Systemic fragility in Indian banking: Harnessing information from the equity market

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Abstract

India's banking system is characterised by high leverage, a subsidised safety net run by the State and the lack of a mechanism for closure of weak banks. In this paper, we obtain empirical estimates for the extent of leverage present, the stock of assets required to recapitalise the banking system, and the subsidy implicit in the existing safety net. We utilise option pricing theory in harnessing the information embedded in the level and volatility of equity prices for this purpose.

We find that in market value terms, the value of assets of banks range from 10 to 100 times of the value of equity. We estimate that atleast 8% of GDP would be required to bring the banking system up to a point where the value of assets were 10% higher than liabilities. Our estimates suggest that the safety net presently operated by the Indian State implies a subsidy, which works out to between 600 to 650 basis points on protected liabilities, and corresponds to an annual transfer of Rs.500 to Rs.700 billion a year to protected entities.

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1 Motivation

India's banking system presents severe problems for policy formulation, given a combination of public–sector domination, high leverage, high reserve requirements and the lack of an institutional mechanism for bank closure.

One important component of a strategy for banking reforms is a formal system of deposit insurance, as a way for moving away from a non–transparent State guarantee towards a transparent contract with well–defined rules (Talley & Mas 1990). As of today, all banks get deposit insurance from the Deposit Insurance and Credit Guarantee Corporation (DICGC) for a flat price of 0.05 basis points, and the first Rs.100,000 of each deposit is insured. Even though Indian banking experienced severe problems in the decade of the 1990s, only one bank was closed in this period. The State has, thus far, adopted the full liabilities of all banks, including some large bail–outs for banks with a negative net–worth. In this environment, the flat deposit insurance premium of 0.05 basis points could be a large subsidy in favour of insured deposits.

A recent working group of the Reserve Bank of India proposed important improvements in the system of deposit insurance (RBI 1999). The major proposals of this working group included a stronger role for the DIC as a liquidator of weak banks, and a migration towards risk–based premia.

As of yet, India has no experience with the closure of banks. Hence, actuarially fair values for deposit insurance premia cannot be estimated from historical experience.[1] Yet, the establishment of actuarially fair deposit insurance premia is an important question in financial sector reforms, for three reasons:

- First, if the premia are set too low, then the DIC would become bankrupt, and the safety net would fall back upon the resources of the State.
- Second, the shareholders of banks have perverse incentives to form highly risky portfolios in an environment where deposit insurance is not correctly responsive to the risk of their portfolio. This is particularly relevant in India today, given the sharp rise in the importance of private banks from 1992 onwards: a regime with flat pricing of deposit insurance is likely to generate a response from this group in the form of highly risky portfolios.
- Third, in the competition between banks and non–banks, deposit insurance constitutes a State subsidy which favours protected entities. It hinders the extent to which competitive forces shape the character of financial intermediation.

[1] The RBI report proposes certain values:

(basis points)

	CAMEL Rating		
Tier 1 Capital	A	B	$\geq$ C
Well capitalised ($\geq 9\%$)	5	6	9
Adequately capitalised (4–9 %)	10	12	16
Undercapitalised ($< 4\%$)	17	19	24

However, these values are essentially ad–hoc, and not vulnerable to objective discussions. The report says that these values were chosen so as to obtain Rs.9.3 billion per year of premiums into the DIC, a value that was chosen so as to reach the "prescribed 2% deposit insurance fund" within four years. This does not reflect the risk of bank failure in an actuarial sense. The variation of the deposit insurance premium in the 3×3 matrix is purely ad-hoc.

In recent years, in India, there have been heightened concerns about the contingent liabilities to the State that derive from "off–balance sheet" guarantees. In recent research (Laeven 2000, Kaplan 1998), the gap between actuarially fair prices for deposit insurance and the prices actually charged is interpreted as the subsidy implicit in the safety net. This subsidy directly impairs the allocative efficiency of the financial sector. Laeven finds that banks with are paid large subsidies are more likely to fail; i.e. that a subsidised safety net could actually increase the probability of a banking crisis.

In this paper, we use option pricing theory to infer deposit insurance premia for some Indian banks. This approach is attractive for two reasons:

- For the most liquid bank stocks of India, which we focus on, there is likely to be a strong community of speculators who watch the bank, obtain a wide variety of information about the bank (including some information which is not public), and undertake speculative trades based on a valuation of the bank. The stock market valuation would certainly go far beyond accounting data in forming a judgement about the bank. The stock market valuation is likely to be a holistic view, which would reflect the valuation and risk of the asset portfolio, NPAs, profitability rates, technology and processes, etc. The analytical framework of this paper exploits the level and volatility of the share price of a bank in judging the failure probability of the bank.
- It is an objective and transparent procedure that is rooted in sound economic theory. It is easy to replicate these calculations and explore the sensitivity of the results to underlying assumptions.

We are unable to embark upon formal statistical testing of the accuracy of these estimates: since banks have not been closed down in recent decades in India. However, we do obtain some qualitative feedback about the information content of these estimates.

These estimates allow us to measure the subsidy that accrues to protected entities in India, by virtue of the safety net which is presently in operation. It also gives us estimates for the fresh equity capital that is required to contain the leverage in Indian banking.

2 Analytical framework

The modern understanding of credit risk originated in Merton's work from 1974 to 1978 (Merton 1974, 1977, 1978). These articles applied the insights of option pricing theory (Black & Scholes 1973, Merton 1973) into the structure of a firm, where equity holders are viewed as having a call option on the assets of the firm, and bond holders are viewed as being short a put option on these assets. Merton's approach is an elegant and consistent framework for thinking about credit risk.

In the context of deposit insurance, suppose the assets of a bank are V with volatility σ_V. Let the face value of deposits be B and T be the expiration date of a deposit insurance contract. From $t = 0$ onwards, V will fluctuate from day to day, and if the bank is closed down when $V < B$, the DIC will stand to lose $B - V$. The payoff of the DIC is identical to that of an american put option with strike price B written on the assets V. Hence, option pricing theory is directly relevant in measuring the actuarially fair value of the deposit insurance. However, actually computing deposit insurance premia requires estimates of V and σ_V, which are normally unobserved. The path towards obtaining estimates of these is by exploiting observations of the equity market capitalisation E (a call option on the assets of the bank) and the equity volatility σ_E.

Our approach draws upon a key innovation of Ronn & Verma (1986) in modeling the expectations of the stock market about the "forbearance" that the banking regulator will display. Their model of the expectations of the stock market uses a "forbearance factor" ρ, where the DIC does not close down a bank when the net worth reaches zero. Bank closure is only triggered when $V < \rho B$ where $\rho < 1$. Given India's history of bailing out weak banks, we would expect that the stock market factors expectations about forbearance into its valuation of banks.

With forbearance in the picture, the market capitalisation of equity (E) is the value of a call option on the assets of the bank with the strike price set to ρB instead of B:

$$X = \rho B \tag{1}$$
$$E = VN(d_1) - XN(d_2) \tag{2}$$
$$\text{where } d_1 = \left(\log \frac{V}{X} + \frac{\sigma_V^2 T}{2}\right)(\sigma_V \sqrt{T})^{-1} \tag{3}$$
$$\text{and } d_2 = d_1 - \sigma_V \sqrt{T} \tag{4}$$

Using Ito's lemma, the standard deviation of the process dE/E, σ_E, is given by:

$$\sigma_E = \sigma_V \frac{V}{E} \frac{\partial E}{\partial V} \tag{5}$$
$$\text{i.e. } \sigma_E E = \sigma_V V N(d_1) \tag{6}$$

This gives us two equations in two unknowns V and σ_V: Equation (2) which values the equity, and Equation (6), which links up the volatility of the asset to the volatility of the call.[2] We solve these to obtain estimates which we call $\hat{V}$ and $\hat{\sigma}_V$.[3] The deposit insurance premium p per rupee of insured deposits is then calculated as:[4]

$$X = B \tag{7}$$
$$p = N(-d_2) - \frac{\hat{V}}{B} N(-d_1) \tag{8}$$

Ronn & Verma (1986) explore the implications of demarcating between B_1, insured liabilities, and B_2, uninsured liabilities. The failure of a bank is triggered by *total* liabilities $B = B_1 + B_2$. The fair price for deposit insurance, per rupee of deposits, is driven by the failure probability and is not sensitive to B_1/B. Hence, for our first goal, which is the measurement of fair prices for deposit insurance, we focus on the total liabilities B. In Table 4, where we translate these prices of deposit insurance into a flow of subsidy from the State, we decompose the subsidy implied by a safety net for deposits B_1 versus the subsidy implied by a safety net for all liabilities $B = B_1 + B_2$.

[2] We should note that in Equation 6, d_1 is computed using $X = \rho B$.

[3] This is done using the `fsolve` function in Octave <`http://www.che.wisc.edu/octave`>, which in turn calls the `hybrd` function in MINPACK. The starting values $V_0 = E + B$ and $\sigma_{V0} = E\sigma_E/B$ give robust convergence for all values of ρ used in this paper.

[4] We should note that in Equation 8, d_1 and d_2 are computed using $X = B$.

Recent research has dealt with the impact of stochastic volatility upon deposit insurance premium calculations (Duan 1994, Duan & Yu 1999). This research has developed a maximum–likelihood framework for measuring the deposit insurance premium which is consistent with stock returns which follow a GARCH process. There is strong evidence that stock price volatility is not constant, from financial markets across the world (Bollerslev et al. 1992) and from India (Thomas 1998, Thomas & Shah 1999), so these new ideas could improve our ability to map stock prices into deposit insurance premia. However, this framework requires a daily time–series for the deposits of the insured bank. In India, we are restricted to observations of bank deposits at the end of the year only. Hence, while these innovations could be of great value to the DIC in forming operational procedures for the calculation of risk–based premia, we do not address these issues in this paper.

The above methods have been used in numerous empirical studies, such as studies of Japan (Oda 1999, Fries et al. 1993), Canada (Giammarino et al. 1989), Taiwan (Duan & Yu 1994) and Thailand (Kaplan 1998). Laeven (2000) applies these methods to a sample of 137 banks in 12 countries and explores the implications of the cross–sectional variation in the implicit subsidy of existing deposit insurance programs. These studies have helped us develop some confidence about the practical usefulness of this approach.

3 Empirical issues

3.1 Defining the universe of banks covered by the safety net

Strictly speaking, only banks are covered by the DICGC, and the safety net operated by the DICGC is only supposed to cover deposits upto the first Rs.100,000. However, in practice, the safety net is much more extensive:

- The normal interaction between DICGC and banks such as Indian Bank should have been one where the bank was closed down, and DICGC paid off depositors. Instead, the Indian State ensured the survival of Indian Bank, a much more encompassing notion of the safety net.
- UTI has no contract with DICGC, yet the Indian State organised a bail–out for UTI's US–64 product. This may reflect an inclination to protect public sector entities, or it may reflect a "too big to fail" situation.

In this paper, we treat banks and development financial institutions (DFIs) on a common footing, presuming that they obtain a safety net at the price of 0.05%. This is an approximation at two levels: (a) DFIs do not pay 0.05% to DICGC so the subsidy implicit in the safety net extended to them is slightly higher than is the case with banks. (b) There is no publicly announced safety net which protects DFIs. However, as the US-64 experience shows, there is good reason to believe that a DFI in distress would be able to elicit a bail–out from the State.

3.2 Lack of stock market liquidity

The values of $\hat{V}$ and $\hat{\sigma}_V$ by solving Equations 2 and 6 are transformations of values for E and σ_E that we observe from the stock market. The usefulness of the latter is based on the informational efficiency of the stock market. If the market for the shares of a bank is efficient, then E and σ_E will reflect a wealth of information about the value of assets of the bank, and the estimates of $(\hat{V}, \hat{\sigma}_V)$ that are then obtained out of (E, σ_E) will be reliable.

Stock market liquidity is known to be a key determinant of market efficiency. If the shares of a bank are thinly traded, then the prices will suffer from the bid–ask bounce, stale prices, and will be more vulnerable to market manipulation. Low liquidity is associated with lower information production by speculators of the economy, and is associated with short–horizon mean–reversion, and an upward bias in volatility.

In recent years, the Indian equity market has made major advances in terms of improved market mechanisms, leading to higher liquidity and market efficiency (Shah 1999, Shah & Sivakumar 2000, Shah & Thomas 2000). We may now be in a situation where we have a modest time–series of prices where we may feel confident about the market mechanisms that generated them. Hence, in this paper, we restrict our attention to utilising stock prices over the period from 1 April 1997 till 31 March 2000.

For these reasons, we will restrict our empirical work to banks with highly liquid equities. The National Stock Exchange (NSE), the largest stock market in India, is an electronic limit–order–book market. The most accurate measurement of liquidity is based on "snapshots" of the NSE limit order book. These measures are superior to notions of liquidity based on turnover, which does not measure transactions costs.

NSE makes three snapshots per day available. Table 1 shows the results obtained for the 61 snapshots for January 2000. It shows us the listed banks of India, sorted by stock market liquidity. In this paper, we work with the twenty most liquid banks, thus stopping at BANKMADURA which has a bid–offer spread of around 3% for a transaction size of Rs.10,000.

The estimation of deposit insurance premia for these twenty banks does not solve the problem of the DIC, which needs to deal with all banks, not just the banks with highly liquid shares. However, these empirical estimates can be used for calibrating thumb rules, which map traditional observables such as leverage measured using accounting data, and the CAMEL rating into the deposit insurance premium.

3.3 Stock price volatility

We assume that the relevant stock price volatility is the annualised volatility observed over one year. For example, accounting data for the year ended 31/3/1999 is juxtaposed with the market capitalisation as of this same date, and the historical volatility observed from 1/4/1998 till 31/3/1999.

3.4 Measuring liabilities

Our data is drawn from the CMIE Prowess database. The field `tot_asset` is used to measure total liabilities B, and `deposits` is used to measure the sub–component of total liabilities which are deposits.

3.5 Choice of forbearance factor ρ

Indian banking regulation is characterised by extreme forbearance, where banks which are insolvent continue to be in business. We use the Indian Bank episode as a guide for choosing the forbearance

Table 1 Stock market liquidity of listed banks on NSE in January 2000

This table reports the results of simulating buy and sell market orders worth Rs.10,000, for each listed bank, on all the 61 snapshots of the NSE order book in January 2000. If an execution was completed with a market impact cost below 1.5%, it is classified as "Category I". If an execution is completed but at a market impact cost of worse than 1.5%, it is termed "Category II". Partial executions are "Category III", and are imputed to have an impact cost of 3%. If both buy and sell limit orders are not present in the book, this is termed "Category IV", and are imputed to have an impact cost of 5%.
As an example, consider Nedungadi Bank (the bottom row). Orders for Rs.10,000 translate into an average trade size of 128 shares. In 13 of the 61 snapshots, it was possible to do a single market order of 128 shares at a market impact cost below 1.5%. There were 20 snapshots where the market order was filled, but at an impact cost of worse than 1.5%. In 6 snapshots, there was a partial execution (imputed at 3% impact cost) and there were 22 snapshots where both of bid and offer prices were unavailable (imputed at 5% impact cost). This gave an average buy–side impact cost of 3.351% and a sell–side impact cost of 3.154%. This is roughly equivalent to thinking that the bid–offer spread at 128 shares was around 6.5%.

	Category				Impact cost (%)		
Symbol	I	II	III	IV	Buy	Sell	Shares
SBIN	60	0	0	1	0.248	0.248	40
ORIENTBANK	60	1	0	0	0.384	0.370	210
BANKBARODA	60	0	0	1	0.427	0.413	151
SYNDIBANK	60	0	0	1	0.486	0.491	754
BANKINDIA	60	0	0	1	0.491	0.490	501
IFCI	60	0	0	1	0.580	0.530	896
CORPBANK	57	1	0	3	0.623	0.625	83
BANKPUNJAB	59	1	0	1	0.648	0.657	568
IDBI	56	0	0	5	0.678	0.684	245
J&KBANK	56	4	0	1	0.766	0.773	286
ICICI	54	1	0	6	0.784	0.792	101
VYSYABANK	55	4	0	2	0.986	0.970	78
DENABANK	47	13	0	1	1.086	0.983	707
CENTURION	52	3	1	5	1.167	1.204	441
IDBIBANK	50	1	0	10	1.270	1.244	527
HDFCBANK	48	0	0	13	1.303	1.300	59
KARURVYSYA	49	0	0	12	1.383	1.383	66
BANKRAJAS	38	17	0	6	1.432	1.407	334
GLOBLTRUST	47	0	0	14	1.444	1.439	128
BANKMADURA	45	6	0	10	1.498	1.503	93
INDUSINDBK	46	0	0	15	1.603	1.580	353
UNIWESTBNK	32	23	0	6	1.733	1.685	360
SOUTHBANK	29	31	0	1	1.771	1.754	559
LAKSHVILAS	36	14	0	11	1.848	1.901	236
UTIBANK	44	1	0	16	1.859	1.822	378
FEDERALBNK	36	1	3	21	2.190	2.083	199
ICICIBANK	32	0	1	28	2.551	2.502	143
NEDUNGBANK	13	20	6	22	3.351	3.154	128

Table 2 Deposit insurance premia: Baseline case ($\rho = 0.9$)

This table shows estimates of deposit insurance premia under the assumption that $\rho = 0.9$. For example, the deposit insurance premium required for Bank of Baroda works out to 3.65% on 31/3/1998, 7.46% on 31/3/1999 and 7.74% on 31/3/2000. The premium is expressed as percent of insured deposits.

(basis points)

	31/3/1998	31/3/1999	31/3/2000
Bank of Baroda	365.04	745.74	773.82
Bank of India	428.85	766.12	823.48
Bank of Madura	729.65	827.71	750.80
Bank of Punjab	142.72	465.87	542.11
Bank Rajasthan	735.82	910.02	710.51
Centurion Bank			718.66
Corporation Bank	110.92	413.93	488.71
Dena Bank	645.86	836.58	860.01
Global Trust Bank	128.17	399.25	292.34
HDFC Bank	5.65	44.27	51.56
ICICI	207.42	629.05	209.65
IDBI Bank			296.90
IDBI	159.03	711.67	572.08
IFCI	394.61	824.17	758.75
J&K Bank		834.20	840.52
Oriental Bank	210.83	679.22	714.85
SBI	222.17	499.22	600.29
Syndicate Bank			830.47
Vysya Bank	645.03	762.43	742.05

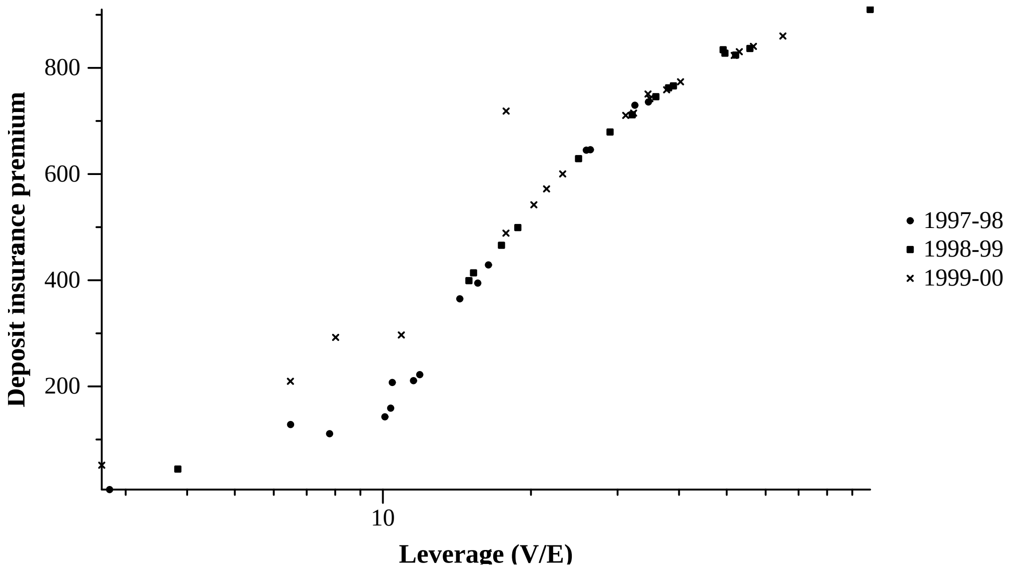
parameter ρ. A value such as $\rho = 0.9$ could be appropriate; i.e. that a bank will indeed be closed down when $\hat{V} - B = -B/10$.

As an example, consider Vysya Bank, which had deposits of Rs.89 billion as of 31 March 2000. A regime with $\rho = 0.9$ implies that the RBI would initiate closure of Vysya Bank when the value of its assets fell below Rs.80.4 billion. If we model the expectations of the stock market as $\rho = 0.9$, we get estimates for Vysya Bank's assets as being Rs.82.7 billion with $\hat{\sigma}_V = 0.021$.

For a comparison, a regime with $\rho = 0.95$ would be one where Vysya Bank would be closed down when the value of its assets fell below Rs.84.5 billion. If we model the expectations of the stock market as $\rho = 0.95$, we get estimates for Vysya Bank's assets as being Rs.87 billion with $\hat{\sigma}_V = 0.02$. It is interesting to note that under either model of expectations of the stock market, Vysya Bank's assets appear to be below B, which is Rs.89 billion.

Figure 1 Leverage and the deposit insurance premium off Table 2

This scatter plot re-expresses the 50 observations of the deposit insurance premium found in Table 2. The estimate of leverage on the x axis utilises our computation of $\hat{V}$ to express leverage as $\hat{V}/B$. Observations for the three years are shown using different symbols. The x axis (leverage) uses log scale.



4 Estimating the subsidy implied by the safety net

4.1 Baseline estimates: $\rho = 0.9$

Table 2 shows deposit insurance premia calculated under the "baseline assumption" of $\rho = 0.9$. The DICGC today charges a flat insurance fee of five basis points. All the values in this table are higher than five basis points. The difference between the value seen in this table, and the price paid to DICGC (i.e. five basis points) is a measure of the subsidy that the safety net is giving the bank. These estimates measure the extent to which the interest rate paid by the bank would have to be higher in the absence of the safety net. This subsidy ranges from values as low as 0.65 basis points for HDFC Bank in 1997-98 to 905 basis points for Bank of Rajasthan in 1998-99.

Table 2 suggests that there is strong heterogeneity in the fair values of deposit insurance premia; that a flat–rate regime would involve a significant cross–subsidy from strong banks to weak banks even if the average level of the insurance premium was set correctly.

4.2 Leverage and deposit insurance premium

There are 50 observations in Table 2, spread over three years and 19 banks. A simple question that can be asked is: in these fifty data points, how does leverage impact upon the deposit insurance premium? Figure 1 shows a scatter plot of these fifty points, and Table 3 shows estimates for a fixed–effects model of this relationship. We find that there is a strong relationship between leverage and the subsidy; that highly leveraged entities are the most subsidised. This is consistent with the findings of

Table 3 Fixed–effects model for the leverage / deposit insurance premium relationship

This shows a fixed–effects regression for the values of the deposit insurance premium seen in Table 2. There is a distinct intercept for the three years of data. Leverage is defined as $\hat{V}/E$ where $\hat{V}$ is the value of assets of the bank computed by us assuming $\rho = 0.9$, and E is the observed equity market capitalisation. Standard errors are shown in brackets.

Coefficient	Slope
Intercept 1997-1998	-10.8381
	(26.178)
Intercept 1998-1999	38.3694
	(33.516)
Intercept 1999-2000	52.1052
	(31.599)
Leverage	26.4151
	(1.526)
Leverage^2	-0.1925
	(0.017)
T	50
R^2	0.9876
σ_ϵ	70.772

Laeven (2000), where the size of the subsidy is found to be a strong predictor of banking distress in a sample of 137 banks in 12 countries.

4.3 The subsidy expressed in value terms

The results showed in Table 2 pertain to the cost of deposit insurance, expressed per unit of insured deposits. In Table 4, this is translated into value terms for the most recent year, under two assumptions: that all deposits are insured, or that all liabilities are insured. This shows that for these 19 banks as a whole, the subsidy implied in the safety net in 1999-2000 was Rs.277 billion (652 basis points) if we think that only deposits were covered, or Rs.412 billion (603 basis points) if we think that all liabilities of these firms were covered.

4.4 Estimates under the assumption $\rho = 0.95$

It is important to emphasise that all the calculations so far are based on an *assumption* that the stock market believes that $\rho = 0.9$, i.e. that the RBI will allow a bank to find its assets a full 10% below liabilities before initiating closure, and that the RBI will indeed initiate a closure when this happens. This is the most optimistic scenario that is consistent with recent experiences such as Indian Bank. In order to illustrate the magnitudes involved, Table 5 shows the values obtained *if we assume that the stock market believed that* $\rho = 0.95$ *instead*.

There is one apparent interpretation of these two tables which is incorrect. If the RBI is actually in a regime with $\rho = 0.9$ and now decides to move into a regime with $\rho = 0.95$, then it is not the case

Table 4 The subsidy of the safety net in value terms (1999-2000)

The first column shows the deposit insurance subsidy implied by (a) the present regime of a flat price of 0.05% and (b) the estimates for 31/3/2000 found in Table 2. The second and third columns show deposits and liabilities as of 31/3/2000 respectively. These are used to compute the subsidy, measured in rupees per year, implied in protecting deposits and protecting all liabilities.
For example, for Bank of Baroda, the subsidy works out 7.69% per year. On a base of deposits of Rs.513.08 billion, this is a subsidy of Rs.39.45 billion. On a base of liabilities of Rs.586.05 billion, this is a subsidy of Rs.45.06 billion.

	DI subsidy			Subsidy	
	(basis pts)	Deposits (Rs.Bln)	Liabilities (Rs.Bln)	Deposits (Rs.Bln)	Liabilities (Rs.Bln)
Bank of Baroda	769	513.08	586.05	39.45	45.06
Bank of India	818	477.43	564.40	39.05	46.16
Bank of Madura	746	36.41	44.43	2.71	3.31
Bank of Punjab	537	26.07	31.95	1.39	1.71
Bank Rajasthan	706	32.42	39.81	2.28	2.81
Centurion Bank	714	38.67	52.24	2.76	3.72
Corporation Bank	484	142.80	167.62	6.91	8.11
Dena Bank	855	132.87	168.51	11.36	14.40
Global Trust Bank	287	61.99	75.42	1.77	2.16
HDFC Bank	51	84.28	116.56	0.42	0.59
ICICI	205	48.59	658.16	0.99	13.49
IDBI Bank	292	34.48	45.12	1.00	1.31
IDBI	567	17.53	721.69	0.99	40.91
IFCI	754	0.00	234.02	0.00	17.64
J&K Bank	836	94.22	105.61	7.87	8.82
Oriental Bank	710	220.95	245.41	15.68	17.42
SBI	595	1968.21	2615.04	117.10	155.59
Syndicate Bank	825	236.55	271.63	19.51	22.40
Vysya Bank	737	74.24	89.35	5.47	6.58
Total					
Rs.Bln		4240.79	6833.02	276.71	412.19
Basis points				652	603

Table 5 Deposit insurance premia assuming $\rho = 0.95$.

This table is the same as Table 2, except that we model the stock market's expectations about bank closure as $\rho = 0.95$ instead of $\rho = 0.9$.

			(basis points)
	31/3/1998	31/3/1999	31/3/2000
Bank of Baroda	72.20	250.36	275.23
Bank of India	80.46	268.23	323.49
Bank of Madura	251.63	329.48	270.17
Bank of Punjab	10.88	100.48	132.90
Bank Rajasthan	241.16	410.02	230.08
Centurion Bank			373.75
Corporation Bank	20.97	100.64	126.07
Dena Bank	150.08	336.58	360.02
Global Trust Bank	41.25	92.69	128.08
HDFC Bank	1.98	17.50	29.29
ICICI	35.99	167.74	91.22
IDBI Bank			88.22
IDBI	13.51	215.52	152.44
IFCI	59.73	324.17	261.89
J&K Bank		337.92	340.53
Oriental Bank	18.32	189.50	221.38
SBI	17.31	98.88	156.03
Syndicate Bank			330.55
Vysya Bank	182.96	266.38	251.79

that the subsidy will move from the values seen in Table 2 to the values seen in Table 5. This is because *stock prices and volatilities will change when ρ moves from 0.9 to 0.95*. These calculations would need to be done afresh in the new regime in order to find out the magnitude of the subsidy with $\rho = 0.95$. The information presented in Table 5 can only be interpreted as estimates of the subsidy if we held the view that the stock market believes that $\rho = 0.95$.

4.5 Implications for setting deposit insurance premia

Our results suggest that the information contained in stock prices, interpreted through the prism of option–pricing theory, could be viewed as an additional input into the process of judging the vulnerability of a bank. The market efficiency literature has given us much evidence about the remarkable ability of stock market speculators in uncovering information and processing it efficiently. Models such as those utilised in this paper make it possible for the DIC to harness this source of information, and improve the transparency of the premium–setting process.

The DIC *could* set premia in a purely ad–hoc manner, based on a judgement about the vulnerability of a bank obtained through inspections and mandatory information disclosure by the bank. However, there is no guarantee that discretionary, non–transparent actions of the DIC will always yield optimal conclusions.

To the extent that publicly available information, processed in a transparent manner, is used as an input into the setting of risk–based premia, it would improve the functioning of the DIC. For example, if a bank contemplates reduced leverage, it can work through these models and arrive at a fairly reliable set of estimates linking up alternative levels of leverage to the deposit insurance premia which would prevail. This is a more transparent environment as compared with a world where the thought process of the DIC is purely judgemental.

There are two classes of publicly visible information which can be processed in a transparent manner: capital ratios and stock prices. It is likely that the private information set of the DIC, the information contained in capital ratios and the information contained in stock prices are all non–overlapping in useful ways. In this case, a sound strategy for the DIC would be to combine two transparent model–based inputs (models based on option–pricing theory, and reduced form models based on capital ratios) with its own, private assessment of the bank.

5 Estimates of capital shortfall

On the path to obtaining estimates of p, the deposit insurance premium, we compute $\hat{V}$, the stock market's view about the value of assets of the bank. This evidence, for the accounting year 1999-2000, is summarised in Table 6. In this table, an infusion of Rs.397 billion of equity capital would be required to bring the sixteen weak banks up to a point where $\hat{V} = B$; an infusion of Rs.1027 billion would be required to bring the eighteen weak banks up to a point where $\hat{V}$ is 10% above B.

Table 6 also offers useful intuition into our assumption that the stock market thinks $\rho = 0.9$. The weakest bank here, J&K Bank, is at $\hat{V}/B = 0.916$. Our assumption of $\rho = 0.9$ can be restated as follows: The stock market believes that RBI will close down J&K Bank if assets drop from $\hat{V} = 96.73$

Table 6 Comparing $\hat{V}$ and B in 1999-2000 in the baseline case

The estimates of the deposit insurance premium assuming $\rho = 0.9$ in Table 2 are based on estimates for $\hat{V}$ and $\hat{\sigma}_V$. This table juxtaposes these estimates of $\hat{V}$ with the liabilities of the bank, for 31/3/2000.
For example, we see that HDFC Bank is estimated to have assets of Rs.167.02 billion, which are 1.433 times larger than the liabilities of Rs.116.56 billion. This table is sorted by $\hat{V}/B$. The first three banks are estimated as having $\hat{V} > B$, the remaining banks have liabilities larger than estimated assets.

Bank	B (Rs.Bln)	$\hat{V}$ (Rs.Bln)	$\hat{V}/B$
HDFC Bank	116.56	167.02	1.433
ICICI	658.16	697.88	1.060
Global Trust Bank	75.42	77.19	1.023
IDBI Bank	45.12	**44.64**	0.989
Corporation Bank	167.63	**159.69**	0.953
Bank of Punjab	31.95	**30.23**	0.946
IDBI	721.69	**680.62**	0.943
SBI	2615.04	**2458.26**	0.940
Centurion Bank	52.24	**49.00**	0.938
Oriental Bank	245.41	**227.87**	0.929
Bank Rajasthan	39.81	**36.98**	0.929
Vysya Bank	89.36	**82.73**	0.926
Bank of Madura	44.44	**41.10**	0.925
IFCI	234.01	**216.26**	0.924
Bank of Baroda	586.05	**540.70**	0.923
Bank of India	564.40	**517.93**	0.918
Syndicate Bank	271.63	**249.07**	0.917
Dena Bank	168.51	**154.02**	0.914
J&K Bank	105.61	**96.73**	0.916
Sum	6833.06	**6527.93**	0.955

by an additional Rs.1.7 billion or 1.74% to $\hat{V} = 95.05$, which is the trigger point for closure in a world with $\rho = 0.9$.

6 Implications for the banking system as a whole

At a qualitative level, we have always known that the safety net operated by the Government of India involves a large transfer to protected entities. The results above give us numerical estimates of the size of the subsidy involved in this operation. As seen in Table 4, the guarantee of the State for these 19 banks is probably worth between Rs.300 billion to Rs.400 billion per year. The size of the subsidy, at around 600 to 650 basis points, is highly economically significant, and is likely to be associated with large distortions in resource allocation by the financial sector.

Our results also give us numerical estimates of the gap between assets and liabilities in Indian banking. As shown in Table 6, 16 of the 19 banks have assets which are smaller than liabilities. An infusion of Rs.1027 billion would be required to bring the eighteen weak banks up to a point where $\hat{V}$ is 10% above B.

The 19 banks analysed in this paper are likely to be the more healthy banks in India, given the selectivity that underlies the process of taking a bank IPO. For example, banks such as Indian Bank have not gone IPO. Hence, if we linearly scale up the estimates obtained for these 19 banks to the banking system as a whole, we are likely to have a bias in favour of understating the difficulties of Indian banking.

The total deposits of Indian banking are 88% higher than the aggregate of these 19 banks. The total liabilities of Indian banking are 69% higher than the aggregate of these 19 banks. Applying linear scaling:

- The subsidy for Indian banking as a whole, implied in the safety net, works out to roughly Rs.521 billion per year if we think that only deposits are protected, and Rs.696 billion per year if we think that all liabilities are protected.
- Roughly Rs.1736 billion of fresh equity capital may be required to bring Indian banking up to a point where all banks have $\hat{V}$ which is atleast 10% above B.

7 Conclusion

Our results paint a sombre picture of India's banking system. The safety net presently in place implies a large subsidy of 600 to 650 basis points to protected entities, and may be associated with an annual transfer of between Rs.500 to Rs.700 billion per year to protected entities. If we think that a sound banking system is one in which all banks have $\hat{V}/B > 1.1$, then fresh equity capital of roughly Rs.1700 billion may be called for to strengthen India's banking system as a whole.

It is likely that these numerical values are understated owing to two key assumptions:

- We assume that the stock market believes that $\rho = 0.9$, i.e. that the RBI will actually close down banks when they hit V/B of 0.9, even though there is no evidence of an institutional mechanism for closing down banks as of today. If lower values such as $\rho = 0.8$ were employed, we would obtain more sombre estimates.

- We assume that the nineteen banks with liquid shares on the stock market are representative of India's banking system, when there is actually a selectivity bias whereby the weaker banks have not yet gone IPO. Our linear scaling from evidence for nineteen banks to the banking system as a whole is a relatively optimistic one.

Hence, these values should be viewed as lower bounds on the actual difficulties of Indian banking.

These results have important implications in two directions:

- The first issue is about the fragility of public finance in India. Our estimates suggest that the State is giving a guarantee to the banking system which is worth between Rs.500 billion to Rs.700 billion per year, and that equity capital of around Rs.1700 billion is needed to get India's banking system to the minimal levels of leverage.

  These are extremely large values by the standards of Indian public finance. From a policy perspective, the most cost–effective way of dealing with this situation is to undertake banking reforms, which would generate smaller values for the implicit subsidy and for the fresh equity capital required.

- The second issue is about distortions in the financial sector, and resource allocation. Our estimates suggest that the safety net involves a subsidy of around 600 to 650 basis points, which is a economically significant distortion. The reduction or elimination of these distortions would be the second payoff from undertaking banking reforms.

  In most countries, the modern development of the financial sector has been accompanied by a migration away from commercial banking towards securities markets (Litan 1991). A regime with subsidised deposit insurance serves to hinder this transition. In particular, in the decade of the 1990s, securities markets in India have obtained revolutionary improvements in terms of institution building, improvements to market mechanisms, and improvements in liquidity and market efficiency. Yet, over the decade of the 1990s, the importance of the banking system in India's economy has only dropped by a modest extent. The existence of this large subsidy to banking may be important in explaining this anomaly.

What strategies can policy makers adopt in trying to obtain lower values for the equity shortfall and the subsidy of the safety net? In the short term, the simplest path is to use a variety of instruments to obtain a smaller stock of bank deposits. Policy initiatives to shrink the safety net from all liabilities down to a subset of deposits would reduce the subsidy. A smooth mechanism to close down banks at $\rho = 1$ would sharply reduce the size of the deposit insurance premium. A move to actuarially fair, risk–based premia would eliminate the subsidy.

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