STOCK PRICE BEHAVIOR AND OPERATIONAL RISK MANAGEMENT OF BANKS IN INDIA

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ABSTRACT

Banks in India work in a controlled regime similar to several other countries. The focus of the research is to test the operational risk of sample banks operating in India and identify the extent to which banks are capable of bearing operational risks. The capital adequacy criteria to account for the operational risk using the Basic Indicator Approach points out that several banks do not meet the regulatory requirements. Further, the stock price movements of banks have been examined for randomness and it has been proved that the bank stock prices do not follow a Geometric Brownian motion. Risk management strategies of banks to reflect the price behaviour have been examined and banks that have adequate exposure to risk cover have been contrasted with banks having inadequate risk exposure cover.

Introduction

Banking system in India could be structured under four major categories namely State Bank of India and its Associates, Nationalized banks, Foreign banks and Other Scheduled Commercial Banks (SCBs). The distinct characteristics of these categories are established through the difference in their deposit size, ROA and the net NPA ratios (Table 1).

The reason as so why State bank of India and its associates are uniquely distinguished is due to their huge deposit size of $150.66 million with lowest return on assets (ROA) of 0.87% and the highest net NPA ratio. Comparatively, foreign banks have the least deposit size of $8.71 million and the highest ROA of 2.09%. Foreign banks participate less in issuance of advances & loans and adapt safe approach strategy in their investment portfolio and interest structure.

The banking system on the whole for the Indian Scheduled Commercial Banks with a capital to risk assets ratio (CRAR) of over 12% is comfortably placed thus complying to the BIS Standards. The average net NPA ratio of the Indian SCBs is 1.12. Also the Indian banking system has been taking considerable steps for combating credit risk.

Among the banks in India, State bank of India and its associates have deposits to the extent of 47.7% of the whole deposit structure of banks in India. The market risk measured through the standard deviation of the Bank NIFTY index returns is 3.52%.

Considerable steps have been initiated in order to combat the credit risk and the market risk. But there have been very few instances that deal with operational risk of banks. Klugman (1998) provides some inspiration as so how operational risks can be insured from the standard model of actuarial science. BIS (2001) tries to highlight the operational risk in its second consultative paper for the new Basel II capital accord. Voit (2002) tests the behaviour of market price and iterates the importance of accounting for operational risk through advanced management tools. BIS (2004) present the outcome of the Basel Committee on Banking Supervision's work over recent years to secure international convergence on revisions to supervisory regulations governing the capital adequacy of internationally active banks. This paper tries to test the behaviour of bank stocks and identifies the extent of operational risk of banks in India.

Performance of banks in India

New private sector banks grew at the highest rate during 2005-06 (43.2% compared to 19.4% in 2005) followed by Foreign Banks (31.2% compared to 12.7% in 2005) and old private sector banks (12.2% compared to 10.6% in 2005); whereas the Public Sector Banks (PSBs) declined in growth rate to 13.6% in 2006 compared to 20.6% in 2005 (RBI, 2006).

Operational performance of banks in India to a very large extent depends on the deposit growth and deposit structure. The share of demand deposits increased from 14.7% in 2001 to 17.0% in 2006, while that of time deposits declined from 85.2% to 83.0% during the same period. However, more significant changes were observed in the components of time deposits. The share of short-term deposits in the total time deposits increased sharply from 43.8% in 2000 to 58.2% in 2006, and that of long-term deposits declined correspondingly (Figure 1).

The share of short-term deposits in time deposits in 2006 was the highest for foreign banks (83.3%), followed by new private sector banks (80.6%), public sector banks (54.3%) and old private sector banks (51.6%) (Figure 2).

The increased preference for short-term deposits could be attributed to low returns on long-term deposits. This is evident from the spread between short-term and long-term deposits, which narrowed down to 75 basis points in 2006 from 100 basis points in 2005. In view of low spread, investors seem to prefer short-term deposits, despite low returns, while waiting for investment opportunities with higher returns. With low short-term interest rates, banks are able to mobilize resources at lower cost. This enables banks in a competitive environment to lend at lower cost to well-rated business firms to contain defaults on their loans. In the Indian context, it is observed that foreign and private sector banks have relatively high share of low cost deposits. Incidentally, these bank groups also have high profit margin and low NPA levels (RBI, 2006).

Stock Price Behaviour

The price behaviour of NSE Bank Nifty Index data taken at a one day time interval during the years 2000 and 2006 shows an upward trend (Figure 3). The Brownian motion process is used to represent the evolution of stock prices and other quantities subject to frequent small shocks.

Random behaviours of prices are tested through computation of the probability for an asset price $S(t)$ at time t. This is because investors require a percentage return over a certain time horizon τ.

$$\delta S_T(t) = \ln \frac{S(t+\tau)}{S(t)} \tag{1}$$

A log plot shows lot of variation (Figure 4) in the bank stock prices. The variation beyond +/- 0.02 is quite frequent indicating the random behaviour of the prices, showing an inconsistency in the pattern with the highest variation being at +0.05 and lowest at -0.06.

In order to analyse whether the prices follow the geometric Brownian motion and are drawn from a lognormal distribution, we plot the data using the following equation, where μ is the drift rate of the returns (growth rate of the asset value) and σ their standard deviation (volatility) (Bachelier, 1995).

$$p[\delta S_T(t)] = \frac{1}{\sqrt{2\pi\sigma^2\tau}} \exp \frac{\left([\delta S_T(t) - \mu\tau]^2\right)}{2\sigma^2\tau} \tag{2}$$

Bank NIFTY stock returns data does not follow the geometric Brownian motion and the plots are positively skewed with a fat tail (Figure 5).

Normalized returns are obtained from Equation (1) by subtracting the expectation value and dividing by the standard deviation of the return series

$$\delta s_T(t) = \frac{\delta S_T(t) - (\delta S_T(t))}{\sqrt{(\delta S_T^2(t)) - (\delta S_T(t))^2}} \qquad (3)$$

Linear correlations of 1-day returns δs_{1d} were computed with 3σ-error bars.

$$C_{1d}(\tau) = (\delta s_{1d}(t)\delta s_{1d}(t+\tau)) \qquad (4)$$

The significant correlations are very less with correlation coefficients varying between +/- 0.05 (Figure 6) with solid line representing a fit of the data of the sixth degree polynomial demonstrating that the data is almost uncorrelated and is given by the equation;

$$
\begin{aligned}
Y = &(9.4 \times 10^{-13})X^6 - (4.5 \times 10^{-10})X^5 + (8.1 \times 10^{-8})X^4 - \\
&(7.1 \times 10^{-6})X^3 + 0.0003X^2 - 0.0053X + 0.026
\end{aligned} \qquad (5)
$$

Market return data shows positive skewness and prominent fat tails, hence operational risk of Indian scheduled commercial banks (SCB) is different from that of any other banking entity. This could be due to the fact that the SCB's are monitored by RBI, whose proactive regulatory attitude to a large extent reduces the risk exposure of banks.

Operational Risk in India

The Basel Committee on Banking Supervision (BCBS) has adopted a common industry definition of operational risk, namely: "**The risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events**" (BIS, 1988).

In India considerable steps have been taken to counter the operational risk with Reserve Bank indicating that banks would start implementing Basel II with effect from 2007. The Reserve Bank also issued a guidance note for operational risk management and several initiatives were taken with RBI permitting banks to raise capital through new instruments namely (I) innovative debt instruments; (II) perpetual non-cumulative preference shares etc to enable them to meet capital requirements for facilitating the smooth transition to Basel II.

Later it was announced that Indian banks with presence outside India and foreign banks operating in India would be required to migrate to Basel II framework through Basic Indicator Approach with effect from 2008; while all other Indian banks by 2009.

The design and architecture for management of operational risk for banks in India would depend upon various factors namely the size and complexity of business, risk philosophy, market perception and the expected level of capital and hence the exact approach would differ from bank to bank. The Reserve Bank is also involved in capacity building for ensuring the regulators ability for identifying and permitting eligible banks to adopt Internal Rating Based (IRB)/Advanced Measurement approaches (RBI, 2006).

Computation of the Operational Risk in India (Basic Indicator Approach)

Basic Indicator Approach is the simplest approach that links the capital charge for operational risk to a single risk indicator namely the gross income for the whole bank, with each bank holding capital for operational risk equal to the amount of a fixed percentage, α, multiplied by its individual amount of gross income. The Basic Indicator Approach is easy to implement and universally applicable across banks to arrive at a charge for operational risk. Its simplicity, however, comes at the price of only limited responsiveness to firm-specific needs and characteristics. While the Basic Indicator Approach as such might be suitable for smaller banks with a simple range of business activities, the Committee expects internationally active banks and banks with significant operational risk to use a more sophisticated approach within the overall framework. The current provisional estimate is that α be set at around 30% of gross income. This figure needs to be treated with caution as it is calibrated on a limited amount of data (BIS, 2001). In India, for the Basic Indicator Approach RBI has prescribed a capital charge of 15% of the average gross income for the preceding

three years to cover operational risk (RBI, 2003). Capital adequacy requirements in terms of the operational risks are yet to be reached by the Indian banks.

Since the deficiency of the Basic Indicator Approach is the consideration of a single factor namely gross income, in order to accommodate the largest deposit base banks to meet the operational risk, the income structure has been given different weightage. Hence we made an Assumption of 3.5:1.5 for the Net Interest Income to Non Net Interest Income and compute using the Basic Indicator Approach for the three largest banks in India (in terms of deposit size) namely the ICICI bank, Punjab national bank and State bank of India listed in the NIFTY.

UTI bank (category of other SCB) and Syndicate bank (Nationalized) are the only two banks among the twelve banks listed in the Bank NIFTY which have adequate capital (Table 2). Whereas the State bank of India being the largest in terms of deposit size has the worst deficiency of -1574.13% and hence may not be in a position to confront if any operational risk occurs. It has to be made sure that the actual capital need to be increased in order to comply with the RBI's regulatory required capital, so that it would be in a position to withstand the operational risk. Also, Punjab national bank is the second worst with deficiency of -717.14% followed by ICICI bank (-103.62%). Bank of Baroda (-82.71%) and Canara bank (-80.21%) have deficiency of around 80%. Corporation bank (-77.41%) and Union bank (-71.42%) have a deficiency of around 70%. Comparatively for Oriental bank of commerce (-29.09%), HDFC bank (-28.98%) and Bank of India (-14.81%); the need to meet the regulatory capital requirements is relatively less.

Contrast Behaviour

The market risk measured through the standard deviation of the twelve banks listed in the NIFTY index returns is 2.74%. Comparison of ROE (1.55%) and ROA (0.85%) clearly

indicates that the Indian banking system is highly leveraged. Also the comparison of Net profit margin (9.75%) and Operating margin (8.5%) indicates that the Indian banking system is based on the fund based services rather than the traditional banking system (Table 3).

Syndicate bank (Nationalized) and UTI bank (other SCB) being the only two banks which have adequate RBI's regulatory required capital are compared with that of the other banks listed in the NIFTY. It has been found that the fund management efficiency and ROE is low for these two banks. Also, UTI bank has high NPM (10.8%) and low OM (8.1%). Also, it has to be noted that even though UTI bank and Syndicate bank have surplus capital as per RBI's requirements, they are inefficient in terms of the BIS regulatory capital requirements.

Conclusion

The bank index returns have been tested for the Geometric Brownian motion and it has been found that the banks stock return data is positively skewed and does not follow the Geometric Brownian motion. Our work will provide a useful basis for countering the operational risks as banks in India need to comply with the Basel-II requirements at the latest by 2009. The deficiencies of the simple approach namely the Basic Indicator Approach have been overcome by giving suitable weightages to income structure of large banks. It has been found that most of the banks listed in the NIFTY have deficiency in meeting the required Reserve bank of India's regulatory capital requirements and also the functional efficiency is not good in terms of operational risk. We need to explore this further.

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Tables and Charts

Table 1: Deposit size, CRAR, Net NPA ratio and ROA

(Group Averages)	Deposits ($ in millions)	CRAR (%)	Net NPA ratio	ROA (%)
SBI & its Associates	150.66	11.53	1.39	0.87
Nationalized banks	120	12.38	1.28	0.88
Foreign banks	8.71	12.58	0.78	2.09
Other SCBs	36.43	12.49	1.04	1.08
Average	78.95	12.25	1.12	1.23

(Note: $1 = Rs. 45)

Table 2: Basic Indicator Approach

($ in millions) Bank	Regulatory Req. Capital		Actual Capital	Deficiency/Surplus (Percentage)
	BIS (0.3)	RBI (0.15)		
State Bank of India*	38.85	19.42	1.16	-1574.13
Punjab National Bank*	11.45	5.72	0.7	-717.14
ICICI Bank Ltd*	11.25	5.62	2.76	-103.62
Bank of Baroda	2.96	1.48	0.81	-82.71
Canara Bank	3.28	1.64	0.91	-80.21
Corporation Bank	1.1	0.55	0.31	-77.41
Union Bank	3.84	1.92	1.12	-71.42
Oriental Bank of Commerce	1.42	0.71	0.55	-29.09
HDFC Bank Ltd.	1.79	0.89	0.69	-28.98
Bank of India	2.48	1.24	1.08	-14.81
Syndicate Bank	1.55	0.77	1.15	33.04
UTI Bank	0.9	0.45	0.61	26.22

 (Note: $1 = Rs. 45; Deficiency (-ve) and Surplus (+ve); and * represents an Assumption of 3.5:1.5 for Net Interest Income to Non Net Interest Income taken into account and is computed for the three largest banks in India (in terms of deposit size) listed in the NIFTY)

Table 3: Contrast Behaviour

March 2000- 2006 (Percentages)	Standard Deviation	ROE	ROA	OM	Fund Mgmt Efficiency	Asset Mgmt Efficiency	Net Profit Margin
State Bank of India	1.27	5.86	0.7	9.1	7.23	9.4	8.4
Punjab National Bank	3.18	3.3	0.9	9.3	3.52	9.7	9.7
ICICI Bank Ltd.	1.65	1.21	0.9	7.4	1.24	7.8	11.7
Bank of Baroda	2.34	2.14	0.8	8.9	2.62	9.2	8.7
Canara Bank	1.99	1.98	0.9	9.1	1.95	9.4	10
Corporation Bank	0.65	2.65	1.3	9.2	1.96	9.6	14.3
Union Bank	1.56	1.05	0.7	9	1.31	9.3	8.6
Oriental Bank of Commerce	0.58	2.29	1.1	9.6	1.91	10	12
HDFC Bank Ltd.	2.05	1.5	1.2	7	1.22	7.8	15.5
Bank of India	3.21	1.09	0.6	8.7	1.54	9.1	7.5
Syndicate Bank	5.44	0.72	0.8	8.9	0.83	9.3	9.3
UTI Bank	3.15	0.96	0.9	8.1	1.01	8.7	10.8
Average	2.74	1.55	0.85	8.5	1.82	9.2	9.75

Figure 1: Composition of Time Deposits of Scheduled Commercial Banks

Chart 1: Composition of Time Deposits of Scheduled Commercial Banks
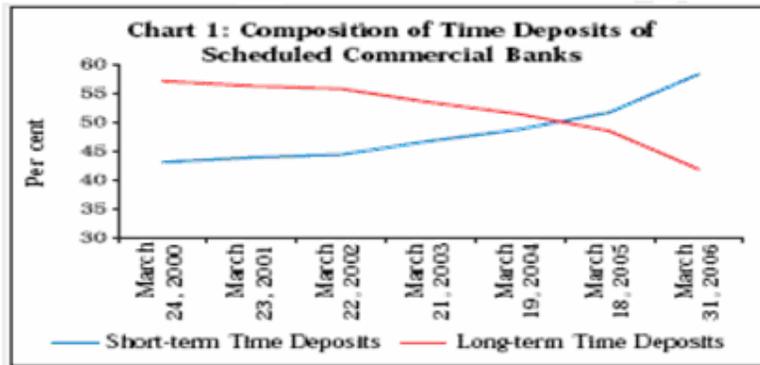
(Source: RBI, Changing Composition of Deposits of Scheduled Commercial Banks)

Figure 2: Bank Group-wise Composition of Time Deposits

Chart 2: Bank Group-wise Composition of Time Deposits (Fortnight ended June 23, 2006)
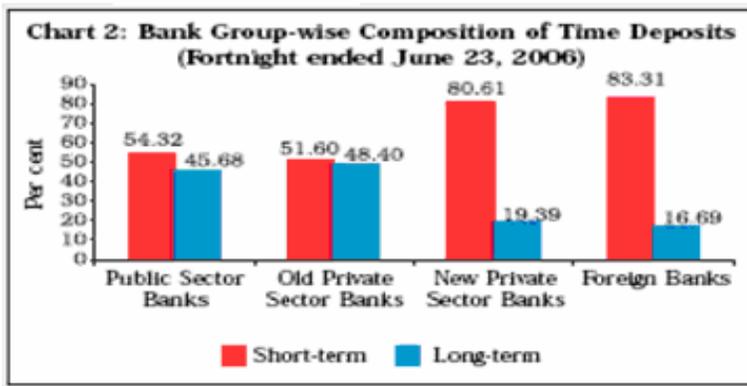
(Source: RBI, Changing Composition of Deposits of Scheduled Commercial Banks)

Figure 3: Price chart of the National Stock Exchange (NSE) Bank Nifty during 2000 and 2006. Data are taken on a one day time scale
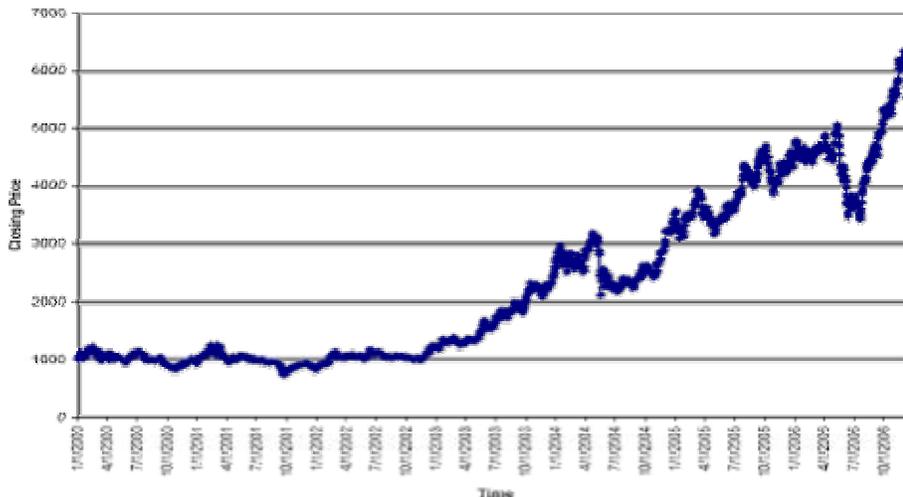
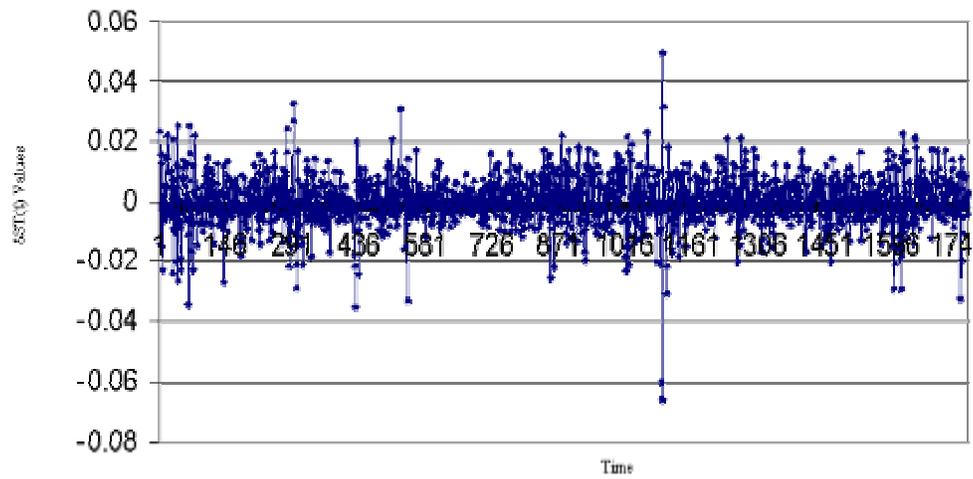**Figure 4: Log Plot for the NSE Bank Nifty**

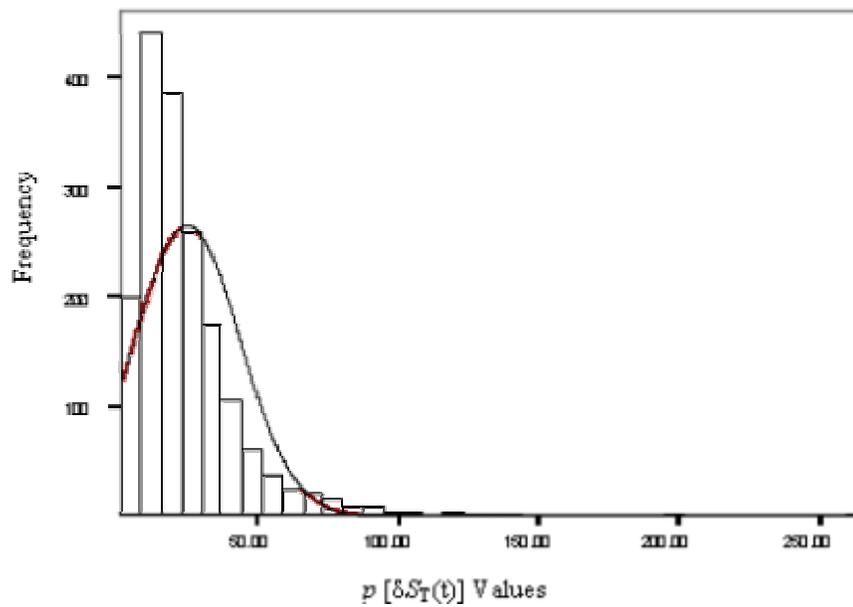**Figure 5: Plot to test the Bank NIFTY stock returns data for Gaussian distribution**

Figure 6: Linear correlations function $C_{1d}(\tau)$ for 1-day NSE Bank Nifty returns (dots) with 3σ-error bars. The solid line is a fit to Equation (5) at the sixth degree polynomial and demonstrates that the data are almost uncorrelated