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Credit Growth, Bank Soundness and Financial Fragility: Evidence from Indian Banking Sector

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Abstract

Using data on Indian banks for 1996-2008, the paper examines the interconnect among credit growth, bank soundness and financial fragility. The analysis appears to indicate that higher credit growth amplifies bank fragility. Besides, the results point to the fact that sounder banks increase loan supply. Coming to bank ownership, the evidence testifies that credit growth has been rapid in state-owned and *de novo* private banks. In terms of policy implications, the analysis appears to suggest the need for giving priority to risk-based supervision as a way to contain the potential risks associated with rapid credit growth

JEL classification: G 21, G 24, P 52

Key words: Banking; Credit growth; Z-score; Non-performing loans; India

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1. Introduction

Across several emerging economies, credit to the private sector has expanded at a fast clip over the past several years. For example, the BIS (2009) reports that several Latin American and transition economies such as Brazil, Argentina, Mexico, Romania, Bulgaria and Estonia recorded exceedingly high growth rate of real credit over the past few years. Among Asian countries, Indonesia, China and India posted significant credit expansion. This rapid growth in credit has been the culmination of a number of factors, including greater corporate leveraging, increased capital market access and the introduction of new products and credit risk management methodologies, in part triggered by increased foreign bank entry. As well, rapid credit expansion has brought important benefits, helping channel savings to households and investors and supporting financial sector development and economic growth.

Yet, this brisk pace of credit expansion has also raised concerns about macroeconomic and prudential risks (Bank of England, 2009; BIS, 2010). Quantifying these risks remains a challenge, especially since financial soundness indicators tend to improve in the upward phase of the credit cycle. Financial sector difficulties cannot be ruled out, for example, loan losses following a protracted recession. How significant are these risks and what role should public policy play are key questions confronting policymakers.

The present paper empirically examines this issue, focusing on India as a case study. The study weaves together several distinct strands of literature. First, the study contributes to macro-level studies that examine the potential drivers of credit growth. Second, the article augments bank-level studies that focus on the impact of credit growth on bank fragility. Third, the analysis recognizes the interplay between bank soundness and fragility, since evidence for developed economies appears to indicate that these variables are intertwined (Shrieves and Dahl, 1992; Kwan and Eisenbis, 1997; Rime, 2001; Stolz, 2008). As well, the study also draws on recent literature emphasizing the role of bank soundness as a factor driving credit growth (Dell' Ariccia *et al.*, 2005, Nier and Zicchino, 2005). Finally, the research adds to the extant literature on capital adequacy by examining the role of bank capital in influencing bank loan supply (Kishan and Opiela, 2000; Gambacorta and Mistrulli, 2004).

Three major hypotheses are examined in the analysis. The first is that rapid credit growth in India has not weakened banks. The second is that credit growth has been rapid in sounder banks. Third, does the capital position of banks impinge on banks' loan supply. These hypotheses

can enable us to understand how significant the prudential risks associated with rapid credit growth are and how best to address them.

The analysis employs a detailed bank-level dataset. The core of the data is the public information on bank's balance sheet including prudential and financial indicators as published by the Indian central bank on an annual basis. The dataset allows differences to be identified between bank groups (domestic- *versus* foreign-owned), by way of listing status and by credit category (public *versus* private sector).

The remainder of the article continues as follows. Section 2 provides an overview of the literature. Section 3 describes the empirical model and the methodology. The variable definitions and their expected effect on risk-taking are provided in Section 4, followed by the data (Section 5) and results (Section 6). The final section concludes.

2. Credit growth of Indian banks

The Indian banking system is characterized by a large number of banks with mixed ownership¹. The commercial banking segment presently comprises 28 state-owned banks in which Government has majority ownership of over 51%, 25 private sector (including 8 *de novo* private) banks and 29 foreign banks. Total bank assets constituted a little over 90% of GDP in 2007-08. Public sector banks had roughly three-quarter share in the assets of the banking system, while private and foreign banks constituted the remaining. In 1991, public sector banks share in the total assets of the banking system was over 90% (See, Chairlone and Ghosh, 2009 for a recent overview of banking reforms in India).

At the initiation of reforms, credit penetration was low with the share of bank credit in GDP averaging less than a quarter during the first few years of reforms. Private sector credit was the only sector which recorded positive growth rates of credit. By the next period, in a liberalized banking environment, there was a rapid growth in unsecured credit and to a lesser extent, priority sector, on the back of lacklustre credit demand from the private sector in a low growth environment. *De novo* private banks became operative during this period and quickly established significant footprints in the financial marketplace with their share in bank credit averaging 11 percent, roughly half of the numbers for old private banks, by the end of the decade.

As the second generation reforms began taking effect, driven by the recommendations of the Government-appointed Committee (Government of India, 1998), the pace of credit growth increased sharply, driven primarily by increases in private sector credit and to a lesser extent, priority sector credit. The latter followed essentially from a gradual expansion of the list of items eligible for inclusion under "priority sector", which made such lending an increasingly profitable

venture. This period also witnessed the beginnings of rapid growth in retail credit, part of which was manifest in unsecured credit expansion. For the banking sector as a whole, the growth in unsecured credit was 9 percent, being close to double digits for SBI group and new private banks.

Table 1. Credit growth by bank groups

Bank group	1991-92	1995-96	1999-2000	2003-04	1995-96
	to	to	to	to	to
	1994-95	1998-99	2002-03	2007-08	2007-08
	Pre sample period		Sample period		
		Sub-period 1	Sub-period 2	Sub-period 3	Whole period
All banks					
Total credit	-0.38	3.43	5.49	9.79	4.99
Private sector credit	2.69	2.64	5.05	10.61	5.74
Priority sector credit	-0.33	4.30	5.53	9.49	5.26
Unsecured credit	-3.87	6.15	8.52	15.47	6.95
Bank credit/Total credit	83.6	79.2	81.5	90.8	84.2
Bank credit/GDP	22.5	20.9	26.5	42.1	28.5
Nationalized banks					
Total credit	-0.92	3.39	5.01	10.00	4.57
Private sector credit	1.00	2.62	3.68	12.01	5.03
Priority sector credit	-1.46	3.79	5.98	8.70	4.63
Unsecured credit	-5.58	5.56	9.28	15.05	5.68
Bank credit/Total credit	74.0	65.8	68.8	82.8	73.5
Bank credit/GDP	12.6	10.6	13.1	20.4	14.4
SBI and Associates					
Total credit	-1.65	2.64	3.57	9.03	4.03
Private sector credit	3.80	1.92	2.37	11.03	5.48
Priority sector credit	-1.22	4.25	3.47	9.03	4.45
Unsecured credit	-4.44	10.39	15.64	14.11	8.74
Bank credit/Total credit	62.7	53.4	55.0	71.1	61.2
Bank credit/GDP	7.4	6.3	7.2	10.3	7.9
Old private banks					
Total credit	7.12	4.39	3.60	5.53	5.31
Private sector credit	10.51	2.06	3.68	5.74	5.43
Priority sector credit	7.07	6.53	2.07	6.55	5.88
Unsecured credit	-2.92	4.46	3.07	8.35	4.71
Bank credit/Total credit	19.8	21.4	23.2	35.0	25.1
Bank credit/GDP	1.1	1.5	1.8	2.2	1.6
New private banks					
Total credit	..	14.77	18.78	12.39	17.20
Private sector credit	..	11.84	18.29	9.84	16.03
Priority sector credit	..	13.54	19.39	14.24	19.21
Unsecured credit	..	11.89	9.35	23.45	16.79
Bank credit/Total credit	0.7	11.0	28.8	59.6	25.6
Bank credit/GDP	0.01	0.7	2.4	6.4	2.5
Foreign banks					
Total credit	2.83	1.79	3.55	8.89	5.30
Private sector credit	1.83	1.61	3.54	7.87	5.07
Priority sector credit	17.89	3.37	3.92	11.83	9.13
Unsecured credit	0.22	4.42	2.14	14.30	6.73
Bank credit/Total credit	24.1	25.3	25.9	39.8	29.1
Bank credit/GDP	1.4	1.9	2.0	2.8	2.0

Source: Computed from RBI (various years)

The final period witnessed an explosion in credit growth across bank groups, which credit-to-GDP ratio averaging 40 percent, double the numbers of previous periods. This rapid increase was shared by all bank groups, although new private banks emerged as major players, at the cost of old private banks (which witnessed several mergers) and to a lesser extent, state-

owned (nationalized and SBI group) banks. Available information appears to suggest that India was one of the high credit growth countries, with (real) corporate credit growth in excess of 20 percent during the last three years and (real) household credit growth far outpacing this number (BIS, 2009).

One feature of the credit growth has been the overwhelming share of commercial bank credit in total credit. By way of example, the average share of bank credit in total credit by all financial entities² was around 85 percent over the entire period; this largely follows from the bank-based nature of the financial system in India (Demirguc Kunt and Levine, 2001; Beck and Demirguc Kunt, 2009). After witnessing a modest decline in the late 1990s, it has trended up thereafter, reflecting to an extent, the folding up of long-term development banks (with several of them converting into banks in the interim) and greater availability of non-deposit funding as also the unwinding of excess investments in an era of rapid credit growth. Taken together, these financed roughly 35 percent of incremental credit in 2004-05 and over 45 percent in 2005-06.

3. Literature Review

Several explanations have appeared in the literature to explain fluctuations in credit policies of banks. The most common reflection of this phenomenon arises from the fact that management compensation structures can generate perverse incentives, which in turn, is an aspect of the *principal-agent* problem. Once managers obtain a reasonable return on equity for their shareholders, they may engage in activities that depart from the firm's value maximization. To the extent that managers have limited liability, a manifestation of this possibility could be to favour high risk-return strategies (i.e., over extension of credit) in order to increase the social presence of the bank managers or the power of managers in an enlarging organization (Williamson, 1963).

Second, strong competition among banks or between banks and other financial intermediaries erodes margins and puts pressure on banks' bottomline. To compensate for declining profitability, bank managers might sacrifice objectivity in credit evaluation standards and increase loan growth indiscriminately at the expense of the (future) quality of their loan portfolios. To the extent that such loans turn out to be non-performing only with a lag, it might encourage further loan growth.

Herd behavior (Rajan 1994) might also help to explain why bank managers finance negative NPV projects during expansions. The fact that others are lending may be considered as invaluable information concerning the creditworthiness of a potential borrower. And importantly,

² Comprising of regional rural banks, cooperative banks, microfinance institutions (PACS) development banks (at both the state and national level) and investment institutions

managerial performance is generally judged relative to some market benchmark. The disincentives for being wrong in company are generally much less than for being wrong in isolation. Managers, as a result, have a strong incentive to behave as their peers, which, at an aggregate level, enhances lending booms and recessions. Short-term objectives are prevalent and might explain why banks become aggressive to finance projects during expansions, leading to rapid loan growth.

The majority of the studies in this area have primarily dealt with developed markets, such as the US banks (Contessi and Francis, 2009), transition (Coricelli and Masten, 2004) and EU countries (Collarelli *et al.*, 2005; Egert *et al.*, 2006; Maechler *et al.*, 2007) and to a lesser extent, the Latin American (Barajas *et al.*, 2005; Breuer *et al.*, 2009) banking sector. Using quarterly (and monthly) data on banks from eight Latin American countries for 1992-2001, Barajas and Steiner (2002) finds that the evolution of deposits to be a key factor explaining credit expansion. Using data for 1997-2004 on Eastern European economies, Maechler *et al.* (2009) found that although loan growth generally had been associated with improvements in bank soundness, over-extension of credit could weaken bank soundness. These studies generally did not find any significant differences in the rate of credit growth for domestic *versus* foreign banks, but confirmed that the latter had a competitive advantage owing to their higher efficiency (de Haas and Lelyveld, 2006).

In the Indian context, studies have examined the existence of credit channel. Employing a Vector Auto Regression (VAR) methodology, Pandit *et al.* (2006) confirm the existence of a bank lending channel. Second, the analysis appears to suggest that large banks are able to successfully insulate their loan supply from contractionary policy shocks *vis-a-vis* small banks. Using monthly data for 1996-2006, RBI (2006) found that the availability of lendable resources, non-performing loans and asset prices to be the major determinants of bank credit expansion. Credit was also found to be positively related to output gap, indicative of its pro-cyclical nature. However, these studies did not take on board the association of credit growth with bank soundness and between bank soundness and financial fragility and this becomes a major concern of the paper.

4. Empirical strategy

We model credit growth, bank soundness and capital adequacy as functions of each other and other bank-specific factors. Credit growth is measure as the annual change in total outstanding loans of individual banks, the soundness of banks is measured by their distance to default (De Nicolo, 2000; Laeven and Levine, 2007; Mercieca *et al.* 2007; Laeven and Levine, 2009) and fragility is measured by the ratio of non-performing loans to total loans. A

parsimonious baseline specification was selected by sequentially testing the relevance of various factors identified in the recent literature as structural determinants of credit growth, bank soundness and financial fragility.

A starting point for the selection of the baseline specification was to include bank-specific variables likely to affect bank soundness, bank fragility and the rate at which banks expand their loan portfolios. These variables reflect the supply-side determinants of credit growth, the importance of which was emphasized by Dell’Ariccia *et al.* (2008), Nier and Zicchino (2006). In line with recent studies of bank soundness (De Nicolo, 2007; Maechler *et al.*, 2007), measures of bank profitability (proxied by the net interest margin), liquidity (proxied by the liquidity ratio) and efficiency (proxied by cost to income ratio) are included as explanatory variables. We also control for income diversification in the soundness equation: using cross-country data on 288 banks for 1995-2000, Laeven and Levine (2008) find that well-diversified banks are less prone to taking risks. To control for size, we follow Berger *et al.* (2005) and employ both total size (measured as log of total asset) and relative size (measured as lag of share of bank assets by total banking assets in a given year). The former controls for scale economies and the latter controls for market power. All equations control for bank ownership and include year dummies to control for year-specific effects, including business cycle and other banking industry-specific considerations.

Based on the above discussion, the general specification of the model for bank s at time t can be specified as follows:

Equation 1: Bank credit growth

$$\begin{aligned} Credit\ growth(s,t) = f(& credit\ growth_{s,t-1}, bank\ soundness_{s,t-1}, bank\ fragility_{s,t-1}, \\ & cost\ income\ ratio_{s,t-1}, interest\ margin_{s,t-1}, liquidity_{s,t-1}, size_{s,t-1}, \\ & relative\ size_{s,t-1}, ownership\ dummies, year\ dummies) \end{aligned}$$

Equation 2: Bank soundness

$$\begin{aligned} Bank\ soundness_{s,t} = g(& credit\ growth_{s,t-1}, bank\ soundness_{s,t-1}, bank\ fragility_{s,t-1}, \\ & cost\ income\ ratio_{s,t-1}, interest\ margin_{s,t-1}, liquidity_{s,t-1}, size_{s,t-1}, \\ & relative\ size_{s,t-1}, income\ diversification_{s,t-1}, \\ & ownership\ dummies, year\ dummies) \end{aligned}$$

Equation 3: Bank fragility

$$\text{Bank fragility}_{s,t} = h(\text{credit growth}_{s,t-1}, \text{bank soundness}_{s,t-1}, \text{bank fragility}_{s,t-1}, \\ \text{cost income ratio}_{s,t-1}, \text{interest margin}_{s,t-1}, \text{liquidity}_{s,t-1}, \text{size}_{s,t-1}, \\ \text{relative size}_{s,t-1}, \text{bank branch growth}_{s,t-1}, \\ \text{ownership dummies}, \text{year dummies})$$

These equations can be estimated using the three stage least squares (3SLS) methodology.

5. Data description

The time period of the study spans 1996-2008 and comprises of all state-owned banks, several (including *de novo*) private banks, and 11 foreign banks, accounting, on average, for around 95% of banking assets. Owing to mergers and acquisitions, primarily in the private banking segment, we have a maximum of 62 banks in the beginning of the sample period to a low of 56 banks in the terminal year of the sample. The data for the analysis are extracted from published sources. With a total of 62 banks spanning across 13 years, we have a maximum of 806 bank-years.

Table 2. Summary statistics – Major variables

Variable	Empirical definition	Obs.	Mean	Std. Devn	Correlation (p-Value)		
					Loan growth	Z-score	NPL
Dependent					Loan growth	Z-score	NPL
Loan growth	Log of first difference of bank loans	793	-0.077	0.516	1.00		
Z-score	$(\pi/A+E/A)/\sigma$ (π/A), where π is net profit, E is equity, A is total asset and σ denotes standard deviation	794	18.677	18.632	-0.012 (0.73)	1.00	
NPL	Non-performing loans/ Total loans	806	0.085	0.068	0.208 (0.00)	-0.077 (0.03)	1.00
Independent							
CIR	Cost income ratio = Operating expense/(Total income minus interest expense)	797	0.555	0.183	0.039 (0.27)	-0.184 (0.00)	0.577 (0.00)
NIM	(Interest income minus interest expense)/ Total asset	797	0.029	0.028	0.016 (0.65)	0.021 (0.54)	-0.112 (0.00)
Liquidity	Liquid assets/Total assets, where Liquid assets = cash in hand + balances with central bank + call money	797	0.125	0.085	-0.052 (0.14)	0.019 (0.59)	0.082 (0.02)
Diversification	Measure of income diversification, based on Laeven-Levine (2007) and is calculated as: $1 - \left \frac{\text{net interest income} - \text{other operating income}}{\text{Total operating income}} \right $ where net interest income equals interest income minus interest expense and other operating income equals net fee income, net commission income and net trading income. Total operating income is the aggregate of net interest income and other operating income	794	0.767	0.195	-0.055 (0.14)	0.019 (0.00)	0.063 (0.07)
Branch growth	Log of first difference of bank branch	795	0.035	0.169	0.062 (0.07)	0.011 (0.76)	-0.144 (0.00)
Size	Log (total asset)	797	4.029	0.626	-0.218 (0.00)	0.219 (0.00)	-0.104 (0.00)
Relative size	Total asset of bank s in year t/Total banking sector assets in year t	797	0.016	0.030	-0.014 (0.69)	0.191 (0.00)	0.098 (0.00)
SOB	Dummy=1, if a bank is state-owned, else zero	793	0.456	0.498	-0.029 (0.42)	0.116 (0.00)	0.254 (0.00)
NPB	Dummy=1, if a bank is new private, else zero	793	0.098	0.298	0.039 (0.27)	0.084 (0.01)	-0.186 (0.00)
OPB	Dummy=1, if a bank is old private, else zero	793	0.271	0.445	-0.003 (0.93)	-0.049 (0.16)	0.059 (0.09)
FORGN	Dummy=1, if a bank is foreign, else zero	793	0.174	0.379	0.010 (0.77)	-0.162 (0.00)	-0.257 (0.00)
MERGER	Dummy=1, for the acquiring bank in the year of merger, else zero	793	0.024	0.153	-0.108 (0.00)	-0.017 (0.63)	-0.096 (0.00)

Source: Author's calculations

6. Findings and discussion

This section details the findings of the regression analysis. We discuss the results under three heads: first, we examine the baseline regression, including robustness checks. Second, we explore which of the components of credit have been instrumental in driving the credit expansion. And third, we focus on state-owned banks (SOBs), which account for nearly three-quarter of the banking system assets. We estimate the general specification of the model for the whole period as also for the sub-period 2004-08, which coincided with a rapid expansion in credit in the banking sector.

6.1 Discussion of the baseline regression

Across all equation, higher bank efficiency, as measured by the cost-to-income ratio, exerts a perceptible influence on the dependent variable. On the one hand higher levels of bank inefficiency dampens credit growth and lowers bank soundness, on the other, it exacerbates bank fragility. This is consistent with studies which predict that inefficient banks tend to be more risky (Berger and DeYoung, 1997; Berger and Humphrey, 1997; Hao *et al.*, 1999; Maudos and Pastor, 2001; Kumbhakar and Sarkar, 2003; Das and Ghosh, 2006; Das and Ghosh, 2009). The evidence indicates that banks with greater market power exhibit lower loan growth.

Table 3. 3 SLS estimation of credit growth, bank soundness and bank fragility

Variable	Period: 1996-2008			Period: 2004-2008		
	Credit growth	Bank soundness	Bank fragility	Credit growth	Bank soundness	Bank fragility
Credit growth	0.195 (0.035)***	-0.073 (0.057)	0.044 (0.012)***	0.181 (0.069)***	-0.560 (1.306)	0.042 (0.019)***
Bank soundness	0.017 (0.015)	0.769 (0.248)***	0.0004 (0.005)	0.012 (0.020)	0.653 (0.387)***	-0.0005 (0.005)
Bank fragility	-0.074 (0.066)	0.624 (1.085)	0.691 (0.023)***	-0.095 (0.156)	-0.082 (0.296)	0.609 (0.043)***
Bank-level controls						
CIR	-0.049 (0.021)***	-0.924 (0.348)***	0.030 (0.007)***	-0.064 (0.038)*	-0.153 (0.073)**	0.026 (0.010)***
NIM	0.543 (0.353)	-0.498 (0.587)	-0.318 (0.123)***	1.510 (0.671)**	0.132 (0.131)	-0.105 (0.184)
Liquidity	0.047 (0.048)	0.348 (0.787)	-0.043 (0.017)***	0.111 (0.067)*	0.055 (0.128)	-0.026 (0.018)
Size	0.006 (0.008)	0.126 (0.149)	-0.0006 (0.003)	-0.007 (0.017)	-0.056 (0.315)	0.0005 (0.005)
Relative size	-0.202 (0.122)*	0.212 (0.199)	0.020 (0.043)	-0.102 (0.236)	0.592 (0.448)	0.018 (0.065)
Income diversification		0.428 (0.258)*			-0.603 (0.445)	
Bank branch growth			-0.004 (0.006)			0.009 (0.016)
Dummy variables						
SOB	0.019 (0.009)**	-0.226 (1.516)	-0.007 (0.003)**	0.038 (0.015)***	-0.182 (0.291)	-0.005 (0.004)
NPB	0.058 (0.011)***	0.183 (0.186)	-0.007 (0.004)*	0.066 (0.019)***	0.114 (0.370)	-0.007 (0.005)
FORGN	-0.011 (0.009)	-0.237 (0.151)	-0.010 (0.003)***	0.013 (0.015)	-0.167 (0.298)	-0.012 (0.010)
MERGER	0.045 (0.018)***	0.052 (0.292)	0.003 (0.006)	0.036 (0.023)*	0.044 (0.430)	-0.0007 (0.007)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Diagnostics						
Observations	721	721	721	289	289	289
R-squared	0.981	0.629	0.849	0.990	0.564	0.681

Standard errors within brackets

***, ** and * denote statistical significance at 1, 5 and 10%, respectively

The analysis also supports the existence of persistence effects: the lagged dependent variable across all three specifications is significant at conventional levels. Among the cross-equation relationships, the analysis indicates that higher credit growth exerts tends to amplify bank fragility. This concurs with the literature that suggests that rapid credit growth could be a harbinger of financial instability (Fernandez *et al.*, 2000; Borio *et al.* 2001; Hilbers *et al.* 2005; Cottarelli *et al.* 2005; Jimenez and Saurina, 2006;). Besides the economic significance, the magnitude is statistically important, as well: a one standard deviation rise in credit growth lowers bank fragility by 0.33 standard deviation. These magnitudes are consistent with previous literature on Indian state-owned banks which posits a dampening effect of rapid credit expansion on bank soundness (Das and Ghosh, 2007).

Coming to bank ownership, the evidence clearly suggests that credit growth has been rapid in state-owned and *de novo* private banks with respect to the control category. As well, all three bank groups appear to be less fragile in terms of their non-performing loan ratio as compared to others.

Since all equations control for the impact of merger and address demand-side considerations by including year fixed effects, it seems less likely that these results are driven by business cycle or other bank-specific effects.

We also estimate the equation system for a much shorter period from 2004-2008, coinciding with the period of significant credit expansion (See, Table1). The results appear to reinforce previous findings: credit growth appears to exert a positive impact on bank fragility. Across ownership, it seems that only the fragility of foreign banks is lower as compared to others; the remaining findings are the same as earlier.

6.2 *Which components of credit are most relevant in explaining the relationship?*

We next examine which components of credit are the most relevant in explaining the relationship. For expositional simplicity, we examine three categories of credit - according to sector, type and security – and consider within each of these sub-categories, the most dominant component of that category.

For instance, in terms of sectoral distribution of credit, we focus on private sector credit. Within the other two categories similarly, we consider growth in term lending and growth in unsecured loans, respectively. Since the control variables are unaltered in sign and significance, we present the findings only with respect to the endogenous variables. Table 4 presents some details.

The findings in Panel A suggests that sounder banks experience higher growth in private sector credit – the coefficient on *bank soundness* is positive and significant at conventional levels. In terms of magnitude, a 1 percentage point rise in bank capital translates into a credit expansion by the private sector of nearly 0.3 percentage point. When we consider the revised sample period, these relationship between private sector credit growth and bank soundness is found to be mutually reinforcing: while higher levels of bank soundness exerts a salutary impact on private sector credit growth on the one hand, on the other, high growth in private sector credit is found to augment bank soundness, perhaps through its impact on bank profitability.³ In addition, bank fragility and credit growth are found to be negatively related. Thus, while high growth in private credit can lead to an improvement in bank soundness, it could also engender higher fragilities, for example, through higher loan delinquencies.

Table 4. 3 SLS estimation of credit growth, bank soundness and bank fragility – Analyzing credit components

Variable	Period: 1996-2008			Period: 2004-2008		
Panel A	Credit component according to sector					
	Pvt. sector credit growth	Bank soundness	Bank fragility	Pvt. sector credit growth	Bank soundness	Bank fragility
Pvt. sector credit growth	0.054 (0.033)*	-0.018 (0.012)	0.115 (0.123)	0.067 (0.064)	0.057 (0.029)**	0.639 (0.351)*
Bank soundness	0.304 (0.080)***	0.590 (0.029)***	-0.697 (0.301)**	0.329 (0.116)**	0.606 (0.055)***	-1.089 (0.624)*
Bank fragility	0.011 (0.012)	0.005 (0.004)	0.355 (0.044)***	0.012 (0.015)	0.005 (0.007)	0.392 (0.081)***
Bank-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Dummy variables						
SOB	0.019 (0.012)*	0.010 (0.004)***	-0.116 (0.042)***	0.044 (0.017)***	0.019 (0.008)***	-0.225 (0.096)***
NPB	0.064 (0.014)***	-0.003 (0.005)	0.032 (0.051)	0.064 (0.021)***	0.017 (0.010)*	-0.087 (0.119)
FORGN	-0.011 (0.012)	0.005 (0.004)	0.159 (0.042)***	-0.009 (0.018)	0.013 (0.008)	0.183 (0.097)*
MERGER	0.030 (0.022)	-0.001 (0.008)	0.004 (0.079)	0.022 (0.026)	0.0005 (0.012)	-0.045 (0.141)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Diagnostics						
Observations	710	710	710	293	293	293
R-squared	0.969	0.525	0.341	0.987	0.482	0.311
	Growth in term lending	Bank soundness	Bank fragility	Growth in term lending	Bank soundness	Bank fragility
Panel B	Credit component according to type					
Growth in term lending	0.111 (0.024)***	-0.002 (0.006)	0.057 (0.056)	0.227 (0.056)***	0.057 (0.018)***	0.545 (0.216)***
Bank soundness	0.048 (0.129)	0.648 (0.030)***	-0.647 (0.300)**	0.364 (0.161)**	0.618 (0.053)***	-1.203 (0.621)**
Bank fragility	0.014 (0.019)	0.005 (0.004)	0.352 (0.043)***	0.012 (0.021)	0.005 (0.007)	0.392 (0.079)***
Bank-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Dummy variables						
SOB	0.021 (0.018)	0.009 (0.004)**	-0.117 (0.041)***	0.038 (0.025)	0.018 (0.008)**	-0.214 (0.095)***
NPB	0.073 (0.021)***	-0.002 (0.005)	0.032 (0.050)	0.058 (0.029)**	0.015 (0.010)	-0.073 (0.118)
FORGN	-0.041 (0.017)***	0.003 (0.004)	0.156 (0.040)***	-0.027 (0.025)	0.014 (0.008)*	0.173 (0.097)*
MERGER	0.052 (0.034)	-0.003 (0.008)	0.002 (0.078)	0.037 (0.036)	0.0004 (0.011)	-0.043 (0.139)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Diagnostics						
Observations	724	724	724	293	293	293
R-squared	0.969	0.525	0.341	0.976	0.493	0.319
	Growth in unsecured loans	Bank soundness	Bank fragility	Growth in unsecured loans	Bank soundness	Bank fragility
Panel C	Credit component according to security					
Growth in unsecured loans	-0.214 (0.032)***	0.005 (0.004)	0.043 (0.049)	-0.114 (0.057)***	0.0001 (0.015)	0.218 (0.179)
Bank soundness	0.537 (0.188)***	0.597 (0.029)***	-0.671 (0.291)**	0.188 (0.199)	0.610 (0.054)***	-1.114 (0.625)*
Bank fragility	-0.016 (0.029)	0.005 (0.004)	0.354 (0.045)***	-0.025 (0.026)	0.005 (0.006)	0.406 (0.081)***

³ In terms of Section 25 of the RBI Act, every bank is required to transfer to its reserves not less than 25 percent of its disclosed profits, every year.

Bank-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Dummy variables						
SOB	0.020 (0.028)	0.008 (0.004)**	-0.117 (0.040)***	0.047 (0.031)	0.019 (0.008)***	-0.232 (0.096)***
NPB	0.095 (0.032)***	-0.005 (0.005)	0.026 (0.049)	0.119 (0.037)***	0.019 (0.010)*	-0.124 (0.121)
FORGN	-0.019 (0.027)	0.003 (0.004)	0.161 (0.040)***	0.046 (0.031)	0.012 (0.008)	0.184 (0.098)*
MERGER	-0.043 (0.053)	-0.002 (0.008)	0.005 (0.079)	-0.015 (0.045)	-0.0004 (0.012)	-0.042 (0.141)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Diagnostics						
Observations	725	725	725	293	293	293
R-squared	0.855	0.528	0.346	0.963	0.476	0.308

Standard errors within brackets

***, ** and * denote statistical significance at 1, 5 and 10%, respectively

Panel B focuses on term lending. The results mirror previous findings: loan supply is higher for banks with stronger balance sheets, as measured by their CAR. The sub-period findings also echo earlier results.

An examination of growth in unsecured credit partially supports the aforesaid findings (Panel C). More specifically, bank soundness leads to a growth in unsecured credit, however, the mutually reinforcing relation between credit and capital, as observed for the previous credit categories is not in evidence.

7. Concluding remarks

Using data on Indian banks for 1996-2008, the paper examines the nexus among credit growth, bank soundness and bank fragility. Alternate measures of soundness and fragility have been employed to ascertain robustness. The analysis appears to indicate that higher credit growth amplifies bank fragility. Besides, the results point to the fact that sounder banks increase loan supply. Overall, this would suggest that prudential risks associated with rapid credit growth are well-contained. Coming to bank ownership, the evidence testifies that credit growth has been rapid in state-owned and *de novo* private banks.

Robustness tests focusing on a shorter time span or various components of credit classified according to sector, type and security veer around to broadly similar conclusions: sounder banks increase credit supply more than weaker banks and that, the relationship between credit risk and bank soundness is mutually reinforcing. In regard to state-owned banks, the results indicate that there are no significant differences in the credit behaviour of fully government-owned *versus* partially government-owned banks.

The results motivate a few policy conclusions. First, it seems important to closely supervise rapidly growing banks to ensure that these banks have adequate risk management systems in place and are pricing risk properly, in conjunction with strengthening prudential guidance for banks. Second, a better understanding of the implications of rapid credit growth for financial stability in the context of financial sector surveillance seems warranted. Across

continents and countries, the evidence indicates that over-extension of credit is often a recipe for potential disaster. Over-stretched financial systems and “search for yields” has been found to lead to riskier banking systems, leading commentators to seek for imposition of “speed limits” (Honohan, 1997), either on their loan book or on segments that appear in danger of over-extension. In the Indian case, for example, in response to perceptible change in credit expansion, the risk weight on certain credit categories and exposures were temporarily increased. Third, in the context of the envisaged Basel II, designing an effective prudential policy response to rapid credit growth seems a challenging task. On the one hand, while overtly intrusive measures could penalize rapidly expanding banks where the risks are well managed and thereby hinder financial deepening, on the other, leaving the aspect unattended could lead to a build-up of risks, imposing costs on the financial system in future. Judged thus, the above considerations suggest the need for giving priority to risk-based supervision coupled with stress testing as a way to contain the potential risks associated with rapid credit growth.

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