.31	2.9
May	103.74	102.5	1.24	100.67	99.99	0.68	100.67	99.99	0.68	107.57	105.83	1.74	103.39	101.3	2.09
Jun	103.65	102.72	0.93	99.77	99.88	-0.1	104.5	101.49	3.01	109.05	107.38	1.67	111.9	109.79	2.11
Jul	99.57	98.6	0.97	99.74	99.71	0.03	103.74	101.55	2.19	124.09	121.47	2.62	108.07	105.81	2.26
Aug	99.76	99.21	0.55	100.95	99.77	1.18	103.9	101.83	2.07	115.36	113.35	2.01	108.39	107.28	1.11
Sep	100.95	101.29	-0.34	100.25	99.72	0.53	104.05	102.17	1.88	119.3	112.97	6.33	108.76	106.47	2.29
Oct	101.85	100.39	1.46	101.51	99.98	1.53	103.08	101.89	1.19	116.8	112.1	4.7	104.5	98.28	6.22
Nov	101.96	99.07	2.89	102.68	100.62	2.06	103.2	102.19	1.01	111.3	109.13	2.17	101.99	100.2	1.79
Dec	99.83	100.91	-1.08	102.33	100.81	1.52	103.32	102.31	1.01	110.07	107.89	2.18	102.88	101.67	1.21
Mean			1.98			0.82			1.62			2.22			2.38

DSP – The Highest price-Closing price dispersion

Table 11(b). The average Close/Low price dispersion for 2000-2004

	2000			2001			2002			2003			2004		
	Close %	Low %	DSP %	Close %	Low %	DSP %	Close %	Low %	DSP %	Close %	Low %	DSP %	Close %	Low %	DSP %
Jan	103.62	102.12	1.5	100.76	99.45	1.31	100.54	99.73	0.81	104.16	102.54	1.62	109.03	106.78	2.25
Feb	97.09	100.69	-3.6	100.73	97.41	3.32	100.90	102.41	-1.51	104.32	101.74	2.58	106.44	104.86	1.58
Mar	98.26	101.85	-3.59	100.63	101.62	-0.99	101.01	102.47	-1.46	101.11	99.62	1.49	105.67	101.87	3.8
Apr	101.9	100.66	1.24	100.44	99.42	1.02	101.03	101.52	-0.49	107.27	104.97	2.3	109.31	106.65	2.66
May	102.5	101.97	0.53	99.99	100.22	-0.23	99.99	101.97	-1.98	105.83	104.29	1.54	101.3	100.01	1.29
Jun	102.72	102.84	-0.12	99.88	99.42	0.46	101.49	103.13	-1.64	107.38	104.47	2.91	109.79	111.73	-1.94
Jul	98.6	98.00	0.6	99.71	98.79	0.92	101.55	101.82	-0.27	121.47	106.73	14.74	105.81	105.81	0
Aug	99.21	97.03	2.18	99.77	99.58	0.19	101.83	102.30	-0.47	113.35	107.96	5.39	107.28	105.45	1.83
Sep	101.29	98.89	2.4	99.72	99.36	0.36	102.37	102.17	0.20	112.97	109.93	3.04	106.47	105.11	1.36
Oct	100.39	92.49	7.9	99.98	100.49	-0.51	101.89	101.74	0.15	112.1	107.30	4.8	98.28	102.11	-3.83
Nov	99.07	99.07	0	100.62	102.08	-1.46	102.19	94.47	7.72	109.13	107.44	1.69	100.2	97.77	2.43
Dec	100.91	99.40	1.51	100.81	102.07	-1.26	102.31	100.78	1.53	107.89	105.30	2.59	101.67	101.22	0.45
Mean			0.87			0.26			0.21			3.72			0.99

Table 12. The average High/Low price dispersion for Treasury bonds 2000-2004

	2000			2001			2002			2003			2004		
	High %	Low %	DSP %	High %	Low %	DSP %	High %	Low %	DSP %	High %	Low %	DSP %	High %	Low %	DSP %
Jan	104.23	102.12	2.11	100.77	99.45	1.32	100.97	99.73	1.24	104.55	102.54	2.01	110.66	106.78	3.88
Feb	109.33	100.69	8.64	101	97.41	3.59	102.96	102.41	0.55	104.48	101.74	2.74	108.45	104.86	3.59
Mar	102.51	101.85	0.66	102.34	101.62	0.72	102.84	102.47	0.37	101.86	99.62	2.24	108.66	101.87	6.79
Apr	101.91	100.66	1.25	100.85	99.42	1.43	103.13	101.52	1.61	109.15	104.97	4.18	112.21	106.65	5.56
May	103.74	101.97	1.77	100.67	100.22	0.45	100.67	101.97	-1.3	107.57	104.29	3.28	103.39	100.01	3.38
Jun	103.65	102.84	0.81	99.77	99.42	0.35	104.5	103.13	1.37	109.05	104.47	4.58	111.9	111.73	0.17
Jul	99.57	98.00	1.57	99.74	98.79	0.95	103.74	101.82	1.92	124.09	106.73	17.36	108.07	105.81	2.26
Aug	99.76	97.03	2.73	100.95	99.58	1.37	103.9	102.30	1.6	115.36	107.96	7.4	108.39	105.45	2.94
Sep	100.95	98.89	2.06	100.25	99.36	0.89	104.05	102.37	1.68	119.3	109.93	9.37	108.76	105.11	3.65
Oct	101.85	92.49	9.36	101.51	100.49	1.02	103.08	101.74	1.34	116.8	107.30	9.5	104.5	102.11	2.39
Nov	101.96	99.07	2.89	102.68	102.08	0.6	103.2	94.47	8.73	111.3	107.44	3.86	101.99	97.77	4.22
Dec	99.83	99.40	0.43	102.33	102.07	0.26	103.32	100.78	2.54	110.07	105.30	4.77	102.88	101.22	1.66
Mean			2.85			1.08			1.80			5.94			3.37