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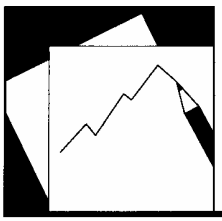

IMF Working Paper

Managing the Interest Rate Risk of Indian Banks' Government Securities Holdings

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Managing the Interest Rate Risk of Indian Banks' Government Securities Holdings

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Abstract

The large holdings of government securities by banks in India draw attention to their risk as interest rates are at historical low levels. This paper measures such a risk using duration and value-at-risk methods and assesses its current management by banks. The main finding is that some public sector and old private banks are vulnerable to a reversal of the interest rate cycle, while foreign and new private banks have built adequate defenses. In this regard, the paper makes a number of recommendations regarding government policies and individual bank practices to manage interest rate risk.

JEL Classification Numbers: G18, G21

Keywords: interest rate, risk management, government securities, duration, value-at-risk, Basel Core Principles

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I. INTRODUCTION

Banks in India invest heavily in government securities, compared with other countries (Table 1). Such investments grew by 25 percent in 2003–04 to reach Rs 6.4 trillion, or 24 percent of nominal GDP at end-March 2004.[2] They represented one-third of total banking system's assets at end-March 2004. As a result, Indian banks have some of the highest holdings of government securities relative to their assets when compared to other countries. Furthermore, government securities holdings are well in excess of the statutory reserve requirements. The ratio of statutory liquid securities (SLR)—mainly government securities—reached 41 percent of net demand and time liabilities by end-March 2004, well above the required 25 percent.

With declining interest rates in recent years, banks have earned substantial profits through interest and trading income on government securities. Interest income on these investments represented 35.8 percent of banking system interest income at end-March 2004. Similarly, trading income accounted for half of the banking system noninterest income at end-2004. Trading income has become one of the main drivers of banking system profitability, accounting for 37 percent of operating profit at end-March 2004.

However, the holdings of government securities by the banking system entail risk as interest rates have reached their historical low levels. Most government securities held by banks are long-term fixed-rate government bonds, which are sensitive to changes in interest rates. Fixed-rate government securities with a 5 to 30 year tenor account for 58.2 percent of banks' total investment portfolios. In contrast, investments with a maturity less than one year represent only 10.4 percent of total as of end-March 2004. At the same time, inflationary pressures have prompted the Reserve Bank of India (RBI) to raise interest rates in 2004. Further increases in the yields of government securities are a significant challenge to the risk management practices of banks in India, with potential negative effects on their profitability and capital adequacy.

This paper first briefly reviews the reasons why banks in India have large holdings of government securities. The paper then estimates the interest rate risk associated with such holdings using duration and value-at-risk methods for the overall banking system and different types of banks. The paper also assesses the management of such risks by banks. Finally, the paper identifies key issues that could mitigate the banking system's vulnerability to interest rate risk.

[2] Based on a nominal GDP of US$603 billion and an exchange rate of Rs 43.6/U.S. dollar at end-2003/04.

II. Why Are Banks' Holdings of Government Securities in India So Large?

The determinants of large holdings of government securities by banks in India are broadly the results of "supply" and "demand" effects. Supply effects include: (1) the financing of the budget deficit and the associated borrowing program of the central government; and (2) the net inflows of capital and their sterilization.[3] In fact, RBI regulations require banks to hold a high proportion of their assets as government securities to comply with the statutory liquidity ratio (SLR) requirement. The SLR requirement, which at some point reached a level of 40 percent of deposits and term liabilities and has been gradually reduced to the current statutory minimum of 25 percent, created in effect a captive market for government securities.[4] Not surprisingly, the government's fiscal deficit has been increasingly financed by government securities (see Table 2). From around 20 percent in the early 1990s, the share of such net market borrowing in financing the fiscal deficit of the central government has increased to 80 percent in recent years (see Mohan, 2004).

In the aftermath of liberalization and the adoption of a market-determined exchange rate, RBI interventions in the foreign exchange market have increased the supply of government securities to the banking sector. Indeed, the sterilization of foreign exchange inflows has required the RBI to conduct open market sales of government securities even when the pace of the government's market borrowing moderated. Recently, the authorities have launched market stabilization bonds for intervention purposes.

A number of "demand" effects have also contributed to the current high holdings of government securities by banks in India. First, a falling interest rate environment and the associated expected treasury profits have provided banks strong incentives to invest in government securities (see Table 2). Second, prudential regulations with respect to capital adequacy requirements for commercial banks have placed little (between zero and 2.5 percent) weight on government securities as compared to 100 percent or even more for many other assets. This regulatory incentive may have been important especially as banks in India have had to reduce high levels of nonperforming loans. Finally, public sector banks (PSBs) with majority ownership by the government dominate the Indian financial system and remain the main investor base for government securities relative to institutional investors and foreign investors which face capital control restrictions.

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[3] In recognition of the transfer of risks associated with government securities to the banking system through open market operations (OMO), the Reserve Bank of India has not conducted OMO auctions in 2004-05 and is using its portfolio of government securities for the conduct of reverse repos under the liquidity adjustment facility (LAF). In contrast, OMO amounting to Rs 407 billion and Rs 527 billion (face value) were conducted in 2002-03 and 2003-04, respectively.

[4] Deputy Governor Mohan noted in a recent speech that "the predominance of government securities in the fixed income securities market of India mainly reflects the captive nature of this market as most financial intermediaries need to invest a sizeable portion of funds mobilized by them in such securities. While such norms were originally devised as a prudential measure, during certain periods, such statutory norms pre-empted increasing proportions of financial resources from intermediaries to finance high government borrowings." (*Reserve Bank of India Bulletin*, October 2004, p 851.)

III. Measuring the Risk from Government Securities Holdings

The RBI conducts periodic sensitivity analyses of banks' balance sheets and found that interest rate risk of Indian banks seems manageable (RBI, 2003). The RBI found a 4.9 percent positive impact on net interest income (NII) following a 200 basis point increase in interest rates at end-March 2003. This analysis does not, however, incorporate the depreciation of banks' holdings of government securities. Given their significant share in the assets of commercial banks in India, it is important to measure the risk of government securities holdings. Gauging the likely reduction in the market value of banks' government securities holdings and the associated reduction in capital adequacy and profitability can guide banks in managing these risks. In addition, identifying banks most vulnerable to the risks can be useful to supervisors.

A. Duration Method

First, we use a duration/convexity method to estimate the government securities portfolio interest rate risk. From the price-yield relationship for bonds, this method estimates bond price changes for a change in yields. The duration of a bond is a linear approximation of a bond price change. The longer the duration of a bond—measured in years—the more interest rate sensitive it is. Since the price-yield relationship for bonds is not linear but convex, a measure of convexity is also used to account for small changes in yields. Convexity is a second order effect that describes how duration changes as yields change. Mathematically, the duration/convexity method uses a Taylor expansion to approximate the relative change in government securities price, *dG/G*, following a small change in the yields of government securities *dy*. *D** and *C* denote the government securities modified duration and convexity, respectively (Jorion, 1997).

$$\frac{dG}{G} = -D^* dy + \frac{1}{2} C (dy)^2 \text{ where } D^* = -\left(\frac{1}{G}\right)\frac{dG}{dy} \text{ and } C = -\frac{dD^*}{dy}. \quad (1)$$

Our estimates[5] (Table 3) show that the interest rate risk sensitivity of banks' government securities portfolio has increased over time, with PSBs and old private sector banks the most exposed to a rise in yields. As of end-March 2004, the average duration of the government securities portfolio of scheduled commercial banks (SCBs) was 5.8 years. PSBs, which account for about 75 percent of total banking system holdings have the highest duration with 6.3 years. Similarly, old private banks have a duration of 6.1 years. In contrast, the government securities portfolio of foreign banks has the shortest duration with 2.9 years compared to 3.3 years for new private sector banks. The average duration for all banks has increased from 4 years in 1999 to 5.8 years at end-March 2004, pointing to potential increased risk.

[5] We calculate weighted durations and convexities of government securities portfolios using the maturity profile of government securities investments and data from the NSE government securities index.

Scenario analysis

In order to approximate interest rate risk to the banking system, we consider both the direct effect on banks' securities portfolio as well as how banks can manage such a shock to attenuate its effects. As a base case we consider a one percentage point parallel rise in the entire yield curve. This is similar to the increase experienced between mid-April and mid-July 2004 for the yield of the benchmark 10-year bond, which rose from 5.07 percent to 6.26 percent. This scenario can also be seen in the context of the worst-case increase in government securities yields over 90 days.[6,7] The scenario considers the effect of such a rise in interest rates on the Available for Sale (AFS) and Held for Trading (HFT) categories of banks' portfolios of government securities as bonds Held to Maturity (HTM) are not marked to market.

Portfolio losses

In the absence of any interest rate risk management by banks, potential portfolio losses from a hike in interest rates would be significant. A one percentage point increase in interest rates would result in losses worth 133 percent of net profit (Table 3). The market value of banks' government securities holdings would be reduced by about Rs 300 billion or 6 percent of portfolio.[8] PSBs and old private banks would be the most exposed with portfolio losses of 153 percent and 123 percent of net profit, respectively, as of end-March 2004. Foreign banks and new private sector banks would be the least vulnerable to such a shock, with losses of 39 percent and 76 percent of net profit, respectively.

Capital adequacy

Such losses would represent about 26 percent of total capital and a drop in the capital adequacy ratio (CAR) to 9.6 percent from 13 percent (Table 3). A similar exercise using 1999 data finds that banks would have lost 18.3 percent of total capital and their CAR would have fallen by 2 percent in 1999, suggesting that the exposure to interest rate risk has increased over the years. The capital adequacy of PSBs would be the most exposed, with their average CAR falling to about the level of the 9 percent regulatory minimum (from 13.2 percent).

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[6] Using five years of monthly data on government securities yields, Sarkar (2003) estimates the 99 percent confidence level to range from 103 basis points to 127 basis points for maturities of 1-10 years.

[7] We also consider two additional scenarios. Scenario 2 simply assumes a shock double the size of that in Scenario 1. Scenario 3 assumes a 320 basis point increase, the worst-case increase in government securities yields over one year with a 1 percent probability, assuming that yields are normally distributed (the standardized interest rate shock recommended by the Bank for International Settlements (BIS) (2003)). Given the strong linearity of equation (1), portfolio losses under these scenarios would be approximately proportional to losses obtained under the base scenario.

[8] A similar approach finds market losses in Japanese banks' portfolio of Japanese government bonds equivalent to 208 percent of net profit or 14 percent of Tier 1 capital (see Nemoto, 2004).

Our results are consistent with previous findings. For instance, Sarkar (2003) estimates the worst-case loss at end-2002 (for a 90-day horizon and a 99 percent confidence level) for a sample of 51 Indian banks at around Rs 265 billion or almost 5 percent of their holdings of government securities. Similarly, private banks are found to be the least exposed to interest rate risk and PSBs the most exposed. No foreign banks (out of 9 banks) would erode more than 25 percent of net worth while, among private banks, the proportion with such risk was around 47 percent (out of 15 banks) and, among public sector banks, 85 percent (out of 27 banks). Sarkar (2003) finds that Indian banks are not uniform in their interest rate risk exposure and there is no clear relationship between their capital adequacy ratio and the market risk they take.

B. Value-at-Risk (VaR) Approach

The duration/convexity approach has well-known limitations, as it measures exposures only for parallel shifts of the yield curve. The value-at-risk (VaR) approach offers a complementary method to measure the interest rate risk of bond portfolios. VaR is the measure of the maximum (worst case) market loss for a given portfolio, for a certain holding period, and for a given confidence interval (see also Patnaik and Shah, 2004). VaR is a measure of the rupee loss on the government securities portfolio that will be exceeded by the end of the chosen time period with the specified confidence level. Duration is directly linked to value at risk and the worst case rupee loss calculations in Scenario 3 can be seen as a VaR estimation at a 99 percent level of significance for a one-year horizon.

Value-at-risk estimation results

Using a variance-covariance (or normal) method, we find results that are comparable to the duration method's estimates. We find that the maximum (worst case) market loss for scheduled commercial banks' portfolio for a one month holding period, and for a 99 percent confidence interval is Rs 320 billion (Table 3). This figure is close to the portfolio loss resulting from a 100 basis point increase in the yield curve obtained using the duration approach (Rs 300 billion).

We use a duration mapping method with linear interpolation using information from zero-coupon government securities from the National Stock Exchange (NSE). Since the NSE database does not provide the correlation of zero-coupon bonds for different maturities, our estimates measure the *undiversified* portfolio VaR of Indian banks. As a result, our estimates assume perfect correlation across all zero-coupon bonds and ignore possible diversification benefits, which may overestimate the diversified VaR.

We also use alternative VaR, including historical simulation methods, together with weighted normal, weighted historical simulation, and extreme value methods. Dharba (2001) argues that the extreme value theory method provides the accurate VaR estimator in terms of correct failure ratio and the size of the VaR. The VaR obtained using the extreme value theory method is estimated to be Rs 134.6 billion or 11.5 percent of total capital, which would lead to a new CAR of 11.4 percent. In comparison the variance-covariance method VaR estimate is Rs 320 billion or (27.4 percent of total capital), which would lead to a new CAR of 9.4 percent. Although the results are sensitive to the choice of methods (see Table 3), we focus

on the variance-covariance method, which yields results similar to the duration method. In the rest of the paper we focus on the risk management of government securities holdings.

IV. Interest Rate Risk Management

While rising interest rates make banks vulnerable to treasury losses, banks in India have a number of lines of defense. First, banks have, in recent years, realized substantial profits from their holdings of government securities, thanks to the soft interest rate environment. Banks are required to follow conservative accounting practices in respect of unrealized capital gains on their investment portfolio and have constituted latent reserves.[9] Moreover, banks in India have been encouraged to build up investment fluctuation reserves as a cushion against interest rate risk (Gangadhar, 2001). Finally, banks can adjust their behavior to offset treasury losses by adequately managing their asset-liability mismatch.

A. Basel Core Principles

The Basel Committee on Banking Supervision (BCBS) has issued principles regarding the supervision of the interest rate risk management of banks, which can be used as a benchmark for the RBI. Investment portfolios are bifurcated into a banking book, which includes securities that banks intend to hold to maturity, and a trading book. Since 1996, Basel I regulation requires banks to set aside capital to cover their market risks, where the latter includes the interest rate risk in the trading book, but not the banking book (BIS, 1996). Pillar II of Basel II advises bank regulators to control the level of the interest rate risk in the banking book. It urges supervisors to identify banks that are "outliers," i.e., those that would lose more than 20 percent of their Tier 1 and Tier 2 capital due to a specific stress scenario (see BIS, 2003).

The IMF (jointly with the World Bank), as part of its financial sector assessment programs, has reviewed countries' compliance with Basel Core Principles (BCP). In the course of 71 confidential assessments covering 12 advanced, 15 transition, and 44 developing economies, it has been found that all advanced economies under consideration have complied with the core principles regarding market risk and risk management (Table 4). In contrast, 66 percent of developing economies and 53 percent of transition economies did not comply with such principles.

The RBI is moving gradually towards Basel I principles for managing interest rate risk. In 1995, the RBI introduced asset liability management guidelines and in 1999 guidelines for risk management. To measure liquidity risk, banks are required to submit periodic reports to the RBI. More recently, the RBI is phasing in the implementation of Basel norm for capital charge for market risk over a two-year period.[10] In addition, since 2000, banks are required to

[9] The RBI conducts periodic sensitivity analyses of banks' investments portfolio and estimates the cushion available in terms of unrealized gains on banks' investment portfolio.

[10] The RBI announced in 2004 that banks would be required to maintain capital charge for market risk in respect of the securities included under the Held for Trading (HFT) and Available for Sale (AFS) categories by 2005 and 2006, respectively.

use a 2.5 percent risk weight for their portfolio of government securities in order to determine their capital adequacy ratio, as compared to zero under Basel I. The RBI also advised banks to examine the soundness of their risk-management systems and draw up a road map by end-December 2004 for migration to Basel II. In addition the RBI initiated in 2004 a pilot program for risk-based supervision.

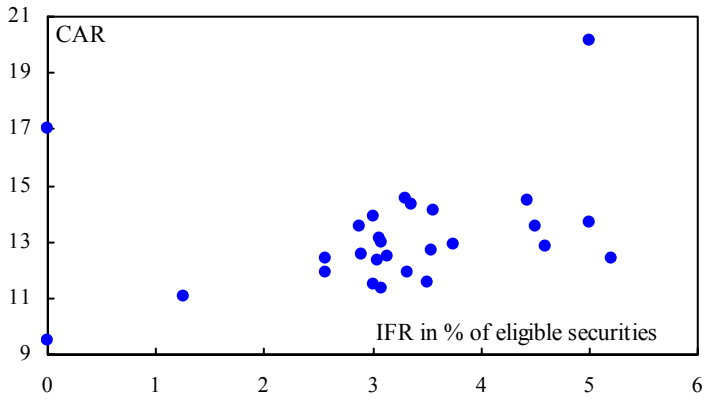
B. Investment Fluctuation Reserves

As an alternative to Basel I, the RBI currently uses the investment fluctuation reserve (IFR) as the main line of defense against a potential reversal of the interest rate environment. In 2002, banks were advised to build up an IFR of a minimum of 5 percent of the investment in HFT and AFS categories within a period of five years. Banks were also advised to achieve the goal earlier and are encouraged to reach a 10 percent ratio. Transfer to IFR is as an appropriation of net profit after appropriation to statutory reserve.

Basel I can be viewed as a more efficient approach to interest rate risk. This is because it recommends capital charges commensurate with the risk exposure of banks, whereas IFR requirements are uniformly applied to banks with no consideration as to the level of interest rate risk and its associated management. As a result, banks with low exposure to interest rate risk bear a regulatory cost if they comply with the advised IFR level. In contrast, the advised uniform level of IFR may not be sufficient to protect some banks from their high exposure to interest rate risk. Furthermore, a number of banks may not have sufficient profitability and capital to build the advised level of IFR. As the RBI moves to international standards, it is expected that the current system will be replaced by Basel I principles.

The current aggregate level of IFR is about half that needed to absorb market losses resulting from a one percentage point increase in government bonds yields. The aggregate banking system's IFR stood at 3.0 percent of eligible government securities at end-March 2004, just over half of the 5.8 percent needed to absorb a one percentage point increase in the benchmark 10-year government bond (Table 3). The shortfall would be from public sector banks and old private sector banks. In contrast, new private banks and foreign banks have IFR levels sufficient to absorb the shock.

Figure 1. India—Public Sector Banks: Capital Adequacy Ratios and Investment Fluctuation Reserves, End-March 2004



Sources: Reserve Bank of India and author's calculations.

Moreover, the required IFR level would not only be short of adequate for PSBs and old private banks but too high for new private and foreign banks. In contrast to the advised 5 percent, PSBs and old private banks would require IFR levels of about 6.3 percent and 6.1 percent, respectively, of eligible securities. However, foreign and new private banks would need only about 2.9 percent and 3.3 percent, respectively, of eligible securities to absorb a one percentage point shock. This result suggests that an IFR level which would take into account the level of interest rate risk in individual banks would be better suited as a risk management tool than a uniform level of IFR.

Individual bank data show a wide dispersion of IFR, suggesting that the RBI should scrutinize closely the most exposed banks, as their IFR could be insufficient to cushion them against large interest rate increases and they could need capital injections. The IFR level of PSBs ranges from zero percent for two small PSBs to 5.21 percent of eligible securities, with a median of 3.13 percent. All PSBs have an IFR level below the minimum needed to absorb the *average* 6.3 percentage-point reduction in the value of government securities holdings following a one percentage point increase in interest rates. After using their existing IFR as a cushion to absorb their portfolio losses, the average CAR of PSBs would fall to 10.4 percent from 13.1 percent, and six out of the 27 PSBs would require capital injection as their CAR would fall below the minimum regulatory level of 9 percent (Figure 1).

C. Mark-to-Market Requirements

The RBI has introduced a number of mark-to-market requirements. Since 2000, banks are required to classify their investment portfolios into three categories with progressively mark-to-market norms: (i) Held to Maturity (HTM); (ii) Available for Sale (AFS); and (iii) Held for Trading (HFT). While investments under the HTM category are not marked-to-market, those under AFS and HFT are to be marked-to-market at year-end and monthly, respectively or at more frequent intervals. Guidelines were also issued for the classification of investments, shifting of investments among the three categories, valuation of the investments, and a conservative methodology for booking profits and losses on sale of investments as well as providing for depreciation. In particular, while net depreciations are recognized and fully provided for, net appreciations are ignored.

As a one-time measure in September 2004, the RBI allowed banks to shift securities to HTM, immediately providing for transfer losses. Prior to September 2004, banks were allowed to classify a maximum of 25 percent of their total investments in government securities in the held-to-maturity category (HTM) category when calculating their IFR. Since September 2004, banks are allowed to hold up to 25 percent of their demand and time liabilities (DTL) in the held-to-maturity category (HTM). However, upon shifting additional securities to HTM, a bank would incur accounting losses due to differences between their prevailing market value and acquisition cost or book value. Under both regulations, the advised IFR is worth 5 percent of banks' government securities in the AFS and HFT categories.

The RBI explains the measure—which is consistent with international standards that do not place limits on HTM category—as a regulatory response to concerns about the impact of the rising interest rates on banks' investment portfolios.[11] Banks that choose to apply this measure will reduce their exposure to interest rate risk but will have to incur the cost upfront of transferring more securities to the HTM category. In contrast, banks that decide not to hold more securities to maturity will be exposed to potential future mark-to-market losses if interest rates increase further. Such banks would be particularly at risk if they currently lack the capital to absorb the cost of shifting securities to the HTM category, should interest rates rise in the future.

D. Other Aspects of Bank Asset Liability Management

It is important to note that conservative accounting rules in India are such that banks hold an additional cushion against interest rate risk. Indeed, valuation norms require that while net depreciation of investments is taken on the profit and loss account, appreciation is not accounted for and the book value remains unchanged. The accumulated provision for depreciation is meant to reflect the diminution in the book value and requires to be added to the cushion of unrealized gains and IFR to better estimate the amount of cushion available to absorb interest rate shocks. Data limitations are however such that we cannot estimate this figure for individual banks but unrealized gains would be positively related to duration.

In addition, offsetting potential treasury losses, higher interest rates on loans can positively affect the net interest rate income of banks. Banks can take advantage of rising short-term rates as loans re-price quicker than deposits, hence widening spreads in an environment of increasing loan-to-deposit ratios. Such higher spreads may attenuate the effect of holding fixed rate government securities in a rising interest rate environment. However, the volatility of deposits needs to be considered as well, as they could be withdrawn in case of a significant interest rate shock. As mentioned earlier, the RBI (2003) found a 4.9 percent positive impact on net interest income following a 200 basis point increase in interest rate at end-March 2003, but this analysis does not include possible losses to banks'portfolio of government securities.

Banks could also manage interest rate risk through a number of measures. Banks could (i) reduce the duration of their assets by selling long-dated government securities; (ii) reduce their holdings of government securities and increase their loan books by building on the recent high growth in consumer credit and infrastructure; and (iii) increase the contribution of fee-based income to operating income.

[11] See RBI (2004a), page 171. The RBI has also noted that banks are required to hold 25 percent of their DTL in the form of approved securities—mostly government securities—as statutory reserves and argued that at least this level should be eligible as HTM.

E. Government Policies to Limit Interest Risk

Over the medium term, a stronger fiscal policy and enhanced opportunities for lending would reduce banks' reliance on government paper. A reduction of the fiscal deficit would reduce the supply of government securities to the banking system. At the same time, continued structural reforms will make lending to domestic enterprises and consumers[12] more attractive, allowing banks to bring their government securities holdings down to the legally required level.

Increasing the issuance of short-dated or floating rate government securities—subject to sound debt management practices—would also help banks manage their interest rate risk. The Indian authorities have initiated the sale of floating rate government securities and in 2003-04, the Government raised 16 percent of its gross market borrowings in the form of floating rate bonds (FRBs). In 2004-05, this proportion increased to about 29 percent of gross issuance.[13] Capital market development could also ensure a better functioning of markets for hedging instruments such as interest rate swaps and forward rate agreements (FRAs), and interest rate futures.[14]

Widening the investor base for government securities could also help reduce the reliance on banks as the main investors in this market. Commercial banks held 61 percent of the outstanding stock of government securities at end-March 2002. The next most important investor was the state-owned Life Insurance Corporation of India (LIC). Other investors included provident funds, mutual funds, other financial institutions, and retail investors. In order to widen the investor base for government securities, the authorities have allowed foreign institutional investors (FIIs) to purchase government securities since February 2004.

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[12] Government securities to some extent compete with loans. As their attractiveness decreases, some banks may increase their lending. However, if credit risk assessment is not appropriate, the overall credit risk of the system could increase, although its interest rate risk has decreased. Banks could also increase the contribution of fee-based income to operating income which could mitigate their overall riskiness.

[13] Including 364-day treasury bills, gross issuance of securities for the purpose of market borrowings having a duration of less than one year amounted to 45 percent of the total. In addition, absorption of liquidity under the Market Stabilisation Scheme using 9-day and 364-day treasury bills is helping lower the duration of banks' holdings of government securities. The authorities have also constituted a Sub-Group of the Technical Advisory Committee on Money, Forex, and Government Securities Markets to address the issue of the low liquidity of FRBs.

[14] See Sarkar (2003), who notes that the swap markets are characterized by a lack of volume and high impact cost. He suggests (1) the introduction of bilateral netting and multilateral netting (through CCIL) which would free up counterparty limits, thus allowing for bigger volumes in the market; an ordinance/change in the SCRA (Securities Contracts Regulation Act, 1956) to cover OTC derivatives like interest rate swaps and FRAs. Similarly, regarding the interest rate futures market, he suggests the following steps to be taken by the securities and exchange board of India (SEBI) and the RBI: (1) allow banks along with principal dealers (PDs) to trade in interest rate futures to help PDs with limited capital create the market where there are hardly any sellers; (2) use market yield to maturity as the benchmark for pricing underlying instruments rather than NSE' s zero-coupon curves to align futures prices with the market; and (3) market players should consistently offer two-way quotes to encourage retail participation in the market.

From a systemic perspective, the transfer of long-dated government securities from the banking system to institutional investors would shift the interest rate risk outside the banking system.[15] However, given the long-dated nature of their obligations, nonbanks may well be better armed to manage their interest rate exposure than banks.

V. CONCLUSIONS

This paper measures and assesses the management of interest rate risk of banks' government securities portfolios in India, which it identifies as a key risk for the banking system. In particular, it finds that the current aggregate level of IFR in the banking system would be insufficient to compensate for market losses resulting from a one percentage point parallel shift in the yield curve. However, while some PSBs and old private banks are the most vulnerable, foreign and new private banks have built in an adequate cushion. As a result, a key priority for the Indian authorities will be to scrutinize the risk management practices of individual banks. Given the potential for interest shocks higher than the one percentage point increase studied in the paper, an accelerating convergence towards Basel I risk-weighted capital charges, and the adoption of the Basel II, Pillar II approach for interest rate risk supervision, especially for those banks most vulnerable to a reversal of the interest rate cycle, could help ensure the stability of the financial system. In addition, the merits of Basel II, Pillar III relative to enhanced transparency on risk management should be considered rapidly. In this regard, the recent review by the Indian authorities of the recommendations of the advisory groups on international financial standards and codes, in particular those related to interest rate risk, is an encouraging step (see RBI, 2004c).

[15] The offloading of government securities may lead to an increase in interest rates as bond prices fall. As banks move to shorter-duration bonds, a sell-off in the long bonds segment can occur, thereby drastically steepening the yield curve. In addition, interest rate derivatives are vulnerable to convexity and can be adversely affected. As noted by Sarkar (2003), the players in swap markets are primarily banks. Since all of them are exposed to interest rate risk due to their holdings of government securities, the swap market would be one sided and lack depth if they were all to come forward to hedge their portfolio.

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Table 1. International Comparison of Banks' Holdings of Government Securities, 2003 [1/]
(in percentage)

	Number of Banks	Government Securities to Total Assets	Government Securities/ Total Securities
Argentina	66	19.1	85.2
Australia	30	1.4	10.3
Canada	26	2.8	9.9
Colombia	34	20.6	72.6
Costa Rica	31	9.5	46.7
Germany	79	5.6	19.9
Hungary	10	9.7	95.9
India	**93**	**32.4**	**79.7**
Indonesia	13	30.9	83.0
Korea	19	0.8	4.9
Lebanon	6	21.3	93.4
Malaysia	34	7.2	36.7
Mexico	40	8.8	47.9
New Zealand	6	4.9	38.1
Norway	45	24.5	85.5
Panama	67	1.2	23.0
Philippines	21	11.0	80.4
Singapore	8	7.8	74.8
South Africa	20	7.4	66.2
Spain	22	18.7	76.7
Sweden	21	3.2	25.3
Thailand	19	15.4	63.0
Turkey	31	37.2	91.6
United States	7770	12.3	64.8

Sources: Bankscope, FDIC, Reserve Bank of India, and Staff calculations

1/ Data for commercial banks for Germany, Spain, and Japan and for public sector banks for India.

Table 2. India: Outstanding Stock, Weighted Average Yield, and Maturity of Central Government Securities

	Outstanding Stock (Rs billion)	Outstanding Stock (in percent of GDP at current market prices)	Weighted Average Yield (in percent)	Weighted Average Maturity (in years)
1992	769	10.3	...	...
1995	1,375	11.6	13.75	...
2000	3,819	18.1	11.77	7.1
2003	6,739	27.3	7.34	8.9
2004	8,243	29.7	5.74	9.8

Source: Adapted from Mohan (2004).

Table 3. India: Interest Rate Risk of Banking System's Government Securities Holdings
(In billions of rupees as of end-March 2004, unless otherwise indicated)

	SCBs	PSBs	Old Private Banks	New Private Banks	Foreign Banks
Banking Indicators					
Total assets	19,750.2	14,714.3	1207	2465.8	1,363.2
Deposits	15,751.4	12,683.8	1053.31	1632.18	797.6
Net worth	1,165.9	792.2	72.9	152.3	148.4
Net profit	222.7	165.5	14.46	20.35	22.4
Capital adequacy ratio (CAR), in percent	12.9%	13.2%	13.7%	10.2%	15.0%
Investment in government securities (G-Sec)					
Total Investment portfolio	8,020.7	6,256.8	474.6	873.4	415.9
G-Sec holdings	6,391.4	5,102.3	352.9	609.5	326.7
G-Sec in AFS and HFT categories	5,093.8	4,023.4	293.1	474.3	302.2
Duration Method					
Modified duration (in years)	5.8	6.3	6.1	3.3	2.9
Convexity	63.9	70.8	68.0	26.4	20.7
Average coupon (in percent)	9.3	9.1	9.4	10.3	10.4
Losses					
Loss from 100bps rise in 10-year G-Sec	297.1	253.7	17.8	15.5	8.8
Loss as percent of portfolio value	5.8	6.3	6.1	3.3	2.9
Loss as percent of net profit	133	153	123	76	39
Loss as percent of net worth	25.5	32.0	24.4	10.2	6.0
New CAR after losses (in percent)	9.6	9.0	10.4	9.2%	14.1
Value-at-Risk Method 1/					
Variance-Covariance (Normal)	320.0	252.8	16.1	26.0	12.0
Exponential weighting	164.7				
Historical simulation	305.5				
Historical simulation (declining weights)	81.1				
Extreme value theory	134.6				
Investment Fluctuation Reserves (IFR)					
Actual IFR (in percent of AFS + HFT)	3.0	3.1	2.8	2.3	2.8
Actual IFR in Rs bns.	189.2	151.9	11.1	15.6	10.6
IFR shortfall	-107.9	-101.8	-6.7	0.1	1.8

Sources: Reserve Bank of India; National Stock Exchange; and author's estimates.
1/ Value-at-risk for a one-month holding period and a 99 percent confidence interval.

Table 4. Non-compliance with Basel Core Principles Relevant to Market and Other Risk Management[1/]
(In percent)

	Developing	Transition	Advanced
Number of countries	44	15	12
Countries noncompliant with CP 12 – Market Risk	66	53	0
Countries noncompliant with CP 13 – Comprehensive/Other Risk Management	66	53	0

Source: IMF.
[1/] Assessed as Materially Noncompliant or Noncompliant.