Market Discipline In The Indian Banking Sector:
An Empirical Exploration

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I. Introduction

Over the last two decades or so, both developed and developing countries alike have endured severe banking crises. The U.S. Savings and Loan debacle in the early 1980s, the Latin American banking crisis in the mid 1980s, the Mexican upheaval in the 1990s and more recently, the financial stress in East Asian economies and subsequently, in Argentina and Turkey are only a few examples. The costs of such crises have often been large, ranging from a modest 3 per cent of GDP for the US S&L crisis to around 35 per cent of GDP for Thailand and a much higher 55 per cent of GDP for Indonesia during the period 1997-99 (Caprio and Klingebiel, 2003). At all times and, particularly, in order to avoid banking crises, authorities need to find ways to promote prudent behaviour by banks. A typical way to address the issue is to tighten prudential supervision (Mishkin, 2001). Alternately, rather than depending on regulatory action alone, banking authorities can supplement the same by increasing their reliance on market discipline to reinforce oversight of banks.

Market discipline in the banking sector can be described as 'private counterparty supervision' (Greenspan, 2001). Such discipline usually takes one of two forms: direct discipline and indirect discipline (Federal Reserve, 2000). *Direct market discipline* is the pressure applied by investors on banks through the interest rate paid (e.g., through sub-ordinated debt), which, in turn, reflects each bank's risk profile. The higher the risk profile, the higher would be the interest rate paid. Banks are therefore, not only 'punished' for maintaining high risk profiles, but the *ex-ante* anticipation of higher funding costs act as a deterrent on risk-taking behaviour. Illustratively, in Argentina, supervisory authorities require banks to issue 2 per cent of their deposits as marketable debt securities, with a minimum maturity of two years (Calomiris and Powell, 2001). This has prompted Benink and Calomiris (1999) to suggest making the issuance of sub-ordinated debt with minimum two-year maturity (and a contingency clause terminating it in the event of a bailout) mandatory for large banks. As an alternate possibility, uninsured depositors, who feel susceptible to excessive risk-taking, may penalize riskier banks by withdrawing their deposits from such banks. *Indirect market discipline*, on the other hand, is the pressure applied by regulators on the basis of sub-ordinated debt prices in the secondary market. To the extent that such prices reflect the (absolute or relative) probability of loss by issuing banks, they can provide valuable input into decisions by supervisors and counter-parties affecting the bank. For example, the frequency and intensity of on- and off-site supervision, supervisory ratings, bank-specific capital requirements and corrective measures could in part be based

on rates paid on sub-ordinated debt. Through the (price) signals on sub-ordinated debt, investors can assist supervisors assess the condition of issuing banks.

As the South-East Asian crisis testifies, the disciplining role of the markets (including the inter-bank market) was particularly weak in the crisis-hit countries. This was due predominantly to the lack of disclosure and transparency of banks and to the fact that limited reliance could be placed on the quality of accountancy data provided in bank accounts. Market discipline is however, not an issue for developed countries alone. Nakaso *et al.* (2000), for instance, argue that market discipline did not operate efficiently in Japan due largely to insufficient financial infrastructure (weak accountancy rules, inadequate disclosure standards, *etc*). Even for the U.S., where market discipline is arguably the strongest, evidence suggests that neither supervisors nor rating agencies nor equity investors are unambiguously more timely and accurate in their assessment of risk than others. All three groups produce valuable complementary information that contributes towards improving the performance of large banks (Berger *et al.*, 2000).

There are a number of potential benefits from enhancing market discipline in a country's banking sector. First, by punishing excessive risk-taking by banks, increased market discipline may reduce moral hazard incentives. Second, market discipline may improve the efficiency of banks by pressurizing some of the relatively inefficient banks to become more efficient or to exit the industry (Berger, 1991). Third, evidence indicates that markets give signals about the credit standings of financial firms, which, combined with inside information gained by supervisory procedures, can increase the efficacy of the overall supervisory process. Flannery (1998), for instance, suggests that market information may improve two features of the overall process for regulators by (a) enabling them to identify incipient problems more promptly, and (b) providing them an incentive and justification to take action more quickly, once problems have been identified. He concludes that market information should be incorporated into the process of identifying and correcting problems. Finally, market discipline might be able to supplement traditional supervisory assessments to distinguish 'good' banks from 'bad' ones and therefore, lower overall social costs of bank supervision (Flannery, 2001). Even the proposed capital Accord of the Basel Committee has designated market discipline as one of the three pillars on which future financial regulation should be based, because '[market] discipline imposes strong incentives on banks to conduct their business in a safe, sound and efficient manner" and expects that the approach 'will encourage high disclosure standards and enhance the role of market participants in encouraging banks to hold adequate capital' (Basel, 1999).

The potential benefits of market discipline could be particularly important in developing economies. This is primarily because financial systems in these economies tend to be predominantly bank-based. Accordingly, in view of the overwhelming dominance of banks, it is widely believed that a well-functioning banking system can play a significant role in efficient allocation of savings.

However, in view of the growing complexity of banking organizations, traditional procedures of supervision can, at best, have limited appeal. As a consequence, considerable interest has been generated in recent times in harnessing market forces to assist regulatory goals.

The present study focuses on Indian banking sector as a case study. A number of factors make the banking sector in India an interesting case to study market discipline. First, in the last decade, India has undergone a liberalisation of the banking sector with the avowed objective of 'enhancing efficiency, productivity and profitability' (RBI, 1991). Second, the banking sector witnessed important transformation, driven by the need for 'creating a market-driven, productive and competitive economy' in order to 'support higher investment levels and accentuate growth' (Government of India, 1998) through prescription of prudential norms and reorientation in the regulatory framework in line with international best practices. Finally, it seems appropriate to conduct a study of market discipline for India, since it has made significant efforts to promote the role of market forces in regulating banks. Illustratively, over the last few years, bank supervisors have undertaken steps towards improving the quality and availability of information on banks. Banks are presently required to disclose, among others, not only their capital adequacy (tier I and tier II, separately) ratios, net NPA to net advances, return on assets and government holdings, but also the amount of sub-ordinated debt raised as tier II capital, movements in NPAs, maturity pattern of deposits and borrowings and lending to sensitive sectors. These have recently been enlarged to encompass disclosures on movements in provisions held towards (a) NPAs and (b) depreciation in investment portfolio, effective March 31, 2002. The importance of market discipline has being recognised by the Reserve Bank wherein it has been observed that "processes of transparency and market disclosure of critical information describing the risk profile, capital structure and capital adequacy are assuming increasing importance in the emerging environment. Besides making banks more accountable and responsive to better-informed investors, these processes enable banks to strike the right balance between risks and rewards and to improve the access to markets. Improvements in market discipline also call for greater coordination between banks and regulators" (Jalan, 2002). Towards this end, we estimate reduced-form equations of individual bank deposits/interest paid on deposits as functions of bank fundamentals, banking industry-level and macroeconomic variables. In particular, we consider two specific aspects of market discipline, *viz.*, (a) do bank fundamentals influence depositor willingness to entrust deposits at a particular bank? and, (b) do differences among bank groups affect the degree of market discipline in the banking sector?

The reminder of the paper is structured as follows. Section II presents an overview of the literature on market discipline. Section III describes the empirical methodology used in the study. Section IV provides a description of the data. Section V presents and discusses the empirical results. Does the existence of deposit insurance or alternately, dilution of Government stake in public sector

banks influence market discipline? These issues are addressed in Section VI. Finally, the concluding remarks are gathered in Section VII.

II. Literature On Market Discipline

The majority of the existing studies on market discipline pertain to the US commercial banking industry over the last two decades. These studies have primarily followed three different approaches. The first set of studies have chosen the price-(or yield) based approach. In particular, they employ yield spreads (the difference between the market yield on bank debt and a risk-free asset like Government paper) as an indicator of the market's perception of bank risk. Studies along this line include those by Baer and Brewer (1986), Ellis and Flannery (1992), Flannery and Sorescu (1996), Jagtiani and Lemieux (2000) and Sironi (2000); the first four pertaining to US and the final one relating to the European banking industry. Overall, these studies support the hypothesis that yields on uninsured deposits contain risk premia. This, in effect, implies that uninsured depositors charge higher interest rates to riskier banks.

A second set of studies adopts the quantity-based approach, by analyzing to what extent a bank is able to raise (uninsured) debt. Covitz *et al.* (2000) find that relatively weak banks are unwilling (or unable) to issue sub-ordinated debt in bad times. Jordan (2000) finds that, in the 1990's, New England banks experienced a fall in uninsured deposits prior to failing. As a case study of market discipline in Colombia, Barajas and Steiner (2000) find that depositors prefer banks with stronger fundamentals and that banks tend to improve their fundamentals after being 'punished' by depositors. Birchler and Maechler (2001), examining market discipline in the Swiss banking sector, find that depositors are sensitive to bank-specific fundamentals and to institutional changes in the Swiss depositor protection system. Finally, Martinez Peria and Schmukler (2001) observe for Argentina, Chile and Mexico, that even small, insured depositors exert market discipline by withdrawing deposits from weak banks.

The final set of studies combine both the price- and quantity-based approaches. These papers (Park, 1995; Park and Peristiani, 1998; Calomiris and Powell, 2000) examine market discipline by looking at the effect of depository's institution risk on both the pricing and growth of uninsured deposits. Overall, these studies find that riskier banks pay higher interest rates, but, at the same time, attract smaller amounts of uninsured deposits.

Despite its potential advantages, market discipline can only complement, not supplant supervision. Market discipline and supervision are not substitutes because the stake of the government and the market participants in the financial system are not perfectly aligned. As observed by Llewellyn (2001), markets are concerned with the private costs of bank failures and the risk arising

thereon is reflected in market prices. The social costs of bank failure may exceed the private cost which may not be fully reflected in market prices.

Thus, while there are clear limitations of the usefulness of market discipline, the global trend is towards placing increased emphasis on market data in the supervisory process. The idea is not that market monitoring can effectively replace official supervision, but that it has a potentially powerful role within the overall regulatory regime. In particular, it has the advantage of exploiting the synergies between supervision and market discipline and thereby increasing the efficacy of the overall supervisory process. In this context, Caprio and Honohan (1998) aver that, 'broader approaches to bank supervision reach beyond the issues of defining capital and accounting standards, and envisage co-opting other market participants by giving them a greater stake in bank survival. This approach increases the likelihood that problems will be detected earlier…[it involves] broadening the number of those who are directly concerned about keeping the banks safe and sound'.

III. Empirical Methodology

This section is devoted to a discussion of the empirical methodology employed to study market discipline. As mentioned earlier, we hypothesize that the dependent variable in the study, which signifies the existence or otherwise of market discipline depends on three sets of variables: (a) bank-specific; (b) banking industry-level; and, (c) macroeconomic. Towards this end, we estimate the following reduced form equation for the dependent variable:

$$DEPVAR_{i,t} = \mu_i + \delta'' SYS_t + \gamma'' MACRO_t + \lambda'' BANK_{i,t-1} + \varphi_{i,t}$$

$$\varphi_{i,t} \sim N(0, \sigma^2_{i,t}) \qquad (1)$$

such that i=1,2,…,N (number of banks) and t=1,2,…,T (number of time periods).

In equation (1), DEPVAR represents the individual bank-specific dependent variable. The panel is balanced, so T is the number of observations per bank. SYS stands for the systemic (or bank industry specific) variable, while MACRO is a vector of macroeconomic variables. Both the systemic and macroeconomic variables change over time, but not across banks. $BANK_{i,t-1}$ is a vector of bank-specific variables. This vector is included with a lag, to account for the fact that balance sheet information is available to the public with a certain delay. This lag structure also takes care of the problem of endogeneity. μ_i is the bank-specific or fixed effect. Thus, according to equation (1), the dependent variable is determined by three major factors: the behaviour of deposits in the overall banking system, the developments in the macro-economy and the evolution of bank-risk characteristics.

The question arises as regards the choice of dependent variable. As our earlier discussion reveals, depositors can exercise market discipline on banks through two channels: by requiring higher interest rates (price variable) and/or by withdrawing their deposits from riskier banks (quantity

variable). The approach adopted in the present paper focuses on both the quantity and price approaches.

In case of the *quantity* variable, DEPVAR represents the first difference of the log of time deposits held by bank i at time t. We consider time deposits since this represents the more stable component of aggregate deposits. In public sector banks, time deposits as proportion of aggregate deposits constitute anywhere between 55-65 per cent; the figure is much higher at around 75 per cent in case of foreign banks and stands at around 70 per cent in case of private banks. In case of the *price* variable, the only calculable interest rate is an implicit rate, rather than a market rate. The reason is that banks do not pay a single deposit rate. Indeed, on any particular day, every bank offers a multitude of rates, depending on classes of customers and types of products the bank supplies. This implicit rate is calculated as the interest paid on deposits to total deposits.

In developing country markets in particular, the quantity variable often proves to be a better indicator of market discipline. Two reasons can be advanced in support of the same. First, under situations of asymmetric information, which is often quite pervasive in developing market economies, a debtor is rationed by quantity rather than price (Stiglitz and Weiss, 1981). Differences in yields may therefore underestimate the presence of market discipline. Second, while the quantity variable is readily obtainable, the appropriate price variable is not readily available. This calls for approximating the price variable *via* some proxy as described above. This proxy does not allow us to discriminate across maturity or size of deposits, and moreover, it is a crude indicator of the market discipline exerted on banks through the price mechanism. However, for sake of completeness, we also include the price variable as an indicator of market discipline. Accordingly, examining whether riskier banks attract lower deposits or alternately, provide higher interest rates on deposits provides a comprehensive test of the existence and the degree of market discipline.

IV. The Dataset And Variables

Three types of data are used in this study: *viz*, bank-specific, systemic and macroeconomic variables. The bank-specific data used in the study have been culled out from the *Report on Trend and Progress of Banking in India* and *Statistical Tables Relating to Banks in India*. Macroeconomic and systemic data come both the *Handbook of Statistics on Indian Economy* as well as from the *International Financial Statistics* of the IMF. Bank-specific data are on an annual basis and comprises of a common set of 72 banks for which consistent data is available over the period 1995-96 through 2001-02. The choice of the period of study can be justified on the ground that it is the period for which data on the relevant variables are available on a consistent basis. More importantly, although the reforms in the banking sector were initiated in 1992-93, the effect of competitive pressures tended to manifest themselves only much later. This argument finds support in the work of Sarkar and Bhaumik (1998) who

concluded that as of 1994-95, the deregulation of entry had not notably impacted the extent of competition in the Indian banking sector. It, therefore, seems reasonable to focus on the period 1996 through 2002 for the purpose of the study. Given the way the quantity variable is constructed, our analysis for the said variable pertains to the period 1996-97 through 2001-02.

IV.A Bank-specific Variables

The vector $BANK_{i,t-1}$ contains several banks-specific fundamentals which are intended to measure bank's risk exposure. The variables are derived from the CAMEL rating system of banks (where the acronym CAMEL stands for **C**apital adequacy, **A**sset quality, **M**anagement, **E**arnings and **L**iquidity).

Capital Adequacy Capital adequacy is measured by the ratio of capital to risk-weighted assets (CRAR). As a sound capital base should strengthen depositor confidence, we expect the capital adequacy variable to exert a positive influence on bank deposits and a lower interest outgo.

Asset Quality A clear signal of asset quality is the ratio of non-performing loans to total loans (GNPA). We employ the gross non-performing loans to gross advances ratio, which is more indicative of the quality of credit decisions made by bankers. As higher GNPA is indicative of poor credit decision-making, we expect this variable to have a negative influence on deposits and an adverse outcome in terms of higher interest rates.

Management To account for management quality, we include the ratio of non-interest expenditures to total assets (MGNT). This variable, which includes a variety of expenses, such as payroll, workers compensation and training investment, reflects the management policy stance. A high level of expenditures in not-directly productive activities may reflect an inefficient management. We expect this variable to have a negative relationship with deposits and a positive linkage with the interest rate variable.

Earnings We measure bank earnings (EARN) by the return on asset ratio. In general, assuming we are adequately controlling for risk, we expect this variable to have a positive effect on deposits and an inverse relation with interest rate.

Liquidity The cash plus balances with central bank to total asset ratio (LQD) is included as an indicator of bank liquidity. In general, banks with a larger volume of liquid assets are perceived to be safer, since these assets would allow banks to meet unexpected withdrawals. This would imply a positive relation between deposits and liquidity and a negative movement between liquidity and interest rate.

In order to control for the size of the bank, the natural logarithm of bank asset (SIZE) is included in the regression to examine whether depositors respond to the 'too-big-to-fail' effect.

IV.B Bank-industry Specific Variables

In order to control for the behaviour of the overall banking sector, our estimations include the ratio of cash outside banks to system deposits (CASH). This variable provides a preliminary way of testing for contagion effects. Contagion refers to a situation in which individual depositors at a given bank act according to what the rest of the banking system appears to be doing, after controlling for bank-specific and macroeconomic factors. CASH reflects the individual preference for holding currency relative to bank deposits. If depositors perceive an increase in systemic risks, they might decide to withdraw their deposit from banks, regardless of bank fundamentals. The value of cash outside banks over system deposits will increase and individual bank deposits will fall. Therefore, a negative correlation between individual bank deposits and CASH can be interpreted as evidence of contagion effects. A reverse argument holds between the interest rate variable and CASH.

Secondly, we include a policy variable (POLICY) indicating specific years when important liberalisation measures were undertaken. Accordingly, we assign a dummy variable which assumes value 1, if important policy measures were undertaken in that year and zero, otherwise. From the point of view of the present exercise, we are concerned with important policy measures that are expected to impinge upon deposits. Illustratively, from the policy standpoint, during 1996-97, the Bank Rate (the rate at which the central bank provides refinance to commercial banks) emerged as a signaling rate and all important interest rates in the system were linked to it. Over the course of the year, the Bank Rate was reduced across the board. This would, expectedly impinge upon deposits as well. As a consequence, we assign a dummy value 1 during 1996-97. Similar dummy values are assigned during the other years when important policy measures impinging on deposits were undertaken.

IV.C Macroeconomic Variables

Deposits at individual banks or the price paid on deposits can also be influenced by the state of the overall economy. Thus, we control for the impact of macroeconomic variables. In particular, we evaluate the effect of growth rate of real gross domestic product (GDPR) and the consumer price index (CPI). As these variables reflect the relative strength of the economy, we expect each having a positive relationship with the quantity variable and a negative relation with the price variable. In order to ascertain the joint significance of the bank-specific variables, we report the corresponding F-statistics. This, in effect, enables us to determine the *joint* significant impact of these variables on deposits, even when some of them might not be individually significant. Similar F-statistics are also report for the joint significance of macro and system variables are also reported.

V. Empirical Results And Discussion

This section evaluates whether there is evidence of market discipline, in other words, whether depositors respond to bank risk-taking by withdrawing deposits and/or by requiring higher interest rates on deposits. Table 1 presents the results for the commercial banking sector as a whole.[1]

Table 1: Response of Growth of Deposits and Interest Rate paid on Deposits to Bank Risk Characteristics – Commercial Banking System

Dependent Variable: Time Deposit				Dependent Variable: Interest Rate			
Explanatory Variables	Parameter Estimate	t-value	Significance	Explanatory Variables	Parameter Estimate	t-value	Significance
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Bank-specific				*Bank-specific*			
Intercept	0.465	0.64		Intercept	16.857	3.28	*
Lag (CRAR)	0.009	1.91	**	Lag (CRAR)	-0.043	-1.22	
Lag (GNPA)	-0.002	-0.08		Lag (GNPA)	0.040	2.27	**
Lag (MGNT)	-0.015	-1.56		Lag (MGNT)	0.051	0.76	
Lag (EARN)	0.014	1.34		Lag (EARN)	-0.235	-3.25	*
Lag (LQD)	-0.019	-2.63	*	Lag (LQD)	-0.099	-1.88	***
Log (SIZE)	-0.069	-3.56	*	Log (SIZE)	-0.031	-0.23	
Systemic				*Systemic*			
CASH	0.233	2.08	**	CASH	-1.208	-1.52	
POLICY	0.169	0.67		POLICY	-0.724	-0.40	
Macroeconomic				*Macroeconomic*			
GDPR	0.295	2.16	**	GDPR	-1.575	-1.62	
CPI	0.087	3.11	*	CPI	-0.374	-1.88	
Adjusted R^2	0.33			Adjusted R^2	0.39		
F-test fixed effects	1.34		**	F-test fixed effects	1.26		***
F-test time effects	2.51		**	F-test time effects	1.00		
F-test bank fundamentals	4.02		*	F-test bank fundamentals	3.42		*
No. of banks	72			No. of banks	72		
No. of observations	432			No. of observations	504		

*, ** and *** indicate significance at 1, 5 and 10 per cent, respectively.

The results lend credence to the finding that deposits respond to bank risk taking. Among the *bank-specific factors*, a rise in the CRAR fosters deposit growth. Secondly, banks with relatively more liquid assets experience a fall in their deposit base, probably mirroring the fact of holding low yielding short-term assets as reflective of poor cash management. Thirdly, the coefficient on the SIZE variable is negative and significant at conventional levels, suggesting that larger banks tend to witness a fall in their deposit growth. At the *bank-industry level*, there is limited evidence to support the presence of contagion. The coefficient on the CASH variable is positive and significant, alluding to the fact that deposits with the entire banking system grew at a slower rate than cash outside banks. The rapid growth of cash outside banks might be a consequence of increase in system-wide liquidity in the face of declining interest rates on bank deposits and limited alternative avenues for parking of funds by depositors. Finally, at the *macroeconomic level*, higher growth in GDP translates into higher

[1] 'Commercial banking sector' in the analysis consists of scheduled commercial banks, excluding regional rural banks.

growth in deposits and the impact is found to be statistically significant. Finally, deposit growth in related positively to inflation as proxied by CPI, suggesting that higher uncertainty propels depositors to lower their cash holdings and instead, keep their money in deposits. The F-test reveals that bank-specific factors are jointly significant at 1 per cent level.[2]

The results pertaining to the interest rate variable also paint a similar story. Banks with higher non-performing loans and lower earnings pay higher interest rates. Thus, banks with poor asset quality and limited earning capacity end up paying higher implicit price. Also, banks with lower liquidity pay higher interest rates on deposits, attesting to the fact that liquidity profile of banks acts as a crucial indicator of market discipline. The table also shows that bank risk characteristics are jointly significant in the price equation, even after controlling for fixed effects and time effects. This lends further support to the existence of market discipline in the banking sector in India.

The next obvious question which arises is: which factors tend to be more dominant for certain bank groups *vis-à-vis* others? The answer to this question is exhibited in Tables 2 and 3. Table 2 depicts the results for bank groups for the quantity (deposit growth rate) variable, whereas the results pertaining to the price variable (interest paid on deposits) is provided in Table 3.

As Table 2 reveals, for the public sector bank-group, for high capital ratio is associated with significantly higher deposit growth, lending credence to this risk-weighted variable in explaining depositor behaviour. Among others, poor asset quality and inefficient management practices tends to lower deposit growth in the concerned bank, while excessive liquidity also tends to exert a negative effect on deposit growth. Since greater liquidity, especially in normal times is often reflective of poor cash management, this suggests that comfortable liquidity position in tranquil periods acts as a negative signal to depositors about cash management practices of the concerned bank. This supports the work of Barajas and Steiner (2000) who, in their study of the Colombian banking system, found that higher liquidity in normal times is associated with lower rate of growth of deposits. At the bank-industry specific level, the coefficient on CASH is positive and significant, hinting at the possibility that greater liquidity in the *system* provides depositors a sense of comfort regarding the safety of their deposits, so much so that bank deposits actually rise, rather than fall, as a result. This evidence is not consistent with the existence of contagion. It is pertinent to mention here that examining market discipline in the Latin American economies of Argentina, Chile and Mexico, Martinez Peria and Schmukler (2001) observed that while there was evidence to support the existence of contagion effect in the Argentine and Chilean banking system, it was conspicuous by its absence in the Mexican banking industry. Finally, higher GDP growth tends to exert a positive influence on deposit growth, hinting that the macroeconomic environment has significant effect in explaining depositor behaviour

[2] The results with aggregate deposits as the dependent variable are not materially different as that obtained by using time deposits as the dependent variable.

in public sector banks. The F-statistics for bank fundamentals are jointly significant, attesting to the existence of market discipline among depositors of public sector banks.

Table 2: Response of Growth of Deposits to Bank Risk Characteristics – Bank Group-wise Analysis

Explanatory Variables	Public Sector Banks	t-value	Private Sector Banks	t-value	Foreign Banks	t-value
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Bank-specific						
Intercept	0.595	2.13(**)	0.726	2.23(*)	1.261	1.00
Lag (CRAR)	0.004	1.98(**)	0.010	2.12 (**)	-0.018	-0.78
Lag (GNPA)	-0.001	-1.26	-0.005	-1.84(**)	0.002	0.48
Lag (MGNT)	0.028	1.57	-0.039	-1.30	0.014	0.84
Lag (EARN)	0.004	0.40	0.006	0.25	0.016	0.35
Lag (LQD)	-0.007	-1.91(**)	-0.002	-0.35	-0.104	-2.96 (*)
Log (SIZE)	-0.022	-2.15	-0.037	-2.40 (**)	-0.014	-0.24
Systemic						
CASH	0.047	1.86(**)	-0.016	-1.30	-0.169	-2.77(*)
POLICY	-0.022	-0.38	0.073	1.78 (**)	-0.055	-0.30
Macroeconomic						
GDPR	0.063	2.09(**)	0.027	1.61 (***)	0.128	1.61
CPI	-0.001	-0.96	0.002	1.08	0.012	0.91
Adjusted R^2	0.48		0.35		0.16	
F-test fixed effects	1.95(*)		1.95(**)		1.74(**)	
F-test time effects	1.20		2.56(**)		2.10(**)	
F-test bank fundamentals	2.79(**)		8.39(*)		2.04(***)	
No. of banks	27		25		20	
No. of observations	162		150		120	

*, ** and *** indicate significance at 1, 5 and 10 per cent, respectively.

The results are, however, distinctly different in the case of private and foreign banks. For private banks in particular, deposit growth is mostly driven positively by capitalization and negatively by non-performing assets to the exclusion of other bank-specific variables. More importantly however, systemic and macroeconomic variables play a crucial role in determining deposit growth among private banks. In particular, deposit growth responds positively to POLICY, hinting at the possibility that depositors with private banks responds pro-actively to a policy announcement. Finally, as in the case with public sector banks, deposit growth is driven positively by GDP growth.

The results for foreign banks, on the other hand, seem to demonstrate that neither of asset quality, capital ratio or earnings plays an influential role in harnessing deposit growth. Only liquidity plays an important role in influencing deposits, hinting at the possibility that depositors take limited cognizance of the overall soundness of foreign banks in entrusting their deposits. Since, more often than not, foreign banks mobilise wholesale deposits of high net worth individuals and corporates, it seems that profitability of foreign banks is of limited concern for these groups of depositors, possibly because they expect these banks to be bailed out by their parent company in case of exigencies. At

the bank-industry level, there is evidence to suggest the presence of contagion among the foreign bank group as evidenced by the negative and significant coefficient on CASH.

Table 3: Response of Interest Paid on Deposits to Bank Risk Characteristics – Bank Group-wise Analysis

Explanatory Variables	Public Sector Banks	t-value	Private Sector Banks	t-value	Foreign Banks	t-value
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Bank-specific						
Intercept	14.214	8.25 (*)	9.386	4.62 (*)	20.975	2.31(**)
Lag (CRAR)	0.011	0.81	-0.142	-4.61 (*)	0.139	0.85
Lag (GNPA)	0.016	2.18(**)	0.002	0.09	-0.063	-1.64 (**)
Lag (MGNT)	-0.463	-4.21 (*)	-0.323	-1.70 (***)	-0.009	-0.08
Lag (EARN)	0.013	0.27	0.234	1.66(***)	-0243	-1.90 (**)
Lag (LQD)	-0.043	-2.15(**)	-0.049	-1.46	-0.037	-0.15
Log (ASSET)	-0.359	-5.46(*)	0.066	0.70	-0.089	-2.02(**)
Systemic						
CASH	0.424	2.69 (*)	-0.068	-0.92	0.162	0.43
POLICY	0.163	0.44	-0.645	-2.73(**)	-0.014	-0.54
Macroeconomic						
GDPR	-0.382	-2.07(**)	-0.157	-1.61(*)	-0.248	-0.47
CPI	-0.095	-2.42(*)	-0.030	-1.79(**)	-0.063	-0.46
Adjusted R^2	0.57		0.30		0.15	
F-test fixed effects	1.90(*)		0.98		0.78	
F-test time effects	2.30 (**)		4.29(*)		0.51	
F-test bank fundamentals	6.23 (*)		5.75(*)		2.54(**)	
No. of banks	27		25		20	
No. of observations	135		125		100	

*, ** and *** indicate significance at 1, 5 and 10 per cent, respectively.

The results pertaining to the interest rate variable is presented in Table 3. The lower the quantum of sticky loans, the greater is the compensation required for depositors. In particular, this impact is significant for public sector and foreign banks. Bank capitalisation plays a crucial role in determining the interest rate paid by private banks: lower the capital levels, larger the interest outgo. Interest rate paid by public and private banks are driven by non-interest expenses in the sense that lower non-interest expenditures tend to be associated with higher interest outgo. Lower non-interest expenses imply lower overhead costs (wage bill, printing and advertisement cost, etc). This, in effect, adversely affects customer sentiment regarding the service provided by the bank, so that the bank has to perforce pay higher interest rates to attract customers. Earnings are important in explaining interest paid by foreign banks. For public sector and foreign banks, size is inversely associated with interest rates, probably reflecting the public perception that larger banks have lower probability of failure and can afford to pay lower interest rates. Among bank-industry variables, there is limited evidence to support contagion effect among public sector banks. The macroeconomic variables play an important role in determining interest paid by public sector and private banks: expectedly, lower GDP growth is associated with higher interest rates. A volatile economic environment is associated with lower interest paid, reflecting consumer preferences to park their funds in bank deposits, irrespective of interest paid, in the face of uncertainties. The F-tests show that the bank-specific

variables are jointly significant at conventional levels of significance. This, in effect, supports the presence of market discipline in the banking sector in India.

Summing up the foregoing discussion, while bank-specific factors are dominant in case of public sector banks, systemic factors, and in particular, policy variable, in addition to bank-specific indicators tend to be dominant in case of private banks. For foreign banks, the macroeconomic condition tends to overwhelm bank-specific factors in explaining behaviour of depositors. Nonetheless, the capital ratio is a key determinant of depositor behaviour for Indian banks, in general. Irrespective of the ownership pattern, liquidity plays a significant role in fostering deposit growth. In case of state-owned banks, bigger size of banks does not translate into higher deposit growth, suggesting that depositors are insensitive to the 'too-big-to-fail' effect. For private and foreign banks, there exists evidence of contagion effects influencing the deposit accretion process. Therefore, we can conclude that there exists market discipline in the Indian banking system.

VI. Some Additional Findings

Two additional exercises were conducted to test the robustness of the results. First, the study sought to empirically examine whether the behaviour of depositors would undergo any change consequent upon the introduction of a safety net in the form of deposit insurance. In particular, we attempt to distinguish between insured and uninsured depositors. The economic rationale for this argument can be stated as follows. Assuming the deposit insurance scheme is credible, one can expect insured depositors to have fewer incentives to monitor bank risk-taking. However, if the deposit guarantee is not credible or if there are costs associated with the recovery of deposits following a bank failure, we may find evidence that insured depositors enforce market discipline. On the other hand, uninsured depositors claims are not protected by the deposit guarantee, so, in theory, we expect these depositors to withdraw their funds from risky banks.

As it stands, the deposit insurance variable is at an aggregate level for different bank-groups. This, in essence, implies that the analysis of the impact of a safety net on market discipline can be undertaken only for the banking system as a whole and not across bank groups. More particularly, the only available variable in this context is the ratio of insured deposits to assessable deposits (Deposit Insurance and Credit Guarantee Corporation, various years). The economic significance of this ratio lies in the fact that it captures the proportion of *overall* deposits of the concerned bank group covered by deposit guarantee. Illustratively, this figure for nationalised banks in 1996-97 was 0.778, implying that 77.8 per cent of the deposits of nationalised banks was covered by deposit guarantee, leaving 22.2 per cent of the deposits as uninsured.

Table 4: Response of Growth of Deposits and Interest Rate paid on Deposits to Bank Risk Characteristics – Insured *versus* Uninsured Depositors

Dependent Variable: log (time deposit)				Dependent Variable: Interest Rate			
Explanatory Variables	Parameter estimate	t-value		Explanatory Variables	Parameter estimate	t-value	
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Bank-specific				*Bank-specific*			
Intercept	0.513	0.69		Intercept	19.549	3.74	*
Lag (CRAR)	0.009	1.90	**	Lag (CRAR)	-0.045	-1.28	
Lag (GNPA)	-0.0001	-0.04		Lag (GNPA)	-0.036	-2.02	**
Lag (MGNT)	-0.015	-1.57		Lag (MGNT)	0.042	0.63	
Lag (EARN)	0.014	1.34		Lag (EARN)	-0.232	-3.24	*
Lag (LQD)	-0.019	-2.48	*	Lag (LQD)	-0.069	-1.29	
Log (SIZE)	-0.069	-3.57	*	Log (SIZE)	-0.049	-0.36	
DEPINS	-0.001	-0.29		*DEPINS*	-0.062	-2.33	**
Systemic				*Systemic*			
CASH	0.254	1.83	**	CASH	0.210	0.21	
POLICY	0.178	0.69		POLICY	-0.250	-0.14	
Macroeconomic				*Macroeconomic*			
GDPR	0.336	1.74	**	GDPR	-0.653	-0.48	
CPI	0.095	2.50	*	CPI	-0.042	-0.16	
Adjusted R^2	0.32			Adjusted R^2	0.41		
F-test fixed effects	1.19			F-test fixed effects	1.35		**
F-test time effects	1.67			F-test time effects	0.12		
F-test bank fundamentals	3.77		*	F-test bank fundamentals	2.96		*
No. of banks	72			No. of banks	72		
No. of observations	360			No. of observations	432		

*, ** and *** indicate significance at 1, 5 and 10 per cent, respectively.

The result of the empirical analysis is presented in Table 4. The first four columns present the results with respect to the quantity variable, whereas the analysis in the subsequent columns pertains to the price variable. The results reveal that the quantitative analysis with respect to deposits is unaltered. Even the sign of the coefficients in this case are virtually unaffected. This, in effect, would mean that deposit insurance seems to exert limited impact on deposit accretion in the banking sector. In other words, the disciplining effect of markets in influencing deposit growth is not affected by the presence or absence of deposit insurance.

The results are, however, altered when we consider the price variable. While GNPA and earnings variables retain their significance as in Table 1, what is interesting is that the deposit insurance variable (DEPINS) turns out to be significant at conventional levels. This would mean that insured depositors tend to exercise market discipline on banks not much by withdrawing their deposits from banks, but more by compelling them to pay a higher price on their deposits. Intuitively, bank deposits in India are perceived as having an implicit Government guarantee in comparison to alternate avenues of deployment of resources. Consequently, although depositors tend to prefer a low-risk, low-return source of parking their funds (like bank deposits), they tend to discipline banks by extracting a higher price on such deposits. This is also evidenced from the data which reveals that the share of bank deposits, on average, at around 36 per cent over the period 1995-96 to 2000-01 constituted the largest source of financial assets of household sector as compared to other alternatives like shares and debentures or contractual savings whose average share over the same period were around 5 per cent and 22 per cent, respectively (RBI, 2001).

The second was the question of divestment, especially in respect of public sector banks[3]. Since the inception of the reforms process, several public sector banks have accessed the capital market to augment their capital base with a consequent dilution of Government stake in these banks. Accordingly, the study sought to empirically examine whether the divestment of Government ownership in these banks has, in any way, impacted the market discipline. Towards this end, we constructed a variable (LISTED) defined as follows: the variable undertook a value of 1 in the year in which the (public sector) bank made an equity offering and for all subsequent years thereafter; and zero, otherwise[4]. The disadvantage of such a variable is that it does not explicitly factor in the *extent* of divestment. However, to the extent that any divestment process in India is essentially a capital-raising exercise and not concerned with management logistics (since no public sector bank can divest more than 49 per cent), it seems fair to observe that LISTED enables a broad inference of the divestment process on market discipline.

Table 5: Response of Growth of Deposits and Interest Rate to Risk Characteristics of Public Sector Banks consequent upon Divestment

Explanatory Variables	Dependent Variable: Log (Time Deposits)		Dependent Variable: Interest Rate	
	Parameter Estimate	t-value	Parameter Estimate	t-value
(1)	**(2)**	**(3)**	**(4)**	**(5)**
Bank-specific				
Intercept	0.512	1.71	9.59	3.82 (*)
Lag (CRAR)	0.005	1.96(**)	-0.011	-0.99
Lag (GNPA)	-0.001	-0.66	-0.001	-0.01
Lag (MGNT)	0.029	1.24	-0.358	-2.16 (*)
Lag (EARN)	0.004	0.44	0.027	0.79
Lag (LQD)	-0.006	-1.77(**)	0.018	1.21
Log (SIZE)	-0.013	-1.14	-0.142	-1.27
Systemic				
CASH	0.003	0.37	-0.026	-0.69
YIELD	-0.031	-0.90	0.081	0.48
LISTED	0.007	0.33	-0.006	-0.04
Macroeconomic				
GDPR	0.018	0.71	-0.096	-0.59
CPI	-0.001	-0.27	-0.023	-1.91(**)
Adjusted R^2	0.48		0.57	
F-test fixed effects	2.52(*)		1.74(***)	
F-test time effects	0.64		8.67 (**)	
F-test bank fundamentals	2.71(**)		2.80 (**)	
No. of banks	27		27	
No. of observations	162		162	

*, ** and *** indicate significance at 1, 5 and 10 per cent, respectively.

The re-estimated equation for public sector banks is presented in Table 5. The second column pertains to the quantity variable, whereas the fourth column relates to the price variable. As can be gleaned from the table, LISTED does not seem to influence either quantity or price variable

[3] We are grateful to an anonymous referee for this point.

[4] Such variable is employed in finance literature, employed particularly in case of 'event analysis'.

in any significant way, attesting to the fact that the divestment process has had limited influence on market discipline.[5] Given the implicit Government guarantee that these banks enjoy by virtue of their state-owned character, it seems that LISTED does not have any perceptible influence on their deposits or the interest rate paid thereon.

VII. Concluding Observations

The purpose of the paper has been to examine the existence of market discipline in the banking sector in India in the 'nineties. Towards this end, we employed bank level data to estimate reduced form equations, in which the dependent variable (quantity, as proxied by time deposits; price, as proxied by implicit interest rate) is modeled as function of bank-specific, systemic and macroeconomic variables.

Our results enabled us to conclude that depositors in India punish banks for risky behaviour. The tests for the joint significance of bank fundamentals were consistently rejected across equations. Put differently, we were unable to reject the null hypothesis that the bank risk variables were not relevant in explaining the behaviour of bank deposits or the interest rate paid on such deposits. This provides testimony towards the existence of market discipline in the banking sector in India.

Prima facie, the results lend support in favour of regulatory efforts to increase the reliance on market discipline to control risk-taking behaviour by banks in the Indian context (for a theoretical discussion and empirical evidence regarding attempts on the same in the Argentine banking sector, see Calomiris and Powell, 2001). However, there are several caveats regarding the conclusions reached in the paper and we venture to point these out for the informed reader.

First, a more complete test of the existence of market discipline involves understanding whether banks respond positively to the signals provided by depositors. Calomiris and Powell (2001) explore this issue for the Argentine banking system by testing whether there is a tendency for individual banks' deposit rates to revert to their mean, a behaviour consistent with market discipline; if interest rates rise too much (i.e., fundamentals fall out of line), then banks must take corrective action to ensure that interest rates fall again. This 'mean reversion' aspect is beyond the scope of the present study.

Second, as pointed out by Martinez Peria and Schmukler (2001), we have not identified the specific channels through which depositors obtain information regarding bank fundamentals. Depositors might access such information from a variety of sources: bank balance sheet, newspaper articles, internet or even from financial advisors. The differential access to these different sources might shed light on what mechanisms promote more efficient market discipline.

Third, owing to paucity of data on data on deposits according to different size classes or according to insured *versus* uninsured deposits at the bank-level, we are unable to study the behaviour

[5] Owing to certain estimation problems arising from the inclusion of the variable POLICY, the same was excluded from the estimation process.

of these two classes of depositors in isolation or even whether the behaviour of these two classes differs across bank groups. This would constitute a crucial aspect of the study regarding the inter-linkage between market discipline with deposit insurance. Alternately, since larger depositors have a larger amount of funds at risk, their deposits might probably represent a smaller proportion of their wealth, implying the possibility of differential behaviour by small *versus* large depositors in exerting market discipline on different bank groups. This is expected to be important, since in India, foreign banks maintain a minimum balance stipulation for maintaining an account, which is several times the multiple of what the public sector banks stipulate (Mathur, 2002).

Finally, the quantity variable employed in the study is the first difference of the natural logarithm of time deposits, whereas the price variable is the implicit interest rate paid on *all* deposits. It would have been useful, in the absence of bank-wise data on deposit interest rate paid across the entire spectrum of deposits, to proxy the implicit interest rate paid by the *interest expenses on time deposits alone* to total deposits. Data constraints however prevent from taking such finer classification of the implicit interest rate paid into account.

References

Baer, H and E.Brewer [1986]. Uninsured Deposit as a Source of Market Discipline. *Economic Perspectives*: Federal Reserve Bank of Chicago.

Barajas, A and R.Steiner [2000]. Depositor Behaviour and Market Discipline in Colombia. *IMF Working Paper* No.214, IMF: Washington, DC .

Basel Committee on Banking Supervision [1999]. *A New Capital Adequacy Framework*, BIS: Basel.

Benink, H and C.Calomiris [1999]. Pushing for a Sub-Debt Requirement. *The Banker*, September, 17-18.

Berger, A.N. [1991]. Market Discipline in Banking. *Proceedings of a Conference on Bank Structure and Competition.* Federal Reserve Bank of Chicago.

Berger, A.N., S.M.Davies and M.Flannery [2000]. Comparing Market and Supervisory Assessments of Bank Performance: Who Knows What When?. *Journal of Money, Credit and Banking.* 32, 641-667.

Birchler, U.W and A.M.Maechler [2001]. Do Depositors' Discipline Swiss Banks?. *Discussion Paper* No.6, Swiss National Bank.

Board of Governors of the Federal Reserve [2000]. *Improving Public Disclosures in Banking.* Staff Study No.173.

Calomiris, C and A.Powell [2001]. Can Emerging Market Bank Regulators Establish Credible Discipline? The Case of Argentina, 1992-99'. in F.S.Mishkin (*ed.*) *Prudential Supervision: What Works and What Doesn't?*. University of Chicago Press: USA.

Caprio, G and P.Honohan [1998]. Restoring Banking Stability: Beyond Supervised Capital Requirements. *Journal of Economic Perspectives.* 4, pp.43-64.

Caprio, G and P.Honohan [2003]. Episodes of Systemic and Borderline Banking Crises. (www.worldbank.org).

Covitz, D.M., D.Hancock and M.Kwast [2000]. Mandatory Sub-ordinated Debt: Would Banks Face More Market Discipline?. *Finance and Economics Discussion Series.* Federal Reserve Board.

Deposit Insurance and Credit Guarantee Corporation. *Annual Report* (various years).

Ellis, D and M.Flannery [1992]. Does the Debt Market Assess Large Banks' Risk? Time Series Evidence from Money Center CDS'. *Journal of Monetary Economics.* 30, pp.481-502.

Flannery, M [1998]. Using Market Information in Prudential Bank Supervision: A Review of U.S. Empirical Evidence. *Journal of Money, Credit and Banking.* 3, pp.273-305.
Flannery, M [2001]. Two Faces of Market Discipline. *Journal of Financial Services Research.* 20, pp.107-119.
Flannery, M and S.M.Sorescu [1996]. Evidence of Bank Market Discipline in Sub-ordinated Debt Yields. *Journal of Finance.* 4, pp.1347-1375.
Government of India [1998]. *Report of the Committee on Banking Sector Reforms.* Government of India: New Delhi.
Greenspan, A. [2001]. Harnessing Market Discipline. *The Region*: Federal Reserve Bank of Minneapolis.
International Monetary Fund, *International Financial Statistics* (various years), IMF: Washington.
Jagtiani, J and C.Lemieux [2001]. Market Discipline Prior to Bank Failure. *Journal of Economics and Business.* 53, pp.313-324.
Jalan, B [2002]. Indian Banking and Finance: Managing New Challenges. Speech Delivered at the Bank Economists' Conference, Kolkata.
Jordan, J [2000]. Depositor Discipline at Failing Banks. *New England Economic Review.* March-April, pp.15-28.
Llewellyn, D.T. [2001]. A Regulatory Regime for Financial Stability. *Working Paper* No.48. Austrian National Bank.
Martinez Peria, M.S. and S.Schmukler [2001]. Do Depositors Punish Banks for Bad Behaviour: Market Discipline, Deposit Insurance and Banking Crises. *Journal of Finance.* 56, pp.1029-1051.
Mathur, K.B.L. [2002]. Public Sector Banks in India: Should They be Privatised?. *Economic and Political Weekly.* 37, pp.2245-2256.
Mishkin, F.S [2001]. Prudential Supervision: Why is it Important and What are the Issues?. in F.S.Mishkin (*ed.*) *Prudential Supervision: What Works and What Doesn't?*. University of Chicago Press: USA.
Nakaso, H., M. Hattori, T. Nagae and H. Hamada [2000]. Changes in Bank Behaviour during the Financial Crises: Experiences of the Financial Crises in Japan. *Paper presented at the IMF Central Banking Conference*, Washington D.C.
Park, S [1995]. Market Discipline by Depositors: Evidence from Reduced Form Equations. *Quarterly Review of Economics and Business.* 35, pp.497-514.
Park, S and S.Peristiani [1998]. Market Discipline by Thrift Depositors. *Journal of Money, Credit and Banking.* 30, pp.347-364.
Reserve Bank of India [1991]. *Report of the Committee on the Financial Systems* (Chairman: Shri M.Narasimham). RBI: Mumbai.
Reserve Bank of India [2001]. *Handbook of Statistics on Indian Economy.* RBI: Mumbai.
Reserve Bank of India. *Report on Trend and Progress of Banking in India* (various years). RBI: Mumbai.
Reserve Bank of India. *Statistical Tables Relating to Banks in India* (various years). RBI: Mumbai.
Sarkar, J and S.Bhaumik [1998]. Deregulation and the Limits to Banking Sector Competition: Some Insights from India. *International Journal of Development Banking.* 16, 29-42.
Sironi, A. [2000]. Testing for Market Discipline in the European Banking Industry: Evidence from Sub-ordinated Debt Issues. *International Finance Discussion Paper* No. 40. Federal Reserve Board.
Stiglitz, J.E. and A.Weiss [1981]. Credit Rationing in Markets with Imperfect Information. *American Economic Review.* 71, pp.393-410.