THE EMERGING INDIAN BOND MARKET: A FIRST GLIMPSE

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Abstract

During the 1990s, as the Indian government and the Reserve Bank of India brought an end to financial repression, the Indian bond market faced the prospect of blossoming into an efficient market. Indeed, data pertaining to the September, 1995-October, 1999 period suggests that there was a significant improvement in both the depth and width of the secondary market for dated government securities. Importantly, there is some indication that, with increasing macroeconomic stabilisation, market participants are able to form reasonable expectations about future short rates, and are therefore more willing to transact in long-term bonds. However, a closer examination of the data suggests that problems persist with the microstructure of the secondary market for bonds, such that pricing anomalies continue to make their presence felt. The paper concludes that the salvation of the secondary market for bonds perhaps lie in the amelioration of informational asymmetry and liberalisation of the domestic insurance sector and pension funds.

JEL classification: G14, O16, P52.
Non-Technical Summary

The importance of the debt market in an emerging economy cannot be overemphasised. In the presence of uncertainty and prudential norms, banks often decline to lend for long term projects, and borrowing from overseas markets may be constrained by country risk perceptions and restrictions on capital mobility. At the same time, businesses in these countries are often closely held within families and communities, and the fear of loss of power often keep such companies away from the primary market for equities. In such cases, the market for debt securities may emerge as the mainstay of the credit and capital markets. Even in a fairly well developed emerging financial market like that in India, only INR 58.92 billion, INR 36.78 billion and INR 98.55 billion respectively were raised by way of equity shares during 1997-98, 1998-99 and 1999-2000. On the other hand, the amounts raised through non-convertible debentures during the corresponding years were INR 265.39 billion, INR 286.98 billion and INR 363.93 billion.

Besides, the debt market allows appropriate evaluation of non-systematic risk, and dissemination of the perception of the investors about firm specific risk by way of the spreads that the corporate bonds command over the benchmark rates. Finally, the debt market helps generate the (zero coupon) yield curve which reflects the expectations of the investors about future interest rates, and thereby becomes an invaluable analytical tool for both monetary authorities and investors in instruments like financial derivatives.

Recent research on the bond market has focussed primarily on the term structure of interest rate. For example, attempts have been made to bridge the gap between stylised models like those by Cox, Ingersoll and Ross, and Heath, Jarrow and Morton. Others have used non-parametric techniques to estimate the term structures of specific countries and specific types of securities. And yet others have explored the covariance between the prices of futures contracts and the cost-of-carry relationship that is determined by the underlying interest rates.

However, analyses of the structure of the emerging debt markets are few and far between. Indeed, the literature on the impact of market structures on the price discovery mechanism and market efficiency has largely been limited to the equity market, with special emphasis on the market for limit orders. But it is safe to hypothesise a priori that market structures have a definitive impact on the price discovery process in the debt markets, and hence on their efficiency. The endeavour of this paper was twofold: it would trace the evolution of the Indian bond market, and draw conclusions about the nature of the market itself from the available data. Given that the market for dated government securities is much deeper and wider than
the market for corporate bonds, the empirical analysis will be restricted to the data available from the
market for dated securities.

The data indicates that the following conclusions can be drawn about the Indian bond market:
The market for government bonds in India has matured significantly during the 1990s, adding to both
width and depth. However, the market remains illiquid, with not more than 20 percent of the outstanding
securities traded on a given day even in the more liquid government bond segment of the market. Indeed,
an average government bond is often not traded for weeks or even months. Government bonds are traded
heavily immediately after they are introduced into the market. Thereafter, these bonds are rarely traded till
their time-to-maturity decline to the point where they become \textit{de facto} money market instruments. The
initial trading activity can be attributed to the process of price searching and duration matching by banks,
mutual funds and insurance companies, while the lack of trading thereafter may be the manifestation of
the inability of the market to formulate accurate expectations about long term interest rates.

Even though the Wholesale Debt Market at the National Stock Exchange facilitates on-screen trading,
most transactions are still over-the-counter in nature, and are often not reported to the NSE and/or the
Reserve Bank of India on the same day. Hence, there is a persistent informational asymmetry which
lingers despite the emergence of additional informational sources like Reuters and Bloomberg terminals.

The informational problem in the market leads to pricing anomalies, and the law of one price that is the
hallmark of a perfect market is conspicuous by its absence. Given any arbitrarily small time period, the
variation among the prices of the same bond, or bonds of similar characteristics and time-to-maturity is
usually significant.

The study, though pioneering in nature, suffers from the shortcoming that some of the arguments have not
been adequately backed up by data. This is, in part, the consequence of a conscious attempt to reduce the
time taken for analysis, given that market structures in a country like India, which is in transition, can
change fast, thereby rendering carefully done analysis anachronistic. Hence, stylized facts like the
dominance of large traders like Unit Trust of India in the bond market has not been substantiated with
data. The analysis also manifests the fragmented nature of data of the Indian bond market which makes
statistical and econometric analysis difficult if not impossible. The challenge in the future would,
therefore, be to rigorously evaluate the hypotheses that have been explicitly and implicitly generated by
the above analysis, as the depth and width of the bond market increase over time.
Introduction

The importance of the debt market in an emerging economy cannot be overemphasised. In the presence of uncertainty and prudential norms, banks often decline to lend for long term projects, and borrowing from overseas markets may be constrained by country risk perceptions and restrictions on capital mobility. At the same time, businesses in these countries are often closely held within families and communities, and the fear of loss of power often keep such companies away from the primary market for equities. In such cases, the market for debt securities may emerge as the mainstay of the credit and capital markets. Even in a fairly well developed emerging financial market like that in India, only INR 58.92 billion, INR 36.78 billion and INR 98.55 billion respectively were raised by way of equity shares during 1997-98, 1998-99 and 1999-2000. The amounts raised through non-convertible debentures during the corresponding years were INR 265.39 billion, INR 286.98 billion and INR 363.93 billion.

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Recent research on the bond market has focussed primarily on the term structure of interest rate.\(^1\) For example, attempts have been made to bridge the gap between stylised models like those by Cox, Ingersoll and Ross, and Heath, Jarrow and Morton. Others have used non-parametric techniques to estimate the term structures of specific countries (Jiang, 1998) and specific types of securities (Briys and de Varenne, 1997; Duffie and Singleton, 1999). And yet others have explored the covariance between the prices of futures contracts and the cost-of-carry relationship that is determined by the underlying interest rates (de Roon, Nijman and Veld, 1998).

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\(^1\) See, for example, de Jong and Santa-Clara (1999), Pritsker (1998), Inui and Kijima (1998), and Conley et al. (1997).
However, analyses of the structure of the debt market are few and far between.\(^2\) Indeed, the literature on the impact of market structures on the price discovery mechanism and market efficiency has largely been limited to the equity market, with special emphasis on the market for limit orders. But it is safe to hypothesise \textit{a priori} that market structures have a definitive impact on the price discovery process in the debt markets, and hence on their efficiency. The endeavour of this paper would be twofold: it would trace the evolution of the Indian bond market, and draw conclusions about the nature of the market itself from the available data. Given that the market for dated government securities is much deeper and wider than the market for corporate bonds, the empirical analysis will be restricted to the data available from the market for dated securities. As we shall see later, the data indicates that while the market for government bonds in India has matured significantly during the 1990s, the structure of the market still fosters illiquidity and, as a consequence, perverse pricing of government securities.

The paper has been structured as follows. In the second section of the paper, we trace the evolution of the Indian market for government securities. Some preliminary observations about the market are presented in the following section, using data made available by the Reserve Bank of India (RBI). The fourth section takes a closer look at the bond market, and highlights certain peculiarities in the behaviour of the market participants that can explain pricing anomalies. Finally, section five sums up the findings of this paper, and explores policy options that can make the market more liquid and the pricing process less perverse.

\textbf{The Market for Government Securities}

The most pervasive feature of the Indian bond market is that while a large number of financial institutions, banks and corporate entities issue bonds on a regular basis, trading in the secondary market is overwhelmingly dominated by government securities. Indeed, the fraction of the turnover in the secondary market that is accounted for by treasury bills (T-bills) and dated government securities\(^3\) increased from 90.6 per cent in 1996-97 to 96.5 per cent during the first three quarters of 1999-2000.\(^4\) The corresponding

\(^2\) The only significant studies that we came across was published by the World Bank and the IFC in 1995 and 2000 respectively [see World Bank (1995), Leonardo (2000) and Thorat (2000)]. But these studies restricted themselves to overview and analysis of policies, and they did not attempt to quantify the pricing anomalies that manifest the imperfection of the market microstructure.

\(^3\) Dated government securities are medium to long term bonds with maturity of one year or more, i.e., when issued they are not money market instruments. Such securities largely take the form of plain vanilla coupon bonds, but of late zero coupon bonds and floating rate bonds have also made their appearance.

\(^4\) Note that the financial year in India stretches from April of a year to March of the following year.
increase in the share of the latter was from 64.7 per cent to 93.1 per cent.\textsuperscript{5} Hence, as mentioned above, we shall focus on the structure of the market for dated government securities.

Prior to April 1993, the prices/yields of government securities were not market driven. The government fixed the yields (and coupons) at low levels in the primary market, so as to reduce its cost of borrowing. As a consequence, banks had little incentive to purchase government securities, and hence the statutory liquidity ratio (SLR) was continually raised during the 1970s and 1980s. Since banks purchased government securities largely (if not wholly) to meet their SLR requirements, transactions in the secondary market were few and infrequent. Further, the secondary market remained an over-the-counter (OTC) market with scheduled commercial banks as the main market participants. Hence, there were significant barriers to dissemination of information about prices and yields in the secondary market, and it was marked by absence of market makers. The resultant informational problems, and the ability of large buyers and sellers to influence prices added to the unattractiveness of trading in the secondary market for government securities.

The years 1994 and 1995 were marked by developments that are likely to shape the future of India’s debt market. In June, 1994, the wholesale debt market (WDM) of the National Stock Exchange (NSE) commenced operation with 224 securities carrying an outstanding debt value of INR 135 billion\textsuperscript{6}. The WDM provides a fully automated screen-based trading platform that is order driven. It matches best buy and sell orders on a price-time priority, while maintaining complete anonymity. Though most market participants have not graduated to this trading mechanism and prefer the OTC platform, OTC trades are usually reported to the WDM segment and this helps disseminate data on intra-day prices and traded quantities.

The initiative taken by the NSE found official support in March, 1995 when the government and the RBI oversaw the emergence of primary dealers. The emergence of primary dealers (PDs)\textsuperscript{7} coincided with auction-based sale of government securities in the primary market, replacing the earlier system whereby government securities were wholly underwritten by the RBI at some pre-determined price-yield. More

\textsuperscript{5} This shift from T-bills to dated securities is itself a \textit{prima facie} evidence about the maturity of the bond market, as the market participants show less reluctance to trade in longer term bonds that are associated with inflation, interest rate and liquidity risk.

\textsuperscript{6} The growth of the WDM has been phenomenal. By the end of 1999, the number of securities listed and permitted to trade on the WDM increased to 1,306, while the average number of trades per day increased from 5 in 1994-95 to 140 in 1999-2000. In rupee terms, the net monthly traded value in the WDM segment increased from INR 10.96 billion in July, 1994, to INR 269.57 billion by August, 1999.

\textsuperscript{7} The number of PDs increased from 6 in 1996 to 13 in 1999. In 1997, 17 satellite dealers were added to the system to add to the market making ability of the dealers.
importantly, the PDs were in a position to make markets\textsuperscript{8} and provide two-way quotes to participants in the secondary market.\textsuperscript{9} Screen based trading, together with two-way quotes for securities, was expected to alleviate the informational problems in the secondary market. Further, the SLR requirements were reduced to 30 per cent in March 1995, from 37.5 per cent in 1992, thereby \textit{releasing} government securities for price-driven trade in the secondary market.\textsuperscript{10}

In 1995, the RBI also introduced the delivery-against-payment system for all government securities. Apart from making it difficult for traders to manipulate prices with uncovered long or short positions, which could be netted out before actual delivery, the system was aimed at eliminating counterparty risk. This system, which mandated that all trades in government securities be routed through the subsidiary general ledger (SGL) accounts with the RBI, was followed, in 1998, by the establishment of custodial and depository services for these securities by National Securities Depository Limited (NSDL), Stock Holding Corporation of India Limited (SHCIL) and National Stock Clearing Corporation Limited (NSCCL). The establishment of these services significantly reduced the probability of bad deliveries, and therefore encouraged trading in the secondary market. Further encouragement came from the government in 1998, in the form of elimination of stamp duty on trades in debt securities.

It is evident that the Indian market for government securities has come a long way since the days of financial repression which persisted till the early 1990s. However, several problems continue to persist. First, the market continues to lack in width. On any given day, only about 20 government securities are traded in the secondary market, and even two-way quotes are available for about 25 securities, the total number of dated government securities outstanding being about 120. The securities that are frequently traded during any time period are commonly known as “benchmark securities.”\textsuperscript{11}

\textsuperscript{8} It is a stylised fact that market making either by speculators with diverse expectations about the future, or by “specialist” individuals and organisations like the PDs is an essential part of the structure of a liquid market.

\textsuperscript{9} Since 1998, two-way quotes for some government securities are available online, and are made available through Reuters and Bloomberg terminals.

\textsuperscript{10} The SLR requirement was further reduced to 25 per cent in October, 1997.

\textsuperscript{11} Since there is little theoretical structure to justify the emergence of a handful of “benchmark securities” in a market, we have to fall back on anecdotal evidence as provided by market insiders, the RBI and institutions like Reuters and Bloomberg. Such evidence suggests that, during a period of time, a security emerges as a benchmark security if, out of a necessity to alleviate problems associated with asset-liability mismatch, large market participants buy and sell large amounts of the bond, thereby giving it substantial liquidity. Often, benchmark bonds are those that have been newly issued, and hence which are bought and sold frequently over a period of time to enable price search and allow major market participants to acquire them in conformity with their requirements for asset-liability management.
Further, while the depth of the market has increased considerably in terms of rupee turnover, the number of trades per security continues to be low on average. Indeed, most of the trades in the government securities market be traced back to “asset-liability mismatch of participating institutions or in their statutory obligations” (Nag and Ghose, 2000). As we shall see later, rupee turnover is not a good indicator of competitive trading in the secondary market, especially when the market is OTC and is dominated by large players like State Bank of India (SBI), Life Insurance Corporation of India (LIC) and Unit Trust of India (UTI). As a result, trading in the secondary market for government securities does not yet take place in a competitive price-searching environment, and hence the pricing of securities in the market is often perverse. We shall quantify some of these observations in the following section of the paper.

**An Initial Quantitative View**

In the previous section, we asserted that the secondary market for government securities in India continues to lack depth, especially if depth is defined in terms of number of trades per period of time, as opposed to rupee turnover. We should, therefore, justify at the outset why the number of trades is a more appropriate indicator of depth in the Indian market, when, traditionally, thinness of a market is expressed in terms of volume of transactions, expressed in some currency unit.

As mentioned above, the Indian bond market is dominated by a handful of major players: the large nationalised banks, the two insurance companies, and large mutual funds. Hence, an increase in the volume of trade from INR 10 billion to INR 20 billion may simply imply that two major nationalised banks like (say) the State Bank of India (SBI) and Bank of Baroda (BoB) have sold the additional bonds to one large mutual fund like (say) the Unit Trust of India (UTI). Why, however, will such a statistic matter?

Unlike stock prices, bond prices have precise relationships with an important macroeconomic variable: the interest rate.\(^\text{12}\) Hence, while a stock market is deemed to be efficient if the stock prices are a random walk, efficiency in the bond market would imply that, given a well-defined term structure of interest rates, bonds of similar maturities and characteristics would have similar prices, i.e., all market participants are informed about, and have endogenised all information about, the term structure. However, if a market is largely OTC in nature, and is characterised by a few trades among a handful of traders, the probability of

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\(^{12}\) The exact nature of the relationship can be found in Fabozzi (1996), chapter 14.
market manipulation and mispricing increases manifold, and prices may be determined more by relative bargaining powers of the buyer and the seller rather than by expectations about the future interest rates.\footnote{13}

Alternatively, the possibility of mispricing, and hence market \textit{in}efficiency, decreases if there is an increase in the number of participants and trades in the market, and if the trades take place online such that the buy and sell orders are available to all market participants in real time. In such a situation, if the market has mispriced bonds, even marginal players are able to identify arbitrage opportunities, and can exploit such opportunities successfully. The ability of market participants to engage in competitive price searching activity increases manifold if, not surprisingly, there are a large number of buyers and sellers, a good proxy for which is the number of trades recorded during a particular time period. The monotonically increasing relationship between the number of trades and the efficiency of the bond market, in an environment of transparent trading, is, therefore, obvious.\footnote{14} Further, if an efficient bond market characterised by theoretically consistent relationships between bond prices and expected interest rates, there should be little variance among yields of plain vanilla bonds with similar maturity structures.

In other words, if the Indian bond market has indeed become more efficient over time, three different trends must emerge over time. First, there has to be an increase in the number of trades recorded per unit of time. Second, the width of the market should increase significantly to enable the estimation of spot rates for a number of time periods. Finally, there should be convergence of bond prices to those that are theoretically consistent with the known term structure of interest rates, such that there is a significant decrease in the intra-period variation of the yields of similar-maturity bonds over time.

Data obtained from the SGL records of the RBI indicate that the secondary market for dated government securities is dominated by a handful of bonds (see Figure 1). Indeed, the six most frequently traded bonds account for as much as 15-20 per cent of the total monthly turnover in the secondary market for most of the months between June, 1996 and October, 1999. In as many as 14 of the 40 months, the concentration ratio of these dated securities exceeds 25 per cent, and for another 4 months this ratio is just below the 25 per cent mark.

\footnote{13}{The problem is further aggravated by the fact that the market’s expectations about future interest rates are reflected by the yield curve, and a meaningful yield curve cannot be constructed if the secondary market for bonds lacks depth and width.}

\footnote{14}{The importance of a \textit{correct} set of bond prices cannot be overemphasised. Note that bond prices prevailing in the secondary market get translated into the spot rates that define the shape of the yield curve which is a tool that is used both by monetary authorities and market participants like derivatives traders. Hence, it is not enough to say that (trivially) a set of spot rates exists for all maturities so as to define the yield curve. The prices must accurately reflect the interest rate expectations of the market participants so as to ensure that it does not send wrong signals to policy makers and market participants.}
It is also evident that the concentration ratio increases significantly during times of enhanced interest rate and macroeconomic risk. For example, following the nuclear explosions in Pokhran in May, 1998, the RBI was forced to increase interest rates to protect the external value of the Indian rupee. Further, the prospect of economic growth had become questionable with the imposition of sanctions by many industrialised countries. In cue, the 6-bond concentration ratio increased to 42.5 per cent in June, 1998, and stayed well over the 30 per cent mark during the June-October period. A similar rise in the concentration ratio coincided with the sharp increase in Indian interest rates in January, 1999, which was brought about to stop the persisting depreciation of the Indian rupee. The concentration ratio remained above 30 per cent during the following three months.

However, while the 6-bond concentration ratio provides little comfort, the data also suggests that there has been an increase in the absolute number of bonds traded per month (see Figure 2). The increase has been more marked for bonds with longer tenor, partially because of the fact that most of the bonds issued after 1998 have tenors of 5 years or more.

During much of the September, 1995-October, 1999 period, short-medium term bonds (with 3 years or less left for maturity) are traded more often than longer term bonds (with more than 3 years to maturity). However, there has been a marked increase in the number of trades involving longer term bonds since January, 1999 (see Figure 3), once again providing *prima facie* evidence that the bond market has matured to an extent such that the market participants are willing to trade in bonds of longer tenor that carry more inflation and interest rate risk. Interestingly, during the aforementioned period, a fall in the frequency of trading of shorter term bonds coincides with a rise in the trading of longer term bonds, and vice versa. In other words, there seems to exist cyclical demand patterns for bonds of different maturities: a period of relatively high demand for longer term securities followed by a period of relatively high demand for shorter term securities. Such behaviour is consistent with active asset-liability management on the part of the banks, which has benevolent implications for both the depth and width of the secondary market, as well as the ability of the market to provide a meaningful yield curve.
Clearly, the evidence about the width and the depth of the secondary market for government securities is somewhat mixed. On the one hand, there has been an increase both in the number of long term bonds being traded in the secondary market, and the frequency of trades involving such bonds. This development indicates greater active asset-liability management on the part of the banks and other market participants, and a greater willingness on the part of these participants to assume the risks associated with securities with longer tenor. In other words, there has possibly been an increase in the risk appetite of the market participants which is an important pre-condition for continual market making and, therefore, greater liquidity. On the other hand, the 6-bond concentration ratio indicates that the market has a long way to go before the benefits associated with these developments become apparent. As yet, the market is thin for all but a handful of “benchmark” bonds, and the relative thinness of the market for non-benchmark bonds increase significantly in the face of macroeconomic shocks and interest rate risks.

Now, as we have argued above, thinness of the market should be reflected in high variance of a bond’s yields within a time period, especially if the thinness of the market coexists with OTC trading and a few dominant market participants. The empirical evidence also suggests that while the pricing process in the secondary market is not completely arbitrary, the intra-month variance of a bond’s yields is significant. For example, while the price of a zero coupon bond (ZCB) maturing on January 18, 1999 monotonically increases and approaches its face value over time, wide intra-month variations in prices is evident even for this highly traded security (see Figure 4). As expected, intra-month variance in price is high during months with fewer trades, thereby vindicating our view that the frequency of trading, as opposed to the rupee volume of trading, is a better indicator of market depth in the Indian context.

INSERT Table 4 about here

How significant, however, is the intra-month variation in price? Theories about bond pricing indicate that there would necessarily be a difference between the prices of the bond at the beginning of a month and at the end of the same month. In case of a zero coupon bond, where accrual of coupon payments are a non-issue, the price at the end of a month would be greater than the price at the beginning of the month, unless there is a significant revision in expectations about future interest rates. The ZCB in question was most frequently traded during the June, 1996-March, 1997 period, and the geometric mean of the intra-month price range of these months was about INR 1.03. Given this intra-month variation, and a price of INR
70.00 for the INR 100.00 par value bond 2.5 years from maturity, it can easily be verified that the implicit change in the yield to maturity (YTM) of the bond would be about 119 basis points over a 12 month period. In India, differences in spot rates of securities of different tenors is high for money market securities, but the spreads are much lower for bonds with higher maturity (Nag and Ghose, 2000; Money and Finance, various issues). Indeed, while the spread between the YTMs of 91-day and 364-day T-bills is often 100 basis points or more, the spread between YTMs of bonds with 1.5 and 2.5 years to maturity is usually 50-75 basis points or less. In other words, the intra-month variation in the YTMs that is implicitly suggested by the intra-month price range of the ZCB is higher than expected, i.e., the price range itself is higher than expected. This result found support in similar experiments involving other government securities involving coupon bonds.

Thus far, we have been able to quantify to an extent the trends in the secondary market for government securities, and its implications for price-yield determination. It is evident that while the efficiency of this market, as defined above, has increased since the initiation of financial liberalisation in the early to mid 1990s, the market still lacks depth and width such that price anomalies are commonplace. However, while lack of depth in the secondary market certainly contributes to large price variations, such variations can also be brought about by rapidly changing expectations about future interest rates. Further, thinness of the market itself can be aggravated by heightened interest rate risk, as market participants rally to minimise overall risk by buying and selling bonds that already have a liquid market. Between September, 1995 and March, 1999 the RBI, faced with industrial slowdown on the one hand and downward pressures on the exchange rate of the rupee on the other, changed its monetary policy stance frequently (Kohli, 2000; Money and Finance, various issues). Hence, the next step of the analysis should attempt to quantify the extent of uncertainty regarding future interest rates, and this will be the endeavour of the next section.

**Interest Rate Uncertainty**

The expectations hypothesis (EH) remains the most important and most debated theory regarding the formation of expectations about future interest rates. Specifically, EH suggests that forecasts of short term interest rates in the future are closely related to the perceptions of the market participants about the future stance of monetary policy, when the policy itself may be determined by way of targeting inflation, economic growth or some other macroeconomic variable (Kozicki and Tinsley, 1997). Indeed, according to the strong form of EH, also known as pure expectations theory, “forward rates exclusively represent the expected future [short] rates” (Fabozzi, 1996).

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15 Note, however, that during December, 1995 and January, 1996 there was one trade involving the ZCB per month, and hence the standard deviation was zero for those months. There was no trade involving the security in...
The strong form of EH suggests that a market’s expectations about short term rates in the future, as given by the forward rates, should equal the actual short rates in future time periods. If so, the EH can be tested by estimating the regression model given by

\[ r(t + i) - r(t) = \beta_0 + \beta_1 [f(t, i) - r(t)] + \epsilon(t + i) \]  \[1\]

when \( f(t + i) \) is the 1-period forward rate \( i \) periods into the future, as estimated during the \( t \)-th period, and \( r(j) \) is the short rate for the \( j \)-th period (Fama, 1984; Fama and Bliss, 1987; Bekaert, Hodrick and Marshall, 1996). If \( \beta_1 \) is significantly different from unity, it can be concluded that \( f(t + i) \) is significantly different from \( r(t + i) \), such that EH can be rejected.

In the Indian context, the data does not allow a rigorous test of the EH. However, back of the envelope calculations indicate that the EH is unlikely to hold for the time period in question, for \( i = 1 \). However, tests of EH are inconclusive with the best of data sets. For example, the hypothesis is usually rejected if tested with data from the United States (Kozicki and Tinsley, 1997). But it is not as easily rejected for Western European countries, except for Austria (Gerlack, 1996). Since both the US and (most) Western European economies are characterised by macroeconomic stability and (monetary) policy continuity, the rejection or non-rejection of the EH clearly does not indicate the extent of interest rate uncertainty prevailing in a country.

However, if a bond market is characterised by an increase in the frequency of trading, presumably involving a larger number of traders, there should be more efficient dissemination of information about interest rate expectations. If so, on average, the market should be better able to predict the interest rates that are likely to prevail in the future, namely, the forward rates, especially if the economy is characterised by macroeconomic and monetary stability. Hence, under conditions of stability, as a market becomes more efficient, we can expect the divergence between the forward rates \( i \) periods from now, and the corresponding actual short rates during that period to narrow down significantly over time.\(^{16}\)

The data indicates that, in the Indian context, expectations about spot rates in the future, as given by the forward rates, are different from the actual spot rates. However, this observation has to be qualified by three others (see Table 1). First, the difference between the actual 1-year short rates in any period \( t \) and the November, 1995.
1-year forward rates estimated one year prior to the current period narrows considerably over time. During 1997, this difference, on average, was about 499 basis points. It narrowed considerably to 152 basis points in 1998, and increased marginally to 164 basis points in 1999. Second, the divergence was greater for expectations formed deep into the future. For example, the average difference between the expected and actual one year rates for the June-October period of 1998 was 293 basis points when the expectations were formed in 1996, but the difference narrowed down to 71 basis points when the expectations were formed a year later, in 1997. Similarly, the average difference between the expected and actual one year rates for the April-October period of 1999 was 242 basis points when the expectations were formed in 1997, but the difference narrowed down to 156 basis points when the expectations were formed a year later, in 1997. Finally, the difference between the forecasts of 1-year rates two years in the past and the actual 1-year rate itself decreased from an average of 293 basis points in 1998 to 242 basis points in 1999. In other words, between 1995 and 1999, there has been a move towards convergence of expected and actual interest rates.

The 1995-1999 period was marked by the RBI’s determination to reduce the interest rate, and yet restrict growth rate of broad money to around 15.5 per cent per annum. The RBI steadily reduced the cash reserve ratio (CRR) and the bank and repo rates over this period. Indeed, if the bank was forced to raise CRR or interest rates to prevent a run on the rupee, the tight money policy was reversed soon after the exchange rate of the rupee stabilised vis a vis the US dollar. By and large, except for a few short periods of sharp depreciation, the exchange rate of the rupee remained stable against the US dollar, such that the RBI was able to reverse its tight money policy within a short period of time. Further, there was a steady decline in the inflation rate from 1995-96 to 1998-99, thereby substantially reducing inflation risk associated with the determination of a bond’s price and yield. As such, the 1995-1999 period can be described as one of stable and predictable medium-long term monetary policy, with aberrations during short periods of time following the South East Asian crisis and the nuclear explosions at Pokhran. The data suggests that there is at least a significant correlation, and perhaps even a causal relation, between stability of monetary policy and the ability of the market participants to accurately form expectations about short rates in the future. This is consistent with evidence from other countries (Evans and Marshall, 1997).

However, while the interest rate risks have perhaps been ameliorated by macroeconomic and monetary stability, an observation that is also supported by a noticeable increase in the frequency of trading in even longer term government securities, involving a larger number of bonds, one other feature of the market suggests that risks associated with longer term bonds may not have been sufficiently reduced. Specifically,

\[ \text{Note that this is not inconsistent with mainstream theories; within the context of a rational expectations framework, it would imply that the variance of the error term for predictions will be reduced.} \]
after bonds are introduced in the primary market, the frequency of trading their trading in the secondary market is significant. Buyers and sellers trade as a part of the price discovery process, and also to ensure that the new bond contributes to the reduction of their asset-liability (i.e., maturity and duration) mismatch. However, once this process of price discovery and asset-liability management is over, the market participants are typically unwilling to trade any further if the maturity of the bonds is many periods away.\footnote{In other words, after the initial process of price discovery, a bond with many months or years left of its maturity will be traded very little in the secondary market. The picks up again once the bond nears its maturity.}

In other words, bonds are traded relatively frequently after they are first introduced in the market, and when they are near their respective maturities.\footnote{It is easy to see why the bonds would be traded more frequently when they near maturity. First, when a bond is very close to maturity, it becomes \textit{de facto} a money market instrument and whether or not a bank would hold it would depend on factors like the overnight lending rates (which reflect liquidity of the banking system) and opportunity costs of the market participants. Second, many market participants may like to hold longer term securities to avoid asset-liability mismatches in their portfolios. In other words, they may sell bonds that are near their maturities to either buy bonds with longer maturities, or meet short term liquidity requirements. Thus as a bond nears its maturity there will exist an incentive to trade. Given that it is possible to form better expectations about the near term, there is scope for actual trading of bonds.}

Hence, the relationship between the proportion of the outstanding volume of a bond traded in the secondary market is usually high early in its life, fall thereafter, and rise once again when it nears maturity, i.e., the curve which can be plotted with the aforementioned proportions on the vertical axis, and periods in the life of the bond on the horizontal one is U-shaped (see Figure 5). In the figure, the U-shape is especially visible for the 13.5 per cent bond maturing in 1998, and the ZCB and the 12 per cent bonds maturing in 1999. The observation is also weakly supported by the fact that a very small proportion of the 14 per cent bond maturing in 2005 is traded throughout the September, 1995 – October, 1999 period. Indeed, only the 12.5 per cent bond maturing in 2004 bucks this trend.\footnote{In other words, increasing macroeconomic and monetary stability in India during the 1995-1999 period has reduced interest rate risks facing investors, and this stability, perhaps together with greater risk appetite and more active asset-liability management on the part of the banks, has added to the width and depth of the market for longer term government securities. However, the reduction in interest rate risk has clearly not been enough to encourage a widespread increase in trading involving longer term bonds, such that the proportion of the outstanding debt values of such bonds being traded in the secondary market}

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continues to be low. Part of the residual risk may be explained in terms of macroeconomic conditions. For example, the persistently high fiscal deficit of both the central and the state governments fosters uncertainty about future interest rates. However, a part of the risk has to stem from the fact that the market is still largely OTC in nature, and is dominated by large market movers, thereby encouraging both non-competitive and perverse bid and offer prices and informational asymmetry among the market participants. Once again, therefore, we return to the structure of the market as an important source of anomalies in the secondary market for government securities.

Concluding Views

The Indian bond market has matured significantly during the past decade. The amount raised by the government, public sector and quasi-government entities and corporate organisations from the market for fixed income securities far outstrip the amount raised by way of equity. This has been matched by an increase in the depth and width of the secondary market for bonds, both in terms of the face value of the bonds traded and in terms of the average frequency of trading per bond. At the same time, the fixed income instruments have become increasingly sophisticated. Both the government and corporate organisations issue floating rate bonds, and bonds with embedded options have made their appearance. Indeed, with the abolition of stamp duty, and the introduction of rupee denominated interest rate derivatives, the bond market may be poised for a take off.

However, the growth of the secondary market for bonds has been held back by three factors that continue to haunt the Indian market. First, while there has been a significant improvement of the Indian economy in so far as macroeconomic stability is concerned, high fiscal deficit and the need to frequently change the short-term stance of monetary policy still make it difficult to form accurate expectations about future short-term interest rates. Second, the market is dominated by large buyers and sellers like the UTI and SBI who can influence the market price significantly, and many of the large buyers and sellers are commercial banks who buy and sell bonds largely to mitigate problems associated with asset-liability mismatch. Finally, the market is largely OTC in nature, and hence, despite the existence of the primary dealers, the WDM of the NSE, and Reuters and Bloomberg terminals, dissemination of information about bond prices (and hence interest rate expectations) is neither spontaneous nor widespread. In brief, on the one hand,

\[16\]

We regressed the aforementioned proportions on a second order polynomial of time, and the results indicate that the U-shape is a reasonable approximation of the time trend of the proportion traded of most of the bonds (approximately) originating and/or maturing during the September, 1995-October, 1999 period.
market making is limited and, on the other hand, informational asymmetry continues to be a dominant feature of the market.\textsuperscript{20}

Macroeconomic stability is a goal that is desirable by its own right, and its discussion lies outside the scope of this paper. Other than enhancement of such stability, the need of the hour is not only online trading, or at least real time reporting of prices negotiated in OTC trades, but also a manifold increase in the number of active portfolio managers who would roll over their bond portfolios often, and who would collectively provide two way quotes for a wide array of securities. Given that a two way quote is a proxy for a trade, albeit imperfect, the depth of the bond market can then increase sufficiently, thereby increasing the market’s efficiency. However, as suggested by experience, the government’s attempt to increase the depth of the bond market by allowing foreign institutional investors (FIIs) to trade in both T-bills and dated government securities is unlikely to be a panacea. The exposure of the FIIs to Indian debt instruments is marginal at best. The liberalisation of the insurance industry would, hopefully, act as a panacea for the Indian bond market.

The study, though pioneering in nature, suffers from the shortcoming that some of the arguments have not been adequately backed up by data. This is, in part, the consequence of a conscious attempt to reduce the time taken for analysis, given that market structures in a country like India, which is in transition, can change fast, thereby rendering carefully done analysis anachronistic. Hence, stylized facts like the dominance of large traders like UTI in the bond market has not been substantiated with data. In part, the analysis manifests the fragmented nature of data of the Indian bond market which makes statistical and econometric analysis difficult if not impossible. The challenge in the future would, therefore, be to rigorously evaluate the hypotheses that have been explicitly and implicitly generated by the above analysis, as the depth and width of the bond market increase over time.

\textsuperscript{20} As we have seen, the problem of informational asymmetry is perhaps further aggravated by the fact that in many cases the macroeconomic variables do not follow some pattern and hence it becomes difficult to form expectations about nominal interest rates, such expectation being an essential informational ingredient of a well functioning bond market.
REFERENCES


Figure 1

Contribution of the 6 Most Traded Government Securities to Total Volume Transacted

Month

Percentage
Figure 2

Number of Bonds Traded per Month

Number of Bonds Traded

- 3 yrs or less to maturity
- >3yrs to maturity
Figure 3

Frequency of Bond Trades Per Month

- 3 yrs or less to maturity
- >3yrs to maturity

Frequency of Trade

Figure 4

Price Variations of a Zero Coupon Bond Over Time

Standard Deviation of Price

Price of the ZCB

Months

s  f  Price of the ZCB
Figure 5

Proportion of Outstanding Face Value Traded

- 13.5% 1998C
- ZCB 1999
- 12% 1999
- 11.64% 2000
- 14% 2005
- 12.5% 2004
Table 1

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<td>10.51</td>
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Note:
- fwd-11:96 = one year forward rate one year from now, computed in 1996
- fwd-11:97 = one year forward rate one year from now, computed in 1997
- fwd-11:98 = one year forward rate one year from now, computed in 1998
- fwd-12:96 = one year forward rate two years from now, computed in 1996
- fwd-12:97 = one year forward rate two years from now, computed in 1997