State Ownership and Systemic Risk: Evidence from the Indian Financial Sector during 2007-09[1]

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Abstract

The global financial crisis which began in the fall of 2007 and progressively worsened in 2008, affected the Indian financial sector beginning only 2008. While Indian financial firms have been fairly resilient compared to their global counterparts, we show that Indian private sector firms faced greater losses compared to public sector firms during the crisis period of 2008-2009. We use a stock market-based measure of systemic risk, *Marginal Expected Shortfall* (MES) (Acharya, Pedersen, Philippon, and Richardson (2010a)), to determine the systemic risk contributed by each Indian financial firm for the period preceding the crisis (January 2007 to December 2007) and compare it to its realized returns during the crisis (January 2008 to February 2009). Our results show that public sector firms outperformed private sector firms despite having greater systemic risk during the crisis. We conclude that investors rewarded Indian public sector firms with greater systemic risk while penalizing private sector firms with similar risk. We attribute this finding to the explicit and implicit government backing of public sector banks. We find that riskier public sector banks with high ex ante systemic risk and low Tier 1 capital received greater capital support from the government.

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Introduction

In 2008, the global financial crisis hit India with the Indian stock market losing more than 60% of its peak valuation. Unlike the developed countries where the crisis spread from the financial sector to the real economy, the slowdown in India occurred in the real economy and then spread to the banking sector. This in turn appeared to have a deteriorating second order effect on the real economy. The government of India (GOI), fearing an even rapid deterioration of the economy, announced wide-ranging stimulus packages in 2009 that appeared to restore the economy back to its pre-2008 growth.

An important observation for the Indian financial crisis of 2008 was the apparent weakness of private financial firms and the growing strength of public-sector or state-owned banks. As an ex ante measure of their potential vulnerability to a market-wide shock, we use a stock market-based measure of systemic risk, *Marginal Expected Shortfall* (MES), proposed by Acharya, Pedersen, Philippon, and Richardson (2010a). Using MES, we determine the systemic risk contribution of each Indian financial firm for the period preceding the crisis (January 2007 to December 2007). Then, for private sector financial firms and separately the public sector financial firms, we analyze the relation between pre-crisis systemic risk and emerging systemic risk during the financial crisis in 2008-2009, measured using (i) realized returns during the crisis (ii) deposit flows during the crisis.

Our main finding is that the relationship between ex ante systemic risk exposure and ex post performance in a systemic crisis was strikingly different for public sector and private sector financial firms. While pre-crisis systemic risk is associated with lower stock return performance and greater deposit base contraction during crisis for private firms (as economic intuition suggests), the relationship is in fact reversed for public financial firms. We argue that the explicit and implicit government guarantees for public sector firms helped them better weather the financial crisis. This has in fact been the theme worldwide: financial institutions with greater access to government guarantees have survived the crisis or even expanded post-crisis while the ones without such access have failed or shrunk. A striking case in point has been the growth of the government-sponsored enterprises (Fannie Mae and Freddie Mac) and commercial banks in the United States – both sets of institutions with explicit government support and ready

access to central bank emergency lending. These institutions expanded their holdings of mortgage-backed securities while investment banks and hedge funds de-leveraged and sold these securities (He, Khang and Krishnamurthy, 2009). Fannie Mae and Freddie Mac were hardly the better-performing institutions of this crisis; they were in fact "guaranteed to fail" (Acharya, Nieuwerburgh, Richardson and White, 2010).

Thus, even though access to government guarantees might be considered a source of financial stability during a crisis, justifying a greater presence of government institutions in the financial sector (or greater extent of government intervention in a crisis), our results suggest that this is likely associated with the misfortune of crowding out the private sector in the long run.

Stable Indian banking sector with mix of public and private banks

Barring a few hiccups, the Indian banking sector has proved to be reasonably robust during the financial crisis of 2007-09 when fragility of the financial sector, especially in Western economies, exacerbated the economic shock into severe recessions. The relative outperformance of the Indian banking sector has been attributed by some to the fact that it is highly regulated and well supervised, preventing banks and financial firms from taking excessive risks. For example, the Reserve Bank of India (RBI) adopted countercyclical measures in the period preceding the crisis and increased risk weights for certain sectors (notably, housing loans) to provide adequate capital buffers in the case of unexpected losses in the future (Gopinath (2009)).[5]

This relative stability of the Indian banks can be gauged from their high level of average capital to risk-weighted assets ratio (CRAR). Globally, this ratio has varied between 8.2% and 17.7% in 2008 (see Table 1). In comparison, CRAR for Indian banks was 13% as opposed to a minimum regulatory requirement of 9% and a Basel minimum requirement of 8%, suggesting that Indian banks were well capitalized and thus more stable (Gopinath (2009)). The quality of assets has also been steadily improving since 2002 as can be seen by reduction in the non-performing loans ratio which decreased to 2.3% in March 2008. The provisions to non-

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[5] Additionally, adversely affected markets during the financial crisis such as the credit derivatives market in the US and the Europe are is still in their nascent stages of development in India. Heavy regulation also restricted financial firms from investing in many of the risky financial derivatives that were responsible for the crisis in the West. Thus, the Indian banking sector had limited exposure to securitized sub-prime assets which were a primary source of losses for the financial sector in the western economies (Subbarao (2009)).

performing loans ratio was at 52.6% compared to a global range of 24.9% to 184%. The Indian banking sector also remained fairly profitable during the crisis period as measured by the return on assets (ROA) which was at 1% as of March, 2008, close to the ratio for other countries. Australia, Japan and the U.S. had much smaller ROAs during this period.

Historically, Indian banks had been wholly owned by the government. In the 1990's, after economic liberalization, the government reduced its stake and allowed private banks and foreign players to enter the market. The Indian financial system still has a substantive public sector ownership. Public sector banks (PSBs) dominate the Indian banking sector and as of March, 2009 they accounted for nearly 71.9% of aggregate assets. This mixed model of public and private ownership popular in emerging markets, also referred to as the Asian model, has been credited with the relative strength of the Indian financial sector compared to its global counterparts.

However, despite the relative overall strength of Indian financial firms, there has been a striking difference in the performance of public and private sector firms during the crisis. Consider the following two differences.

First, while the banking sector as a whole experienced a slowdown in deposit growth, private sector banks ("PSB"s) were affected to a larger extent. As per RBI estimates, public sector bank deposits grew by 24.1% in fiscal year 2009 (March 2008-March 2009) compared to 22.9% a year earlier. In comparison, private sector deposit growth slowed from 19.9% to a mere 8% for the same period. Credit growth showed similar trends. For public sector banks, credit grew by 20.4% (compared to 22.5% in 2008) whereas for private sector banks, it grew by only 10.9% (compared to 19.9% in 2008) (see Figure 1).

Second, market reaction to public versus private sector banks can also be gauged from the widening of CDS spreads for two illustrative firms, namely, State Bank of India (SBI, a public sector bank) and ICICI Bank (a private sector bank) during the crisis of 2008. From Figure 2, we see that the 1-year credit default swap (CDS) spreads for SBI and ICICI Bank were within the same range in 2007 suggesting investors viewed both firms as being equally risky. Beginning 2008, however, the difference between the spreads started widening in SBI's favor indicating

that investors possibly viewed the public sector financial firm to be healthier compared to the private sector firm.

Public sector banks more stable or simply more government-guaranteed?

The Asian model of banking assumes that public sector banks perform better during times of crisis and thus help provide stability to the banking system as a whole. It is argued that the risk-averse cautious approach of public sector firms leads to lower risk-taking during the good times, but pays off during bad times by providing steady results. Casual evidence is, however, to the contrary. Beginning 2005-06, the profitability -- as measured by the ratio of net profits to assets -- of private sector banks exceeded that of public sector banks (see Figure 3). Simultaneously, Figure 3 shows that the quality of assets -- as measured by non-performing assets (NPAs) to total assets -- for public banks has been historically lower than private sector banks, even though in recent years this ratio has improved for both sectors and the improvement has been more dramatic for public sector banks.

We conjecture that the relative underperformance of private sector banks in the crisis in spite of their superior pre-crisis risk-return profile is instead attributable to the implicit and explicit sovereign backing of public sector banks. The Indian Bank Nationalization Act provides an explicit guarantee that all obligations of public sector banks will be fulfilled by the Indian government in the event of a failure. As a result of this guarantee, we hypothesize that during the crisis of 2008-2009 private sector banks experienced a loss of confidence and capital gravitated to PSBs – even when their exposures to an economy-wide crisis were ex ante similar – because investors believed that the PSBs would be bailed out by the government in the event of a failure. And that given this expectation, capital flew from the riskier private sector banks to the more stable public sector banks resulting in a decline in equity valuations of the private sector financial firms during the crisis.

As a first step of our analysis to test these hypotheses, we examine the *ex ante* (pre-2008) measures of systemic risk of public and private financial firms and relate them to their *ex post* (2008-2009) or realized performance to determine the role played by government guarantees. We use the *Marginal Expected Shortfall* (MES) measure to calculate the systemic risk of financial institutions in the Indian financial sector during the crisis of 2008-2009. The MES measure

5

essentially captures the tail dependence of the stock return of a financial firm on the market as a whole. It estimates, in a given past period (say one year preceding a crisis), for the worst 5% days of the market or the financial sector index, the negative of the average market return of a given financial firm. The greater the MES, the more systemically risky is the firm. The question then is whether riskier PSBs as measured by *ex ante* MES fared better or worse than private sector banks with similar systemic risk.

Our results suggest that PSBs performed *better* than private banks in spite of having *higher* systemic risk. While private banks with high MES prior to the crisis (such as ICICI Bank) suffered heavily during the crisis, equally systemic state-owned banks (such as the SBI) gained substantially. For example, both ICICI and SBI had an MES of 5% (refer to Table 2). However, during the crisis period from January 2008 to February 2009, ICICI stock fell by 73% whereas SBI stock fell by a significantly lower 54%. More statistically robust regression results confirm this illustrative example and in fact show that within PSBs, banks with greater ex ante systemic risk did better ex post not worse. Finally, deposit base growth of banks too behaves similarly. While private sector banks with higher ex ante systemic risk experience deposit contractions, the result reverses for PSBs.

Policy implications: Caution against delaying privatization of Indian financial sector

We relate our results to the extent of capital support provided by the Indian government to the PSBs in the aftermath of the crisis, and compare it to PSB performance during the crisis. Evidence suggests that weaker PSBs received capital injections, supporting our hypothesis that in anticipation depositors and stock market investors reward riskier public sector banks while penalizing private sector banks with similar risk.

When the Indian government announced a number of wide-ranging stimulus plans to jumpstart the banking system, the PSBs were promised capital injections to help them maintain a CRAR of 12%. The GOI launched three fiscal stimulus packages during December 2008 – February 2009. As part of the second stimulus package, the government recapitalized state-run banks and infused nearly Rs.3100 crores in 2008-09 as Tier-I capital in four public sector banks. An additional infusion of Rs.16,500 crores is projected for the year 2010-11 that will help PSBs

maintain the minimum 8% Tier-I capital to Risk Weighted Asset Ratio (Government of India (2010)).

In the retail segment, with the backing of the Indian government, PSBs have come out with inexpensive housing, auto and education loans. For example, they are the lead financers in the Tata Nano auto purchases. As a result of the stimulus plans, PSBs are able to offer housing loans at lower rates than those charged by other banks and mortgage companies, such as Housing Development Finance Corporation (HDFC). Recently, private financial firms have in fact complained that SBI schemes do not draw in new customers, but are instead targeted at existing customers and are thus designed not to stimulate the economy but rather to undercut competitors (Wharton, (2009)).

This evidence suggests that state-banking sector may have grown during the crisis at the expense of private banks. Measures taken by the government may have helped bolster public sector banks making it difficult for private sector financial firms to compete with them. The resulting strength of PSBs has in fact strengthened the resolve to persist with them. Until recently, there had been a consistent trend towards privatization. However, the recent underperformance by private sector banks has raised some doubts regarding this approach.[6] Such sentiments have important policy implications and could alter the timeline and extent of privatization initially envisioned by the government. A recent article suggests that government ownership in public sector banks will gradually decline but only after the ongoing crisis has subsided, and that it is unlikely the state-owned banks will be fully privatized as was previously envisioned (Economist, 2010).

Our results strike a note of caution against drawing such conclusions. Examining performance of state-owned banks in a systemic crisis relative to private sector banks that do not have as great an access to government guarantees is perhaps not a sound basis of assessing the overall attractiveness of state presence in the financial sector. At any rate, government bailouts – and investor and depositor anticipation of safety net for public sector banks – seem to have deep

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[6] The ruling party leader, Sonia Gandhi, claimed that "public sector financial institutions have given our economy the stability and resilience we are now witnessing in the face of the economic slowdown." Finance minister, P. Chidambaram, echoed these sentiments when he claimed that India's public sector banks were strong pillars in the world's banking industry (Frontline, 2008).

consequences on competitive forces in the financial sector, potentially shaping their long-run form, and always stacking the odds against the flourishing of private banks.

The remainder of the paper is organized as follows. Section I explains the timeline of events for the financial crisis in the Indian context. Section II explains the systemic risk measure, MES, used to measure each firm's contribution to systemic risk. Section III presents the summary statistics for the MES and the realized returns. Section IV analyzes the realized returns for public sector versus private sector banks during the crisis of 2008-2009 based on their pre-crisis MES. It also presents several robustness checks of our results. Section V analyzes the deposit growth for public and private sector banks during the crisis period. Section VI relates capital support provided by the government to PSB performance during the crisis. Section VII discusses the related literature. Section VIII concludes.

I.   Crisis of 2008

The financial crisis in India was triggered by the much larger financial crisis in the US and other developed economies. While the crisis in the US began in August 2007, its effects were felt in India beginning only 2008. Foreign Institutional Investors (FIIs) facing a liquidity squeeze from abroad, started pulling out capital from India resulting in a sharp decline in the stock market. In 2008-09 FIIs withdrew nearly Rs. 43,337 crores (approx $9-10 billion). As a result, Indian banks and corporations feeling a dearth of capital from overseas markets had to turn to domestic markets for their funding requirements.

   At the same time, Indian banks and financial institutions facing uncertain market conditions started cutting back on credit, resulting in a liquidity crisis in 2008. Corporations, especially ones relying on foreign funding, feared further worsening of global market conditions and withdrew from money market mutual funds (MMFs). The MMFs which were heavily invested in non-banking financial companies (NBFCs) were forced to liquidate their positions. It is estimated that MMFs withdrew nearly Rs 22,355 crores in 2008-09. As a result of these capital outflows, the rupee also came under pressure. There was further liquidity tightening as the RBI intervened in the Forex market to manage rupee volatility. All these events resulted in a money market and credit squeeze which eventually spilled over to the real economy (Subbarao (2009)). The global

slowdown also resulted in a slump in demand for exports. This impact was felt economy-wide and Indian GDP fell from 9% in 2007 to nearly 6.1% in 2008.

Based on the timeline of these events, we use January 2008 to February 2009 as the "crisis" period for our study. Corroborating our choice, Figure 4 shows that the stock market index - S&P CNX NIFTY index - declined sharply starting January 2008. Index prices fell from a peak of 6,288 in January 2008 to 2,524 in October 2008, representing a decline of nearly 60%. Another market index - the BSE index - similarly fell nearly 59% from 20,873 in January 2008 to 8,510 in October 2008.

II.   Marginal Expected Shortfall (MES): A measure for systemic risk

We use the *Marginal Expected Shortfall* (MES) measure (Acharya, Pedersen, Philippon and Richardson (2010a)) to measure the ex ante systemic risk of public and private financial firms. The MES measure captures the tail dependence of the stock return of a financial firm on the market as a whole. The strength of the measure lies in its ability to predict which firms are likely to be affected the worst when a financial crisis materializes, as demonstrated by Acharya, Pedersen, Philippon and Richardson (2010a) in their analysis of the systemic risk of large U.S. financial institutions around the financial crisis of 2007-09.

Specifically, MES estimates the expected losses of a stock conditional on a crisis. Since extreme tail events such as a mild financial crisis happen once a decade and severe crisis such as the Great Depression or the Great Recession only one in several decades, the practical implementation of MES relies on "normal" tail events. We use the normal tail events as the worst 5% market outcomes at daily frequency over the pre-crisis period. In our analysis, we take the 5% worst days for the market returns as measured by the S&P CNX NIFTY index in any given measurement period, and then compute the negative of the average return for any given bank for these 5% worst days. The MES measure can also be interpreted as the contribution of each firm to the systemic risk in the event of a crisis. As such, MES is a statistical measure but Acharya, Pedersen, Philippon and Richardson (2010a) provide a theoretical justification for it in a model where financial sector's risk-taking has externalities on the economy whenever the sector as a whole is under-capitalized.

Another measure we look at is $MES which takes into account the market capitalization of individual firms. While MES gives the conditional expected loss per dollar of share value, $MES gives the dollar value of the expected loss. It is the MES value multiplied by the market capitalization of the firm at the *beginning* of the measurement period.

Our analysis is carried out for large financial institutions in India depending on data availability for the period under consideration. We have used 70 firms in all, 19 public sector banks and 51 private sector banks. Table 2 (sorted by $MES) shows the MES and $MES measures for public and private financial firms using January 2007 to December 2007 as the measurement period. Among private banks ICICI has the largest $MES (Rs. 37 crores) and is followed by State Bank of India (Rs. 31 crores) among the public sector banks. IDBI has the largest MES (6.67%) in the public sector while in the private sector India Infoline Ltd. and IFCI have the highest MES at 6.99% and 6.80% respectively. These mean that on the worst days of the year 2007, on average ICICI lost Rs 37 crore out of its market capitalization and IDBI lost 6.67% of its total market capitalization.

III. Summary Statistics

Table 3 provides the summary statistics for all the measures used in our analysis. The MES and $MES are calculated for the pre-crisis period of 2007, the realized returns for the crisis period are for the period January 2008 to February 2009 and deposit growth is calculated from data provided by RBI for the period from 31st March, 2008 to 31st March, 2009. Panel A reports the univariate statistics for all banks in the analysis. Note that MES, $MES and realized returns are calculated for 70 financial institutions. Deposit growth summary statistics is for the 39 banks for which both MES data and deposit estimates (provided by RBI) are available. Panel B reports the statistics for MES, $MES and realized returns for different types of financial institutions based on the nature of their business and their ownership structure. Panel C gives the deposit growth for public and private financial institutions.

As shown in Appendix A, we use two broad categories of institutions: (A) Public sector banks (19 firms) and (B) Private Sector Banks (51 firms). Private sector banks are further divided into (i) Private Banking Services (7 firms); (ii) Brokers and Securities and Stock traders (20 firms); and (iii) Housing Finance, NBFCs, and Other Financial Services (24 firms).

10

The significant loss of value as suggested by the average realized return values of -68.96% during 2008 (as shown in Panel A) indicates how trying this period was for financial firms. In fact, some private sector firms such as SREI infrastructure, Bajaj Holdings and Investment, Emkay Global financial services and Cholamandalam DBS Finance lost nearly 90% of their market equity value. Public sector firms such as Bank of Maharashtra, Vijaya Bank, Jammu and Kashmir Bank and IDBI Bank lost nearly 70% of their market value. Also, the average MES value of 3.79% is much higher (when compared to the average loss of 68.96% in realized returns in the crisis period) as it captures the average return when the market is in its left tail in "normal" times. What is important for our analysis, however, is not the level but whether a ranking of firms based on the normal-time MES works well even in extreme times.

There are some interesting observations in Table 3. Consider Panel A first. Average MES value is higher for public sector banks (4.34%) compared to private sector banks (3.58%). That is, the public sector banks had on average negative 4.34% returns on the days the market return (S&P CNX NIFTY) was below its 5th percentile for the pre-crisis period from January 2007 to December 2007. India Infoline (6.99%), IFCI (6.80%) and Indiabulls financial services (6.44%) had the highest MES among the private sector financial firms. In the public sector, IDBI bank (6.67%), Union Bank of India (5.41%) and Dena Bank (5.23%) had the highest MES. Focusing next on $MES, in the public sector banks, State Bank of India had the highest $MES (Rs. 30 crores) whereas for private sector banks, ICICI had the highest $MES (Rs. 37 crores) as mentioned above. PSBs had a higher average $MES value (Rs. 396. crores) compared to the average $MES value of private sector banks (Rs. 225 crores).

From Table 3, Panel B, on further examination of the sub-groups under private sector banks, we see that the sub-group of private banking services had more than three times the $MES of PSBs. This is because out of a total of 7 banks under private banking services (under the broader category of private sector banks), three of them have large market capitalizations (HDFC, IDFC and Axis Bank) thus resulting in a high $MES measure. The rest of the 44 private sector banks have much smaller $MES values compared to public sector firms resulting in a lower $MES for the private sector banks as a whole.

Next, Table 3, Panel C shows that deposits grew during 2008 overall by 21.77% between both public and private sector banks. This "flight to safety" is to be expected in a year of severe financial crisis such as 2008-09. However, deposits for private sector banks grew at a lower 17.73% compared to a deposit growth rate of 24.90% for the public sector.

From the summary statistics in Panel B of Table 3, we see that public sector banks had relatively higher systemic risk as measured by MES and $MES compared to private sector banks in the period preceding the crisis. Somewhat surprisingly, however, the average realized return is much higher for public sector banks compared to private sector banks during the crisis period from January 2008 to February 2009. Similarly deposits grew more slowly for private sector banks over this period.

Overall, on comparing average returns for private sector banks with public sector banks, we see that public sector firms performed better during the crisis as compared to private sector banks despite greater aggregate risk exposure. This provides the motivation for the analysis in the next section where we examine the cross-sectional variation for private and public sector banks.

IV.   Effect of the Crisis of 2008-2009 for Public and Private Sector Banks

The aim of analysis to follow is to determine the ex ante systemic risk of financial firms for the period preceding the crisis (January 2007-December 2007) using MES and $MES measures and use it to explain the cross-sectional variation in their performance during the crisis (January 2008-February 2009). We examine private and public sector banks separately. Banks with greater systemic risk (higher MES and $MES) would be expected to fare poorly in the event of a market wide downturn. Similarly, banks with lower systemic risk should have relatively higher realized returns.

Figure 6 shows that MES for private sector banks was able to explain a significant proportion of realized returns (R^2 of 13.41%) during the crisis. There is a statistically significant negative slope, indicating that firms with higher MES were worse hit during the market-wide downturn. Some examples help illustrate this. Reliance Capital, which lost nearly 86% of its market value, had a relatively high pre-crisis MES of 6.28%. On the other hand, IL&FS Investment Managers

Limited which had a lower MES of 1.42% had a relatively lower 64% drop and ICICI Bank, with an MES of 4.66% had a 73% drop in stock price during the crisis period.

Figure 7 shows that MES might explain to a lesser extent the realized returns (R^2 of 4.69%) for public sector banks as well. When the outlier, IDBI was excluded from the analysis, R^2 improves to 23.27%. However, unlike private sector banks, public banks have a *positive* slope. Thus, for public sector banks, the realized returns were smaller for banks with higher MES. Intuitively, we would expect that banks with higher *ex ante* systemic risk would perform worse during the crisis. Possibly, government stimulus packages may have helped public sector banks perform better. In fact banks that had a higher exposure to systemic risk as measured by MES performed better possibly because they were the weakest and (therefore) received a greater implicit government backing. For example, SBI, a PSB with an MES similar to ICICI Bank of 4.63%, had a better return of -54%. On the other hand, Union Bank, another PSB, with a higher MES of 5.41 % had higher relative return of -42% (compared to -54% for SBI). Another example is Jammu and Kashmir Bank which had a lower MES of 2.01% but had a sharp -72% drop in realized returns.

Table 4 shows the results of the regression of realized returns against the dependent variables MES, leverage, pre-crisis returns and assets. Asset value controls for the size of the firm. The asset value is the quasi- market value of assets measured as the difference in book value of assets and book value of equity added to the market value of equity. Leverage is measured as the ratio of the quasi- market value of assets to the market equity. Since the leverage and asset size are strongly related (correlation of 0.42), the pooled regressions use only one of the two variables. Since it is not easy to measure true leverage due to infrequent and limited reporting, we can think of pre-crisis returns as a proxy for leverage since returns will be higher in the pre-crisis period for highly levered firms. The results show that MES is the most significant factor in explaining the crisis returns. For regressions excluding asset as the independent variable, public sector firms have a positive coefficient for MES (3.65, t-stat=1.82) and a negative coefficient for private sector firms (-3.55, t-stat = 2.25). Leverage, while not significant is negative for both public (-.000926, t-stat=1.37) and private (.00001, t-stat= 0.41) firms indicating that firms which were highly levered performed worse during the crisis, as we would expect.

For regressions with the dependent variables MES, pre-crisis returns, and assets, the results are similar. MES is positive for public sector firms (2.51, t-stat=1.15) and negative (-4.51, t-stat=2.85) for private sector firms. The coefficient for assets is positive for both public (0.01, t-stat=0.55) and private sector (0.02, t-stat=2.01) though significant for only private sector firms. Thus, larger private sector firms fared better than smaller private sector firms.

Of note, the results for realized return versus pre-crisis return shows that pre-crisis returns is an important factor for private sector returns as indicated by the high adjusted R^2 of 9.36%. The coefficient for public sector firms (-0.05, t-stat=-0.83) though negative does not have the same explanatory power as shown by the much lower adjusted R^2 of -1.82%. Thus, while riskier private sector firms performed poorly during the crisis, the same is not necessarily true of public sector firms.

To better understand how the relationship between systemic risk exposure of financial firms and the realized returns changed over the crisis period, we also look at the quarter by quarter changes in the dependent variable, realized returns. Table 5 analyses the relationship between pre-crisis systemic risk measures determined by MES and the realized returns in each quarter of the crisis period. In the beginning of the crisis period, both public and private sector financial firms had a negative slope, indicating that a market wide downturn would impact systemically riskier firms to a greater extent. In Q1 2008 and Q2 2008 the slopes for private sector banks were (-3.01, -8.75) compared to (-2.12, -0.82) for public sector banks. The corresponding t-statistics are (1.75, 2.17) for private sector banks and (1.34, 0.46) for public sector banks. However, as the crisis worsened, it seemed likely that financial firms would require government support to tide over this difficult period. Given the implicit government backing for public sector firms, investors believed public sector firms were more likely to receive government support. In Q3, 2008, slopes for both public and private sector firms became positive. While the slope for private sector firms was positive (slope = 2.18, t-statistic = 1.06) in 2008 Q3, the effect was fairly muted compared to the public sector financial firms (slope = 7.43, t-statistic = 2.04). The government announced the fiscal stimulus in December, 2008. For Q4, 2008, slope for public sector banks remained positive (slope = 5.22, t-statistic = 2.63). In contrast, the slope for private sector firms went back to being insignificantly negative (slope =-1.47, t-statistic = 0.95).

Robustness checks

We conduct three checks for the robustness of our analysis.

Stability of MES and $MES ranks over time. A measure of systemic risk that varies substantially over time could make it difficult to determine whether banks which were systemically important in 2006 remained systemically important in 2007, from 2007 to 2008, and so on. Hence, we check whether the choice of time period affects the results obtained. Figure 8 plots the MES rankings from January 2006 -December 2006 against the MES ranks from January 2007 - December 2007. The high R^2 of 17.6% implies MES rankings in 2006 were reflective of which firms would be systemically important during 2007. Appendix C shows the MES and $MES rankings for firms using 2006 as the measurement period.

The regression was repeated for $MES and showed similar results. R^2 was nearly 92.5% (see Figure 9). We find that rankings remained almost the same across the two periods; firms which had the highest dollar losses in the lowest 5th percentile market return during the pre-crisis period remained consistent across 2006 and 2007. Of note, rankings based on $MES remained far more stable compared to MES rankings. For example, ICICI was ranked 47 in 2006 but became systemically more important in 2007 and was ranked 17. Its $MES ranking, however, remained the same for both periods.

BSE SENSEX as the index. Our second robustness check determines whether the choice of market index affects the measures and the results of our analysis. In our analysis we used S&P CNX NIFTY to determine market returns while calculating the MES values. We now compare results using the BSE SENSEX index to determine market returns. From Figure 1, we see that both the S&P CNX NIFTY index and BSE SENSEX Index had similar trends. The crisis period as per our analysis in Section I, began in January 2008. This period had a sharp drop in value for the BSE SENSEX Index as well. Appendix B provides the MES and $MES rankings measured based on BSE SENSEX values.

The correlation of ranks based on the two indices is 0.98 for MES and 0.99 for $MES. The higher ranked banks had similar ranking measures for both indices (with most of these banks appearing within +/-6 ranks based on either index). Of course, as we go lower down the table, the

rankings change more dramatically since small differences in MES and $MES values are more likely to change rankings drastically. For example, Sydicate bank which is ranked 28 (on MES) based on S&P CNX NIFTY is ranked 18 based on the BSE SENSEX. However, overall rankings for all banks remain within +/- 14 ranks based on either index, indicating the choice of index is unlikely to drastically change the results of our analysis.

Regressions in Section IV were repeated using the BSE SENSEX to determine the market returns. That is, MES measures were determined for all banks during the crisis period from January 2007 and December 2007 given that the market returns as measured by the BSE SENSEX was below its 5th percentile. The realized returns were calculated for the period from January 2008 to February 2009. Regression results show that the private sector banks had an R^2 of 13.07% with a negative coefficient of -4.2 (t-stat = 2.92). As opposed to this public sector banks had an R^2 of 1.31% with a positive coefficient of 2.26 (t-stat = 1.11).

Statistical analysis using the quarter by quarter realized returns as the dependent variable yield results similar to those discussed in Section IV. 2008 Q1 and 2008 Q2 had negative slopes for MES with slopes of (-2.84, -8.07) for private sector firms and (-2.84, -0.36) for public sector firms. The corresponding t-statistics are (1.72, 2.08) and (1.80, 0.19). The slope for public sector firms are positive (6.80, 4.5) for Q3 2008 and Q4 2008 with t-statistics of (1.76, 2.07). In contrast, for private sector firms, while the slope was positive (1.92, t-statistic= 0.97) in Q3, 2008, it reverts back to being negative (-1.35, t-statistic= 0.91) in Q4, 2008.

Placebo tests outside of the crisis. Finally, we check for robustness assuming different crisis periods (Table 5). These regressions test whether the discrepancy in returns for public versus private firms holds *only* during crisis periods or whether it is true in other periods as well. Table 5 shows the regressions for public and private sector firms assuming the dependent variable to be the placebo "crisis" period returns corresponding to 2005, 2006, 2007 and 2008. The corresponding independent variables are the "pre-crisis" period annual returns for the years 2004, 2005, 2006 and 2007. The pre-crisis returns explain the crisis period behavior only for private sector firms for the 2008 crisis period. As expected, the regression coefficient is negative (-0.02, t-stat=-2.23) and corresponds to an adjusted R^2 of 7.33%. And as we know from earlier results, there is no such effect for public sector banks. All the other periods have insignificant t-

stats and low adjusted R^2, importantly for both private and public sector banks. Thus, annual returns in the non-crisis periods, namely 2005, 2006 and 2007 are not explained by the prior year returns. However, in times of a crisis, the government guarantees start to matter and affect private and public firm returns differently.

V.   Deposit Growth

Section IV illustrated the difference in equity performance for public sector and private sector relating it to pre-crisis measure of their systemic risk exposure. In this section, we add to this evidence by focusing on the deposit flows for private and public sector banks and analyze how this relates to the pre-crisis systemic risk exposure.

Of the 50 firms for which the Reserve bank of India (RBI) provides annual deposit flow data, 39 are listed and have stock market data which can be used to measure MES. Table 2 also provides the deposit growth for the 39 firms during the crisis period from March 31st 2008 to March 31st 2009. The question is whether deposit flows show trends similar to realized returns for public and private sector firms. Figure 10 provides a regression analysis of deposit flows with MES as the regressor. The evidence presented in this section strongly supports our hypothesis that investors treated public and private firms differently during the crisis. There was a shift in deposits from private sector firms to the public sector.

Formal statistical analysis as presented in Figure 10, graph A shows that MES does a good job of explaining the growth in deposits for private sector firms (R^2 of 20.4%). As we would expect intuitively, the sign for the independent variable is negative, suggesting private sector banks with high exposure to systemic risk performed poorly during the crisis. A few cases illustrate this point well. Indusland bank with a high MES of 5.90% had a deposit growth of 16% in the crisis period. Compared to this, Axis bank with a relatively lower systemic risk exposure (MES of 3.75%) had a higher growth rate of 34%.

Next, we look at public sector banks. As shown in graph B, the statistical analysis yields a *positive* sign for the regressor variable MES. This is counter-intuitive since depositors should penalize firms with greater systemic risk exposure and move money from the riskier firms which are likely to fail during a crisis to firms with low systemic risk exposure. In particular, looking at

specific examples, we see that deposits for State Bank of India with an MES of 4.63% grew by 38% whereas in contrast deposits for Andhra Bank (with a lower MES of 3.61%) grew by only 20%. However, the results are similar to what we saw in section IV wherein the sovereign backing of public sector firms distorts market behavior during systemic crisis and the market rewards public sector firms with greater systemic risk, since there is a greater likelihood that these banks will be bailed out in the event of a failure during a systemic crisis. From graph B, we see the coefficient for MES is statistically significant with a t-statistic of 3.08 and it does a fairly good job of explaining the deposit growth (R^2 of 32.1%).

Now we look at the quarterly variation in deposit flows for the banks. The public sector banks account for a significant proportion of nearly 75-80% of the total deposit amounts. From Figure 11 for the quarterly changes graph we see that initially when the crisis hit India in 2008, both public and private sector had similar deposit growth rates. In Q1 2008, deposits for both sectors grew by 10%. As the crisis worsened, the disparity between public and private sectors is evident. Public sector bank deposits grew by (1.7%, 5.5%, 5.2%) compared to a much lower growth of (0.0%, 1.0%, -0.3%) for private sector banks in (Q2, Q3, Q4) of 2008. Towards the end of the crisis both sectors posted relatively higher growth rates of 12.0% for the public sector and 8.2% for the private sector.

Finally, Table 7 shows the results of the regression of deposit growth against the dependent variables MES, leverage, pre-crisis returns and assets. Again as in Section IV, due to the high correlation between leverage and asset values we use only one of the two variables in the pooled regressions. For regressions with MES, leverage and pre-crisis returns, public sector firms have a positive coefficient for MES (3.29, t-stat=3.04) and a negative coefficient for private sector firms (-6.74, t-stat = 1.23). For regressions with the dependent variables MES, pre-crisis returns, and assets, the results are similar. MES is positive for public sector firms (2.97, t-stat=2.60) and negative (-7.71, t-stat=1.47) for private sector firms.

Thus, our analysis shows that deposits shifted from private sector firms to public sector banks in the crisis period. Following the credit crisis and the subsequent fall of Lehman, many depositors shifted capital out of private and foreign banks and moved it government banks. Anecdotal evidence is consistent with this "flight-to-quality": Infosys transferred nearly Rs. 10

trillion of deposits from ICICI to SBI just after Lehman's collapse in the third quarter of 2008 (Economic Times (2009)).

VI. Capital Injections in Public Sector Banks

In this section we relate PSB performance observed during the crisis period to the capital injections made by the government in PSBs in the period following the crisis.

A major component of the fiscal stimulus packages announced by the government since December 2008 has focused on jump-starting the banking sector. Specifically, the Indian government has promised to provide capital resources to PSBs to help them maintain CRAR ratio of 12%. In order to fulfill the funding gap, the GOI requested financing of Rs. 1700 crores ($3.4 billion) from the World Bank in December 2008. The timing and size of these capital injections was left up to the discretion of the GOI. Capital injections were to be determined based on PSBs ability to access equity markets, capital requirements for growth and existing capital resources (World Bank, (2009)).

Since December 2008, the GOI has announced a number of capital injections for PSBs. In February 2009, the government announced a capital injection in 3 PSBs, namely UCO Bank (Rs. 450 crores), Central Bank of India (Rs. 700 crores) and Vijaya Bank (Rs. 500 crores). For the 2008-2009 period the government injected a total of Rs. 250 crores into United Bank of India.

In the 2010-2011 budget, the government promised an additional Rs. 16,500 crores of capital infusion to help PSBs maintain their minimum Tier- 1 capital ratio of 8%. As part of this effort, the government has announced capital infusion of Rs. 6,121 crores in five PSBs namely IDBI Bank (Rs. 3,119 crores), Central Bank (Rs. 2,016 crores), Bank of Maharashtra (Rs. 590 crores), UCO Bank (Rs. 375 crores) and Union Bank (Rs. 111 crores)

The amount of capital injections was determined based on PSB funding requirements and the need for a capital buffer. Thus PSBs which performed the worst during the crisis resulting in high capital depletion were more likely to receive support from the government. As of March 2009, all the banks mentioned above (except Union Bank) had Tier 1 capital less than 8%. The Tier 1 capital ratios for Bank of Maharashtra, Central Bank of India, UCO Bank, Union Bank of

India, Vijaya Bank and IDBI Bank were at 6.1%, 7.0%, 6.5%, 8.2%, 7.7% and 6.8%, respectively. Based on the MES measure, these were also among the riskiest banks in our analysis. For example, IDBI had an MES of 6.67%, Union Bank of India had an MES 5.41% and Vijaya Bank had an MES of 5.02%. UCO had a relatively lower MES of 4.26%. IDBI with a high MES of 6.67% received the highest capital injection of Rs 3,119 crores.

The evidence in this section supports the hypothesis that the implicit and explicit government guarantees helped PSBs perform better during the crisis. The effect of the bailouts in end of 2008 on market sentiment towards PSBs versus private sector banks can be seen in Table 5. The quarter-by-quarter regressions of realized returns versus MES show that public sector firms had a high positive slope of 5.22 (t-stat 2.63) in Q4 2008: worst banks in terms of systemic risk exposure fared better in this quarter. Compared to this, private sector firms had a negative slope of -1.42 (t-stat 0.95).

VII.   Related Literature

In our analysis we have used the MES measure shown in Acharya, Pedersen, Philippon, and Richardson (2010a) to estimate systemic risk exposures of financial firms. Broadly, systemic risk measures in current literature can be classified into two categories namely structural approach and the reduced form approach. The structural approaches are based on the contingent claims of the financial institutions' assets. Reduced form approaches are based on the tail behavior of asset returns of financial firms.

Lehar (2005) based on a structural approach uses financial firm's assets based on stock market data and a Merton model of bank liabilities. It then estimates each institution's contribution to the total regulator liability in case of a bailout across different period and different countries. Gray, Merton, and Bodie (2008) provide a systemic risk measure using a contingent claims approach across different sectors and countries. Gray and Jobst (2009) apply this measure to the current financial crisis and measure the contribution of the largest firms to the systemic crisis of 2007-2009. The main difficulty in applying the structural approaches described above is the assumptions that need to be made about the liability structure of the financial firms.

Reduced form approach such as that proposed by Huang, Zhou and Zhu (2009) are based on the correlations between credit default swap (CDS) and stock returns. This is then used to estimate the expected credit losses above a given share of the financial sector's total liabilities. Adrian and Brunnermeier (2009) propose a systemic measure CoVar which measures the Value at Risk (VaR) for the financial sector as a whole given that each bank has a VaR loss. Segoviano and Goodhart (2009) use CDS data to determine each financial firm's contribution to the distress across the financial sector as a whole.

The systemic risk measure, MES (Acharya, Pedersen, Philippon, and Richardson (2010a)) has the advantage of both the structural and reduced form approaches described above. While they build a structural model that measures the systemic risk contribution of each firm under certain assumptions, it also uses easily observable data (common to reduced form approaches described above). Thus, the MES measure provides a way to estimate systemic risk based on standard techniques and easily available market data.

We now turn to specific literature concerning bank bailouts. Existing literature suggests that bailout by regulators may induce banks to manage their risks differently. Penati and Protopapadakis (1988) show that banks invest inefficiently in common markets to attract deposits at cheaper costs, assuming that in the event of a system wide failure involving a large number of banks, the regulator will insure uninsured depositors. Perotti and Suarez (2002) show that in a systemic crisis, failed banks are sold to surviving banks thereby increasing the value of surviving banks. Thus banks anticipating this reduce their risks ex-ante. Cordella and Yeyati (2003) show that the regulator by committing to bailout banks during systemic crises can encourage banks to stay solvent and thus incentivize banks to manage their risks prudently. In our analysis, we empirically examine whether the presence of such a commitment in the form of explicit guarantees by the Indian government induced public sector banks to manage risks prudently. Our analysis indicates otherwise.

Current literature also examines when regulators are likely to bailout banks. Brown and Dinç (2009) empirically show that the governments are less likely to rescue a failing bank when the banking system, as a whole, is weak. They show that thus, a too-many-to-fail effect exists and is larger for larger banks. In contrast, Acharya and Yorulmazer (2007) show that the too-many-to-

fail problem exists for smaller banks and thus gives banks incentives to herd and increases the risk that banks fail together.

Veronesi and Zingales (2009) investigate the impact of government intervention on banks. They conduct an event study and specifically investigate the U.S. Government intervention in October 2008 and bailout of U.S. banks and calculate the benefits to the banks and costs to taxpayers. They find that the government intervention increased the value of banks by $131 billion compared to a tax payer cost between $25 to $47 billion.

Adding to this literature, our analysis explicitly examines how markets react to the possibility of a government bailout when the bailout is explicit in the form of government guarantees such as those for public sector banks. This is then compared to private sector banks where no such guarantees exist. Our analysis indicates that when there is an explicit guarantee, banks that take greater systemic risks are rewarded.

VIII. Conclusion

In this note, we have made an attempt to explain the relatively strong performance of public sector banks versus their private sector counterparts. The global crisis which erupted in 2007 had its impact on the Indian economy beginning only 2008. While the global impact on the financial sectors has been severe, Indian financial firms have fared much better. Much of this has been credited to the public sector firms which lent stability during the crisis period. Our analysis shows that while this may be true, public sector firms benefitted significantly from government guarantees. At the peak of the financial crisis, the Indian government announced a series of stimulus packages with the aim of restoring the economy. As a result even some risky public sector banks performed better than their less risky public sector counterparts and overall they fared better than the private sector counterparts. Interpreting this lack of a level-playing field as the relative stability and efficiency of public sector banks relative to private sector banks appears questionable.

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Table 1: Comparison of Cross-Country Banking Sector Indicators
This table contains ratios used to analyze the financial stability of the banks across countries. Data is from 2002 to 2008. The regulatory capital to risk weighted assets (CRAR) ratio measures the capital adequacy of banks. Non-performing loans to total loans and provisions to non-performing loans measure the quality of assets of a bank. Return on Assets (ROA) measures the profitability of a bank.

Country	Regulatory Capital to Risk-Weighted Assets (CRAR) (in %)				Non-performing Loans to Total Loans (in %)				Provisions to Non-performing Loans (in %)				Return on Assets (ROA) (in %)			
	2002	2006	2007	2008	2002	2006	2007	2008	2002	2006	2007	2008	2002	2006	2007	2008
Developing Economies																
Argentina	-	-	16.9	16.8	18.1	3.4	2.7	2.5	73.8	130.2	129.6	130.9	-8.9	2	1.5	1.6
Brazil	16.6	18.9	18.7	16.6	4.5	4.1	3	2.9	155.9	152.8	181.8	170.9	2.1	2.5	2.9	2
China	-	-	8.4	8.2	26	7.5	6.7	2.5	-	-	39.2	115.3	-	0.9	1	-
India	**12**	**12.4**	**12.3**	**13**	**10.4**	**3.5**	**2.5**	**2.3**	**-**	**58.9**	**56.1**	**52.6**	**0.8**	**0.9**	**0.9**	**1**
Indonesia	20.1	21.3	19.3	16.8	24	13.1	4.1	3.5	130	99.7	87.7	98.5	1.4	2.6	2.8	2.6
Korea	11.2	12.8	12.3	10.9	2.4	0.8	0.7	1.1	89.6	175.2	199.1	155.4	0.6	1.1	1.1	-
Malaysia	13.2	13.5	13.2	12.6	15.9	8.5	6.5	5.1	38.1	50.7	77.3	86.9	1.3	1.3	1.5	1.6
Mexico	15.7	16.3	15.9	15.3	3.7	2.1	2.7	2.5	138.1	207.4	169.2	184	0.7	3.1	2.7	1.8
Philippines	16.9	-	15.7	15.5	26.5	18.6	5.8	5.2	30.1	37.4	81.5	84.1	0.8	1.3	1.3	1.1
Russia	19.1	14.9	15.5	14.5	5.6	2.6	2.5	2.5	112.5	159.3	144	140	2.6	3.2	3	1.6
South Africa	12.6	12.3	12.8	12.5	2.8	1.2	1.4	2.6	46	-	-	-	0.4	1.4	1.4	1.8
Thailand	13	13.8	14.8	15.3	15.7	7.5	7.9	6.5	62.9	79.4	86.5	-	-	2.3	0.1	-
Turkey	24.4	21.1	19	17.7	12.7	3.2	3.5	3.3	64.2	90.8	88.4	81.6	1.2	2.4	2.8	2.2
Developed Economies																
Australia	9.6	10.4	10.2	10.9	0.4	0.2	0.2	0.5	106.2	204.5	183.7	87.2	1.4	-	1	0.9
Canada	12.4	12.5	12.1	12.7	1.6	0.4	0.7	1.1	41.1	55.3	42.1	34.7	0.4	1	0.9	1.3
France	11.5	-	10.1	-	4.2	3.2	2.7	-	58.4	58.7	61.4	-	0.5	-	0.4	-
Germany	12.7	-	12.9	-	5	4	2.7	-	-	-	77.3	-	0.1	0.5	0.2	-
Italy	11.2	10.7	10.4	-	6.5	5.3	4.6	-	-	46	49.5	-	0.5	0.8	0.8	-
Japan	9.4	13.1	12.9	12.3	7.4	2.5	1.5	1.5	-	30.3	26.4	24.9	-0.7	0.4	0.2	0.3
United Kingdom	13.1	12.9	12.6	-	2.6	0.9	0.9	-	75	-	-	-	0.4	0.5	0.4	-
United States	13	13	12.8	12.5	1.4	0.8	1.4	2.3	123.7	137.2	93.1	84.7	1.3	1.3	0.8	0.3

Source: Reserve Bank of India, (2008)

Table 2: Systemic Risk Ranking of Indian Financial Firms during January 2007 to December 2007

This table contains the list of Indian financial firms used in our analyses. The firms are listed in descending order according to their dollar Marginal Expected Shortfall at the 5% level ($MES). Pre-crisis period measurements are market capitalization, MES, MES Rank, $MES, $MES Rank and % MES contribution. Market Capitalization is for the individual firms as of January 2007. MES is the marginal expected shortfall of a stock given that the market return is below its 5th – percentile for the pre-crisis period from January 2007 to December 2007. Market return is based on the S&P CNX NIFTY for the pre-crisis period from January 2007 to December 2007. "MES Rank" ranks firms in descending order of MES values (assigns rank 1 to the firm with the largest MES). $MES (in INR crores) is the MES multiplied by the market capitalization at the beginning of the measurement period, January 2007. "$MES Rank" ranks firms in descending order of $MES values (assigns rank 1 to the firm with the largest $MES). %MES contribution is the $MES divided by the total sum of $MES. Crisis period measurements included in this analysis are total stock returns and deposit growth. Total Stock Return is the stock return for the individual firms during the crisis period from January 2008 to February 24, 2009. Deposit growth for the crisis period is calculated from data provided by RBI for the period from 31st March, 2008 to 31st March, 2009. The 39 firms for which both MES data and RBI deposit growth estimates are available were used in this analysis.

Name	Type of Financial Institution	Public/ Private Sector	Pre-Crisis Period						Crisis Period	
			Market Cap (INR lacs)	MES	MES Rank	$MES (INR lacs)	$MES Rank	%MES Contribu tion	Total Stock Return	Deposit Growth
I C I C I BANK LTD.	Private Banking services	Private	80232	4.66%	17	3735.0	1	19.68%	-72.66%	-10.67%
STATE BANK OF INDIA	Public Sector Banking services	Public	65974	4.63%	18	3053.3	2	16.09%	-54.29%	38.08%
HOUSING DEVELOPMENT FINANCE CORPN. LTD.	Housing finance services	Private	40497	3.57%	38	1447.3	3	7.63%	-55.80%	
H D F C BANK LTD.	Private Banking services	Private	33721	3.29%	42	1110.7	4	5.85%	-50.59%	41.72%
RELIANCE CAPITAL LTD.	Securities and stock traders	Private	13893	6.28%	5	872.8	5	4.60%	-85.72%	
G M R INFRASTRUCTURE LTD.	Securities and stock traders	Private	12363	6.15%	6	760.5	7	4.01%	-69.33%	
PUNJAB NATIONAL BANK	Public Sector Banking services	Public	16131	4.86%	15	783.2	6	4.13%	-48.38%	26.01%
BAJAJ HOLDINGS & INVST. LTD.	Securities and stock traders	Private	27745	2.57%	58	714.3	8	3.76%	-90.70%	
CANARA BANK	Public Sector Banking services	Public	11355	4.89%	14	555.6	10	2.93%	-53.00%	21.30%
POWER FINANCE CORPN. LTD.	NBFC	Private	12815	4.50%	19	577.0	9	3.04%	-49.97%	
BANK OF INDIA	Public Sector Banking services	Public	10145	5.37%	10	544.6	11	2.87%	-40.89%	26.46%

Name	Type of Financial Institution	Public/ Private Sector	Pre-Crisis Period						Crisis Period	
			Market Cap (INR lacs)	MES	MES Rank	$MES (INR lacs)	$MES Rank	%MES Contribution	Total Stock Return	Deposit Growth
INFRASTRUCTURE DEVELOPMENT FINANCE CO. LTD.	NBFC	Private	8818	5.96%	7	525.8	12	2.77%	-77.18%	
AXIS BANK LTD.	Private Banking services	Private	13157	3.75%	35	493.7	13	2.60%	-62.61%	33.95%
I D B I BANK LTD.	Public Sector Banking services	Public	5512	6.67%	3	367.6	15	1.94%	-70.59%	53.98%
BANK OF BARODA	Public Sector Banking services	Public	8815	4.24%	24	374.1	14	1.97%	-54.58%	26.55%
INDIABULLS FINANCIAL SERVICES LTD.	Brokers	Private	5152	6.44%	4	331.9	18	1.75%	-87.15%	
UNION BANK OF INDIA	Public Sector Banking services	Public	6205	5.41%	9	335.5	16	1.77%	-41.77%	33.55%
ORIENTAL BANK OF COMMERCE	Public Sector Banking services	Public	5709	5.84%	8	333.6	17	1.76%	-62.72%	26.35%
SYNDICATE BANK	Public Sector Banking services	Public	3902	4.00%	28	156.0	21	0.82%	-56.82%	21.77%
CORPORATION BANK	Public Sector Banking services	Public	5048	3.17%	46	159.9	20	0.84%	-62.97%	33.49%
INDIAN BANK	Public Sector Banking services	Public	4227	4.04%	27	170.8	19	0.90%	-53.98%	18.90%
ALLAHABAD BANK	Public Sector Banking services	Public	3982	3.69%	36	146.9	23	0.77%	-66.10%	18.65%
ANDHRA BANK	Public Sector Banking services	Public	4207	3.61%	37	151.7	22	0.80%	-58.87%	20.13%
VIJAYA BANK	Public Sector Banking services	Public	2044	5.02%	13	102.5	24	0.54%	-72.80%	13.73%
INDIA INFOLINE LTD.	Brokers	Private	1461	6.99%	1	102.1	25	0.54%	-86.96%	
UCO BANK	Public Sector Banking services	Public	1715	4.26%	23	73.0	27	0.38%	-63.66%	25.42%
NETWORK 18 MEDIA & INVST. LTD.	Securities and stock traders	Private	1832	4.00%	29	73.2	26	0.39%	-85.23%	
JAMMU & KASHMIR BANK LTD.	Public Sector Banking services	Public	3061	2.01%	66	61.4	28	0.32%	-71.79%	15.43%
J M FINANCIAL LTD.	Securities and stock traders	Private	2478	2.35%	63	58.2	30	0.31%	-84.54%	
DENA BANK	Public Sector Banking services	Public	1068	5.23%	12	55.9	31	0.29%	-66.20%	26.83%
FEDERAL BANK LTD.	Public Sector Banking services	Public	1903	2.93%	48	55.7	32	0.29%	-61.27%	24.25%
I F C I LTD.	NBFC	Private	859	6.80%	2	58.4	29	0.31%	-81.10%	
KARNATAKA BANK LTD.	Private Banking services	Private	1842	2.92%	49	53.9	33	0.28%	-72.66%	19.49%
L I C HOUSING FINANCE LTD.	Housing finance services	Private	1379	3.84%	33	52.9	34	0.28%	-46.16%	

Name	Type of Financial Institution	Public/ Private Sector	Pre-Crisis Period						Crisis Period	
			Market Cap (INR lacs)	MES	MES Rank	$MES (INR lacs)	$MES Rank	%MES Contribution	Total Stock Return	Deposit Growth
BANK OF MAHARASHTRA	Public Sector Banking services	Public	1746	2.66%	56	46.5	37	0.25%	-74.71%	25.14%
MAHINDRA & MAHINDRA FINANCIAL SERVICES LTD.	NBFC	Private	2421	1.99%	67	48.3	35	0.25%	-39.38%	
I N G VYSYA BANK LTD.	Private Banking services	Private	1456	3.24%	44	47.1	36	0.25%	-61.53%	21.67%
I L & F S INVESTSMART	Other financial services	Private	1359	2.67%	55	36.2	39	0.19%	-78.41%	
KARUR VYSYA BANK LTD.	Private Banking services	Private	1454	2.95%	47	43.0	38	0.23%	-54.38%	20.33%
TATA INVESTMENT CORPN. LTD.	Securities and stock traders	Private	1329	2.42%	61	32.1	41	0.17%	-71.81%	
SUNDARAM FINANCE LTD.	NBFC	Private	1177	2.84%	52	33.4	40	0.18%	-56.63%	
SHRIRAM TRANSPORT FINANCE CO. LTD.	NBFC	Private	2077	1.19%	69	24.8	44	0.13%	-53.68%	
S R E I INFRASTRUCTURE FINANCE LTD.	NBFC	Private	582	4.74%	16	27.6	42	0.15%	-88.96%	
BAJAJ AUTO FINANCE LTD.	NBFC	Private	1212	2.08%	65	25.2	43	0.13%	-86.65%	
SOUTH INDIAN BANK LTD.	Private Banking services	Private	614	3.98%	31	24.4	45	0.13%	-75.71%	19.37%
GEOJIT FINANCIAL SERVICES LTD.	Brokers	Private	536	4.41%	20	23.6	46	0.12%	-77.46%	
CHOLAMANDALAM M D B S FINANCE LTD.	NBFC	Private	535	3.53%	39	18.9	47	0.10%	-93.63%	
DEWAN HOUSING FINANCE CORPN. LTD.	Housing finance services	Private	381	4.34%	22	16.5	48	0.09%	-77.00%	
EMKAY GLOBAL FINANCIAL SERVICES LTD.	Brokers	Private	192	5.28%	11	10.1	49	0.05%	-91.92%	
SHARYANS RESOURCES LTD.	Securities and stock traders	Private	299	3.25%	43	9.7	50	0.05%	-90.05%	
JINDAL SOUTH WEST HOLDINGS LTD.	Securities and stock traders	Private	170	4.34%	21	7.4	51	0.04%	-91.35%	
BALMER LAWRIE INVSTS. LTD.	Securities and stock traders	Private	227	2.58%	57	5.9	53	0.03%	-55.12%	
OSCAR INVESTMENTS LTD.	Securities and stock traders	Private	263	2.14%	64	5.6	54	0.03%	-30.92%	
I L & F S INVESTMENT MANAGERS LTD.	Other financial services	Private	326	1.42%	68	4.6	55	0.02%	-64.02%	
G I C HOUSING FINANCE LTD.	Housing finance services	Private	250	2.44%	60	6.1	52	0.03%	-67.55%	
CAN FIN HOMES LTD.	Housing finance services	Private	144	2.86%	51	4.1	56	0.02%	-43.93%	
APOLLO SINDHOORI CAPITAL INVSTS. LTD.	Brokers	Private	81	3.45%	40	2.8	58	0.01%	-66.59%	

			Pre-Crisis Period						Crisis Period	
Name	Type of Financial Institution	Public/ Private Sector	Market Cap (INR lacs)	MES	MES Rank	$MES (INR lacs)	$MES Rank	%MES Contribution	Total Stock Return	Deposit Growth
TRANSWARRANTY FINANCE LTD.	Other financial services	Private	66	3.84%	32	2.6	59	0.01%	-83.18%	
NETWORTH STOCK BROKING LTD.	Brokers	Private	67	3.81%	34	2.5	60	0.01%	-89.51%	
GRUH FINANCE LTD.	Housing finance services	Private	472	0.71%	70	3.4	57	0.02%	-57.98%	
INDBANK MERCHANT BANKING SERVICES LTD.	Brokers	Private	84	2.91%	50	2.4	61	0.01%	-79.78%	
MOTOR & GENERAL FINANCE LTD.	Other financial services	Private	57	4.12%	26	2.3	62	0.01%	-77.23%	
A K CAPITAL SERVICES LTD.	Other financial services	Private	65	3.22%	45	2.1	63	0.01%	-63.88%	
VAS INFRASTRUCTURE LTD.	Other financial services	Private	42	3.99%	30	1.7	65	0.01%	-92.75%	
H B STOCKHOLDINGS	Other financial services	Private	70	2.39%	62	1.7	64	0.01%	-92.07%	
J K SYNTHETICS LTD.	Other financial services	Private	33	4.22%	25	1.4	67	0.01%	-79.10%	
SUAVE HOTELS LTD.	Other financial services	Private	45	3.30%	41	1.5	66	0.01%	-74.82%	
J R G SECURITIES LTD.	Brokers	Private	44	2.75%	54	1.2	68	0.01%	-74.86%	
KHANDWALA SECURITIES LTD.	Brokers	Private	27	2.45%	59	0.7	69	0.00%	-72.34%	
JOINDRE CAPITAL SERVICES LTD.	Brokers	Private	14	2.82%	53	0.4	70	0.00%	-79.19%	
STATE BANK OF BIKANER & JAIPUR*		Public		1.36%		26.48			-97.4%	15%
STATE BANKOF MYSORE*		Public		2.53%		56.77			-70.6%	20%
STATE BANKOF TRAVANCORE*		Public		1.17%		26.69			-69.9%	19%
CENTRAL BANK OF INDIA*		Public		1.32%		61.48			-75.6%	19%
INDIAN OVERSEAS BANK*		Public		3.63%		223.30			-75.8%	19%
BANK OF RAJASTHAN LTD*.		Private		3.82%		16.385			-75.4%	10%
CITY UNIONBANK (NSE)*		Private		3.53%		13.823			-70.7%	28%
DEVELOPMENT CREDIT BANK LTD.*		Private		4.52%		40.417			-88.7%	-24%
DHANALAKSHMI BANK LTD.*		Private		3.32%		5.843			-48.9%	38%
INDUSIND BANK (NSE)*		Private		5.90%		81.015			-76.2%	16%
KOTAK MAHINDRA BANK LTD.*		Private		4.12%		537.878			-80.7%	-5%
LAKSHMI VILAS BANK LTD.*		Private		2.51%		10.252			-65.1%	31%
YES BANK LTD.*		Private		4.07%		160.851			-79.8%	22%

#NBFC, non-banking financial corporation
*These firms are included only in the analysis for Deposit Growth.

Table 3: Descriptive Statistics

This table contains the summary statistics for MES, $MES, deposit growth for the banks used in our analyses. MES is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile. Market return is based on the S&P CNX NIFTY for the pre-crisis period from January 2007 to December 2007. $MES (in INR crores) is MES multiplied by the market capitalization at the beginning of the measurement period i.e. in January 2007. Realized return is the actual stock return during the crisis period from January 2008 to February 2009. The descriptive statistics for MES are for the top 70 firms with the highest $MES. Deposit growth for the crisis period is calculated from data provided by RBI for the period from 31st March, 2008 to 31st March, 2009. The 39 firms for which both MES data and RBI deposit growth estimates are available were used in this analysis. Panel A provides overall descriptive statistics of the measures MES, $MES and realized return. Panel B gives the descriptive statistics for each category of banks. Banks are classified as public sector banks and private sector banks. Private sector banks are further classified into (i) Private Banking Services, (ii) Brokers and securities and stock traders and (iii) Housing finance, non-banking financial companies (NBFCs), and other financial services. Panel C gives the descriptive statistics for deposit growth by institution type.

Panel A: Descriptive statistics summary

Summary- Overall				
Number of banks	70			39
	Realized Return	**MES**	**$MES (INR crores)**	**Deposit Growth**
Mean	-68.96%	3.79%	378.34	21.77%
Median	-71.19%	3.72%	87.65	21.67%
Std	15.31%	1.38%	702.32	13.41%
Min.	-93.63%	0.71%	9.70	-23.51%
Max.	-30.92%	6.99%	3734.96	53.98%
Value Weighted	-63.37%	4.32%	1598.29	19.66%

Panel B: Descriptive statistics of the measures MES and $MES by institution type.

	I. Public Sector Banks			**II. Private Bank Sector Banks**		
Number of banks	19			51		
	Realized Return	**MES**	**$MES (INR crores)**	**Realized Return**	**MES**	**$MES (INR crores)**
Mean	-59.76%	4.34%	396.21	-72.39%	3.58%	224.50
Median	-61.27%	4.26%	159.94	-75.71%	3.30%	24.42
Std	9.80%	1.17%	675.34	15.64%	1.40%	592.69
Min.	-74.71%	2.01%	46.52	-93.63%	0.71%	0.40
Max.	-40.89%	6.67%	3053.32	-30.92%	6.99%	3734.96
Value Weighted	-54.93%	4.63%	1470.67	-68.34%	4.14%	1658.74

	II. Private Sector Banks								
	Private Banking Services			**Brokers + Securities & Stock traders**			**Housing Finance + NBFCs + Other Financial Services**		
Number of banks	7			20			24		
	Realized Return	**MES**	**$MES (INR crores)**	**Realized Return**	**MES**	**$MES (INR crores)**	**Realized Return**	**MES**	**$MES (INR crores)**
Mean	-64.31%	3.54%	786.83	-78.03%	3.87%	150.88	-70.05%	3.36%	121.83
Median	-62.61%	3.29%	53.85	-82.16%	3.35%	9.92	-75.91%	3.41%	17.69
Std	9.72%	0.63%	1360.22	14.80%	1.57%	283.43	16.53%	1.43%	320.44
Min.	-75.71%	2.92%	24.42	-91.92%	2.14%	0.40	-93.63%	0.71%	1.37
Max.	-50.59%	4.66%	3734.96	-30.92%	6.99%	872.84	-39.38%	6.80%	1447.33
Value Weighted	-65.74%	4.16%	2595.65	-84.22%	4.42%	637.99	-58.56%	3.86%	939.37

Panel C: Descriptive statistics for deposit growth by institution type.

	I. Public Sector Banks	**II. Private Sector Banks**
Number of banks	22	17
	Deposit Growth	**Deposit Growth**
Mean	24.90%	17.73%
Median	23.45%	20.33%
Std	8.89%	17.11%
Min.	13.73%	-23.51%
Max.	53.98%	41.72%
Value Weighted	30.22%	7.97%

Table 4: Event Return versus MES, Leverage, Pre-crisis returns and Assets

The table below shows the regression results of the dependent variable event return versus the dependent variables MES, leverage, pre-crisis returns and assets. MES is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile during the period 1st January, 2007 to 31st December, 2007. Market return is based on the S&P CNX NIFTY for the pre-crisis period from January 2007 to December 2007. Realized return or event return is the actual stock return during the crisis period for the period January 2008 to February 2009. Pre-crisis returns is the stock return for the period January 2007 to December 2007. The asset value measured as of March 31, 2008 is the quasi- market value of assets measured as (book value of assets – book value of equity + market value of equity). Leverage (LVG) measured as of March 31, 2008 is the ratio of the quasi- market value of assets to the market equity. The 64 firms for which data for all variables is available were used in this analysis. The results for the regressions for private sector and public sector financial firms are shown below.

	MES		LVG		PreCrisis Returns		Assets		Multiple Regression (Incl. LVG)		Multiple Regression (Incl. Assets)	
	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank
Intercept	-0.71	-0.56	-0.53	-0.72	-0.57	-0.68	-0.87	-0.85	-0.63	-0.56	-0.83	-0.71
t-stat	-8.04	-9.68	-7.41	-30.19	-12.46	-24.58	-3.27	-8.96	-6.58	-9.73	-3.07	-7.63
MES	2.59	-4.44							3.65	-3.55	2.51	-4.51
t-stat	1.31	-3.00							1.82	-2.25	1.15	-2.85
LVG			-7.17E-04	-6.15E-06					-9.26E-04	-1.10E-05		
t-stat			-1.08	-0.21					-1.37	-0.41		
PreCrisis Returns					-0.05	-0.02			-0.04	-0.02	-0.06	-0.01
t-stat					-0.83	-2.42			-0.79	-1.57	-1.04	-1.00
Assets							2.03E-02	1.31E-02			0.01	0.02
t-stat							1.02	1.48			0.55	2.01
Adj. R-squared	4.05%	14.52%	1.00%	-2.08%	-1.82%	9.36%	0.27%	2.46%	10.51%	15.45%	0.62%	22.27%
Degrees of freedom	16	46	16	46	16	46	16	46	14	44	14	44

Table 5: Quarter over Quarter Event Return versus MES for public and private sector financial firms

The table below shows the regression results of the MES computed during the period 1st January, 2007 to 31st December, 2007 period versus the total realized return each quarter for the period 1st January, 2008 to 24th February, 2009. MES is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile during the period 1st January, 2007 to 31st December, 2007. Market return is based on the S&P CNX NIFTY for the pre-crisis period from January 2007 to December 2007. $MES (in INR crores) is MES multiplied by the market capitalization at the beginning of the measurement period, January 2007. Realized return or event return is the actual stock return during the crisis period for each quarter from January 2008 to December 2009. Q1 2008 returns are from January 2008 to March 2008, Q2 2008 returns are from April 2008 to June 2008, Q3 2008 returns are from July 2008 to September 2008 and Q4 2008 returns are from October 2008 to December 2008. 70 firms were used in the analysis. The regressions are carried out for both private sector and public sector financial firms.

	Overall	
	Public Sector Banks	Private Sector Bank
Intercept	-0.71	-0.57
t-stat	-8.23	-10.09
MES	2.65	-4.34
t-stat	1.37	-2.96
Adj. R-squared	4.69%	13.41%
Degrees of freedom	17	49

	Q1 2008		Q2 2008		Q3 2008		Q4 2008		Q1 2009	
	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank
Intercept	-0.27	-0.33	-0.21	0.21	-0.10	-0.16	-0.32	-0.21	-0.15	-0.08
t-stat	-3.80	-4.95	-2.58	1.34	-0.61	-2.07	-3.62	-3.52	-2.01	-1.53
MES	-2.12	-3.01	-0.82	-8.75	7.43	2.18	5.22	-1.47	-1.73	-2.99
t-stat	-1.34	-1.75	-0.46	-2.17	2.04	1.06	2.63	-0.95	-1.07	-2.19
Adj. R-squared	4.22%	3.97%	-4.57%	6.93%	14.98%	0.23%	24.77%	-0.20%	0.78%	7.06%
Degrees of freedom	17	49	17	49	17	49	17	49	17	49

Table 6: Robustness checks for crisis period: Regressions of realized returns versus pre-crisis returns

The table below shows the regression results of the MES computed during the period 1st January, 2007 to 31st December, 2007 period versus the total realized return each quarter for the period 1st January, 2008 to 24th February, 2009. MES is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile during the period 1st January, 2007 to 31st December, 2007. Market return is based on the S&P CNX NIFTY for the pre-crisis period from January 2007 to December 2007. $MES (in INR crores) is MES multiplied by the market capitalization at the beginning of the measurement period, January 2007. Realized return or event return is the actual stock return during the crisis period for each quarter from January 2008 to December 2009. Q1 2008 returns are from January 2008 to March 2008, Q2 2008 (Q2 2008) returns are from April 2008 to June 2008, Q3 2008 returns are from July 2008 to September 2008 and Q4 2008 returns are from October 2008 to December 2008. 70 firms were used in the analysis. The regressions are carried out for both private sector and public sector financial firms.

|	2005 versus 2004		2006 versus 2005		2007 versus 2006		2008 versus 2007	
	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank
Intercept	0.01	1.14	-1.04	-1.15	0.7	1.82	-0.57	-0.69
t-stat	*0.2*	*3.63*	*-1.01*	*-1.83*	*6.78*	*5.36*	*-12.67*	*-25.77*
MES	0.02	-0.19	3.76	-0.06	-0.01	0.05	-0.04	-0.02
t-stat	*0.14*	*-0.42*	*0.71*	*-0.21*	*-0.58*	*0.56*	*-0.79*	*-2.23*
Adj. R-squared	-5.76%	-1.68%	-2.85%	-1.95%	-3.84%	-1.39%	-2.14%	7.33%
Degrees of freedom	17	49	17	49	17	49	17	49

Table 7: Deposit growth versus MES, Leverage, Pre-crisis returns and Assets

The table below shows the regression results of the dependent variable deposit growth versus the dependent variables MES, leverage, pre-crisis returns and assets. MES is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile during the period 1st January, 2007 to 31st December, 2007. Market return is based on the S&P CNX NIFTY for the pre-crisis period from January 2007 to December 2007. Pre-crisis returns is the stock return for the period January 2007 to December 2007. Deposit growth (reported annually) for the crisis period is measured from 31st March, 2008 to 31st March, 2009. The asset value measured as of March 31, 2008 is the quasi- market value of assets measured as (book value of assets − book value of equity + market value of equity. Leverage (LVG) measured as of March 31, 2008 is the ratio of the quasi- market value of assets to the market equity. The 37 firms for which data for all variables is available were used in this analysis. The results for the regressions for private sector and public sector financial firms are shown below.

	MES		LVG		PreCrisis Returns		Assets		Multiple Regression (Incl. LVG)		Multiple Regression (Incl. Assets)	
	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank
Intercept	0.11	0.48	0.24	0.21	0.22	0.24	-0.08	0.32	0.09	0.46	-0.11	0.50
t-stat	2.43	3.01	12.30	4.16	5.66	3.21	-0.42	0.86	1.73	2.62	-0.61	1.35
MES	3.40	-8.49							3.29	-6.74	2.97	-7.71
t-stat	3.08	-1.97							3.04	-1.23	2.60	-1.47
LVG			2.01E-08	-3.01E-07					1.87E-08	-1.31E-07		
t-stat			1.36	-1.19					1.51	-0.47		
PreCrisis Returns					0.04	-0.06			0.03	-0.02	3.46E-02	-2.05E-02
t-stat					0.92	-1.03			0.75	-0.37	0.88	-0.34
Assets							2.46E-02	-1.13E-02			1.60E-02	-1.92E-03
t-stat							1.65	-0.38			1.18	-0.07
Adj. R-squared	28.78%	15.19%	3.95%	2.46%	-0.74%	0.37%	7.58%	-5.63%	32.14%	4.61%	29.04%	3.03%
Degrees of freedom	20	15	20	15	20	15	20	15	18	13	18	13

Figure 1: Deposit and Credit Growth

The graphs below show the group-wise growth in deposits and credit in banks. Growth rates are year-on-year as of March 28, 2008 and March 27, 2009.
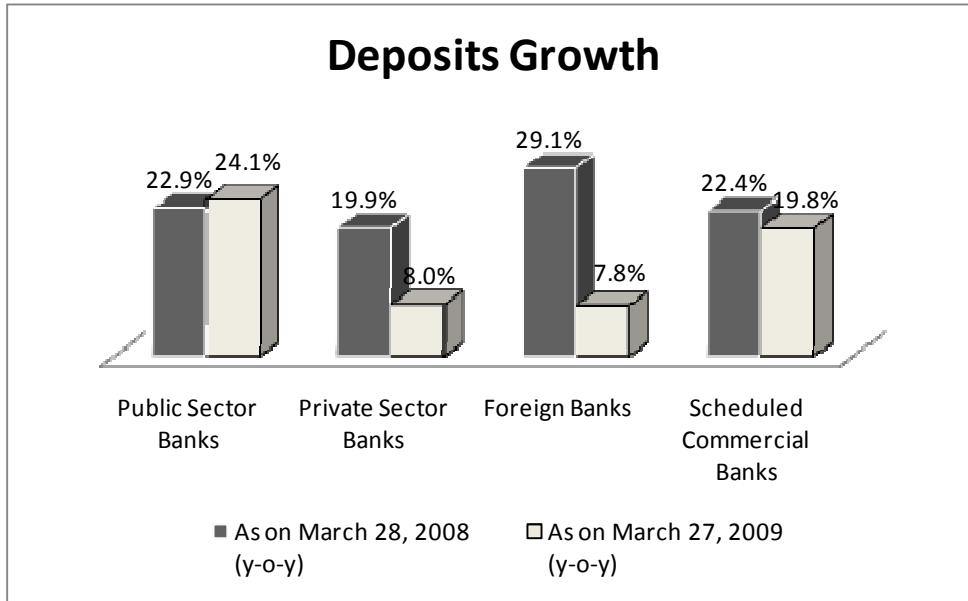
Source: (RBI, 2009-2010)
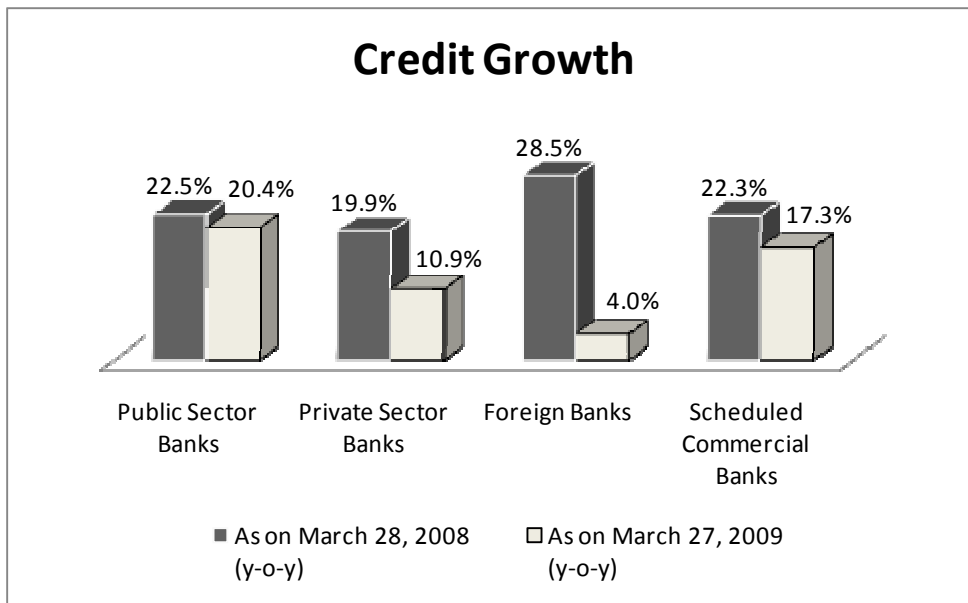
Source: (RBI, 2009-2010)

Figure 2: CDS Spreads for ICICI and SBI

The graphs below show the 1-year and 5-year CDS spreads for ICICI Bank (private sector bank with the largest MES) and State Bank of India (public sector bank with the largest MES). MES is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile for the pre-crisis period from January 2007 to December 2007. Market return is based on the S&P CNX NIFTY for the pre-crisis period from January 2007 to December 2007.
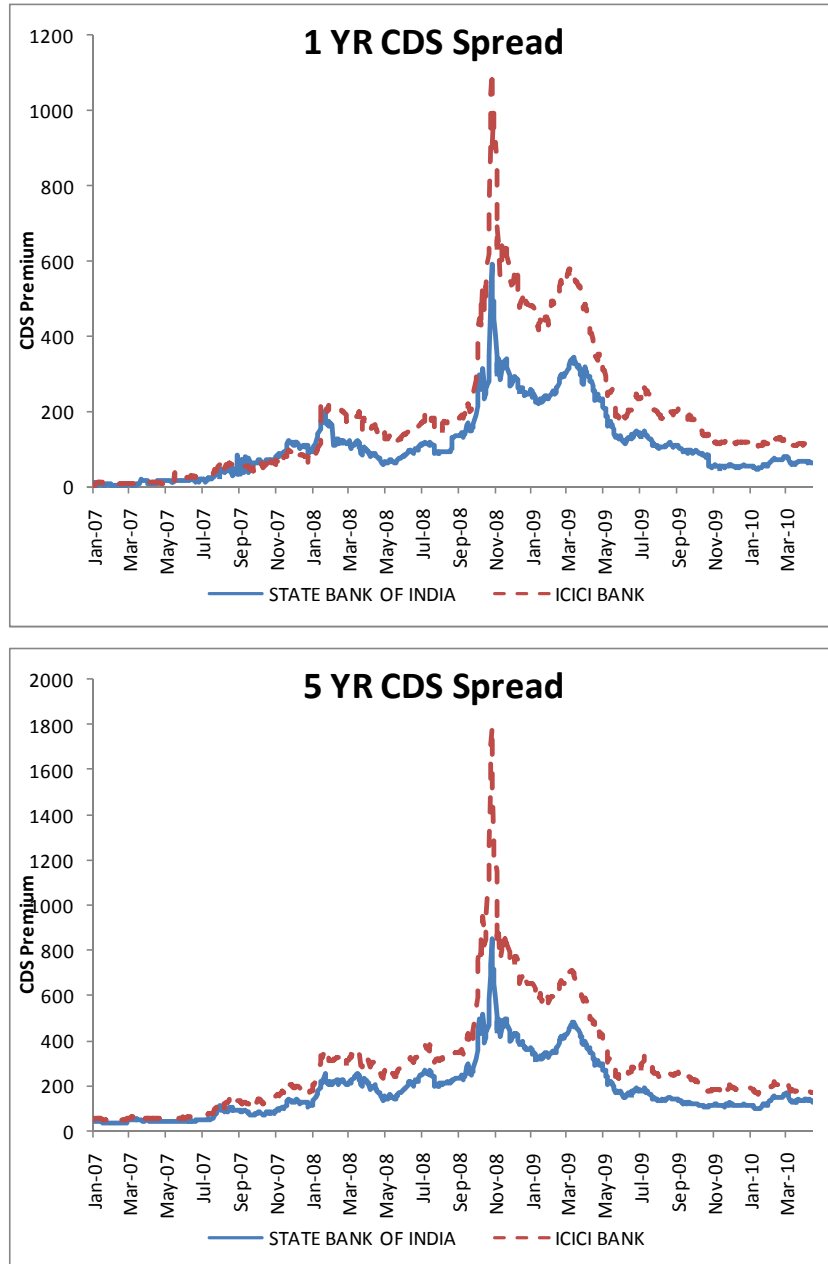
Source: Datastream

Figure 3: Financial Performance of Public Sector versus Private Sector Banks
The first graph below shows the bank group-wise ratios of non-performing assets (NPAs) as a percentage of total assets for public and private banks from 2004 to 2009. This measure is used to assess the quality of assets. The second graph shows net profit as a percentage of total assets for the fiscal years from 2002-2003 to 2008-2009.
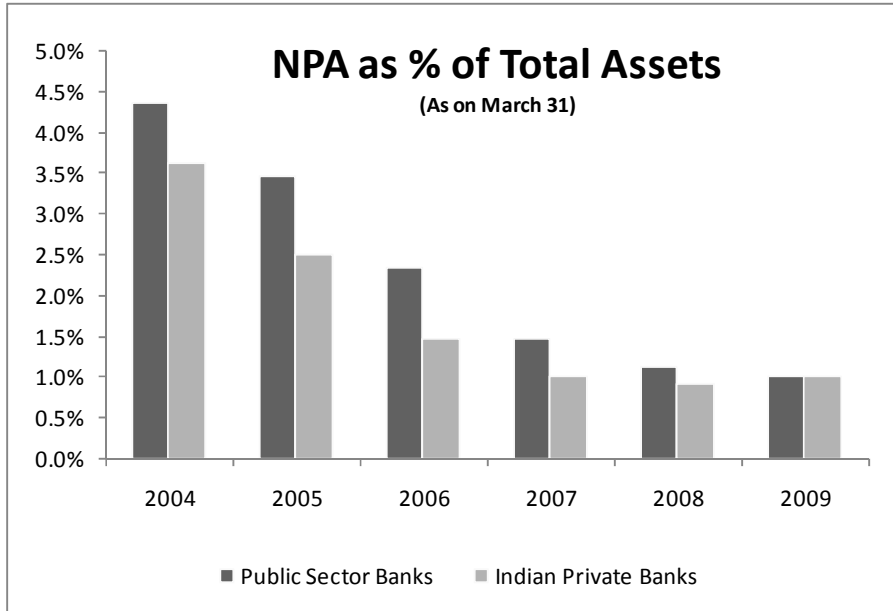
Source: (RBI, 2009-2010)
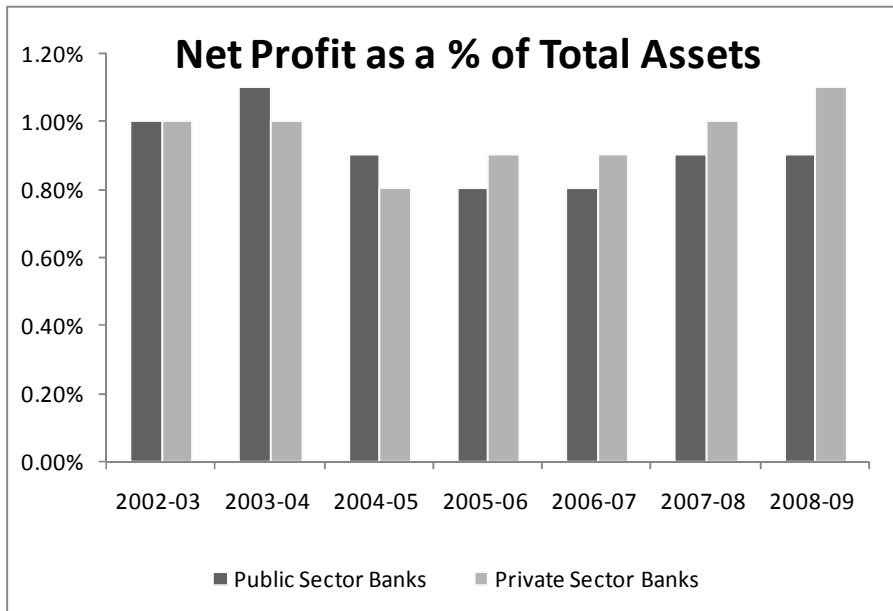
Source: (RBI, 2009-2010)

Figure 4: Stock Index Performance

The plot below shows stock index performance for the period starting January 2007 to February 2009. Two indices, S&P NIFTY and BSE SENSEX, are represented. The S&P CNX NIFTY (or NIFTY; base level of 1000 defined as of November, 1995) is a free float market capitalization index on the National Stock Exchange and consists of 50 companies. Bombay Stock Exchange Sensitive Index (BSE Sensex or Sensex) is a value-weighted index composed of 30 stocks with a base level of 100 in 1978-1979.

Stock Index Performance for NSE NIFTY and BSE Sensex between Jan'07-Feb'09
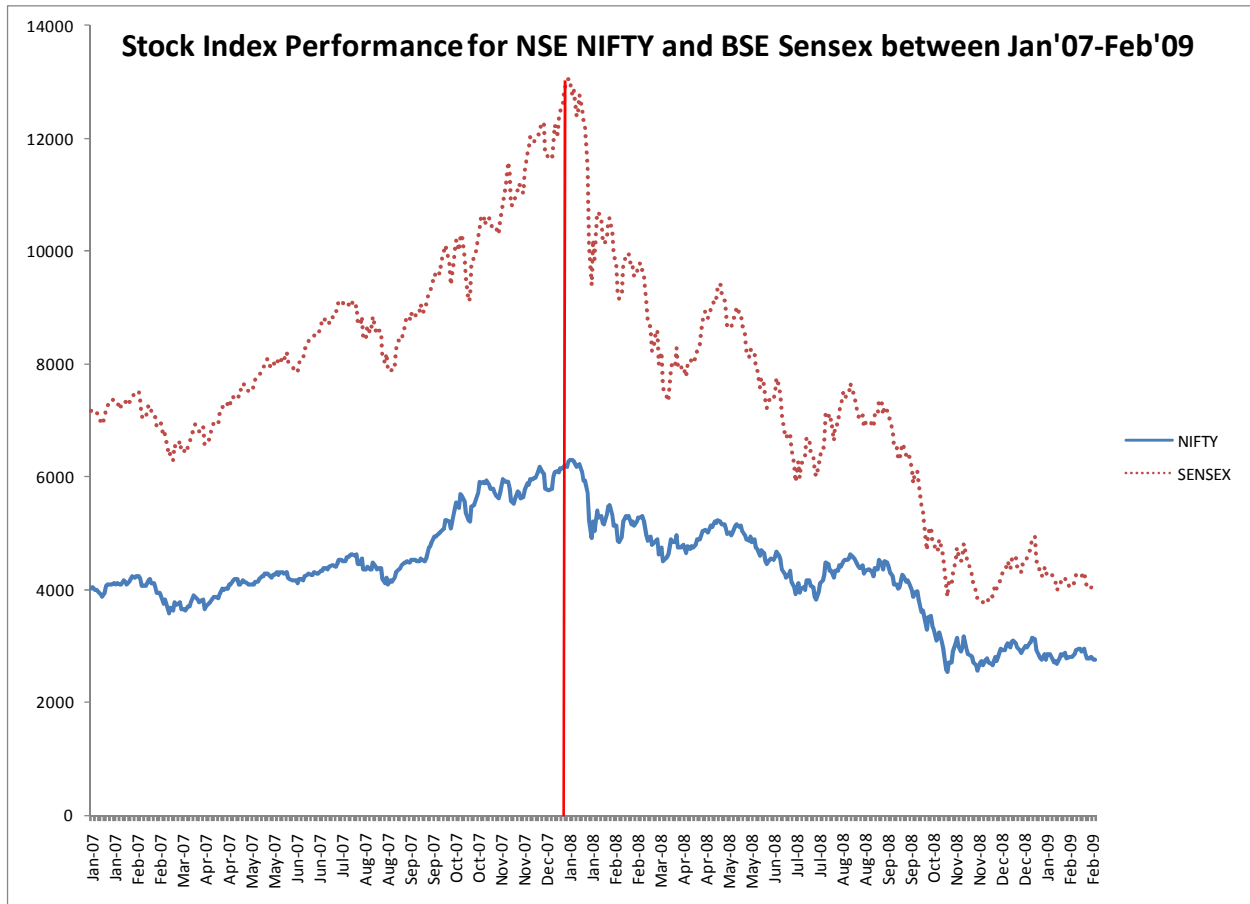
Figure 5: Stock Performance for Public and Private Sector Firms

The plot below shows the equally weighted average returns for public and private sector financial firms for the period starting January 2007 to February 2009. The indexed equally weighted returns for the private (public) sector represents the average returns for the private (public) sector firms used in our analysis. The indexed value weighted returns for the private (public) sector represents the returns weighted by the market capitalization of the private sector firms used in the analysis. Both series use a base value of 100 as of January 2, 2007.

Indexed Equally Weighted Returns
Index=100 on January 2, 2007

Indexed Value Weighted Returns
Index=100 on January 2, 2007
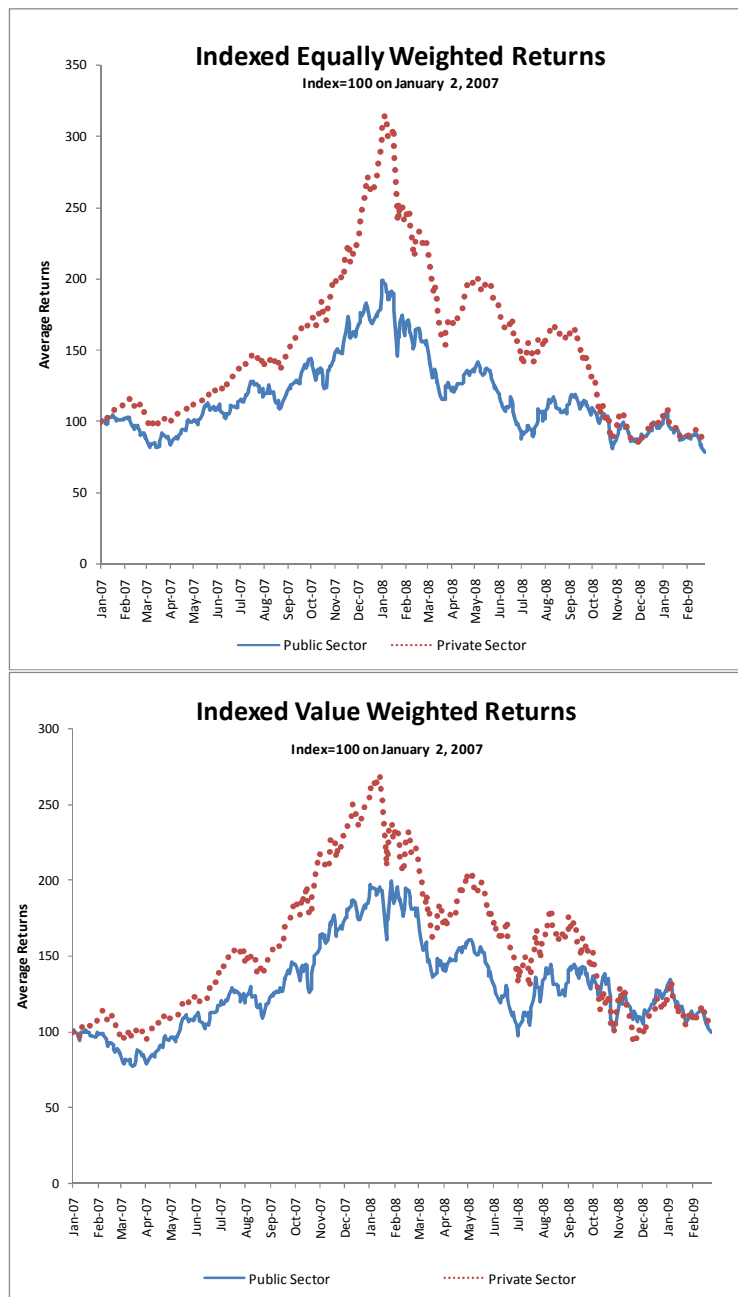
Figure 6: Event Return versus MES for Private Sector Banks

The graphs below shows the scatter plot of the MES computed during the period 1st January, 2007 to 31st December, 2007 period versus the total realized return for the public sector banks during 1st January, 2008 to 24th February, 2009. MES is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile during the period 1st January, 2007to 31st December, 2007. Market return is based on the S&P CNX NIFTY for the pre-crisis period from January 2007 to December 2007. $MES (in INR crores) is MES multiplied by the market capitalization at the beginning of the measurement period, January 2007. Realized return or event return is the actual stock return during the crisis period from January 2008 to February 2009. The top 70 firms with the highest $MES were used in the analysis.

Regression Statistics
Realized Return = -0.57 - 4.34 * MES
R-squared = 13.41%
T-statistic = -2.96
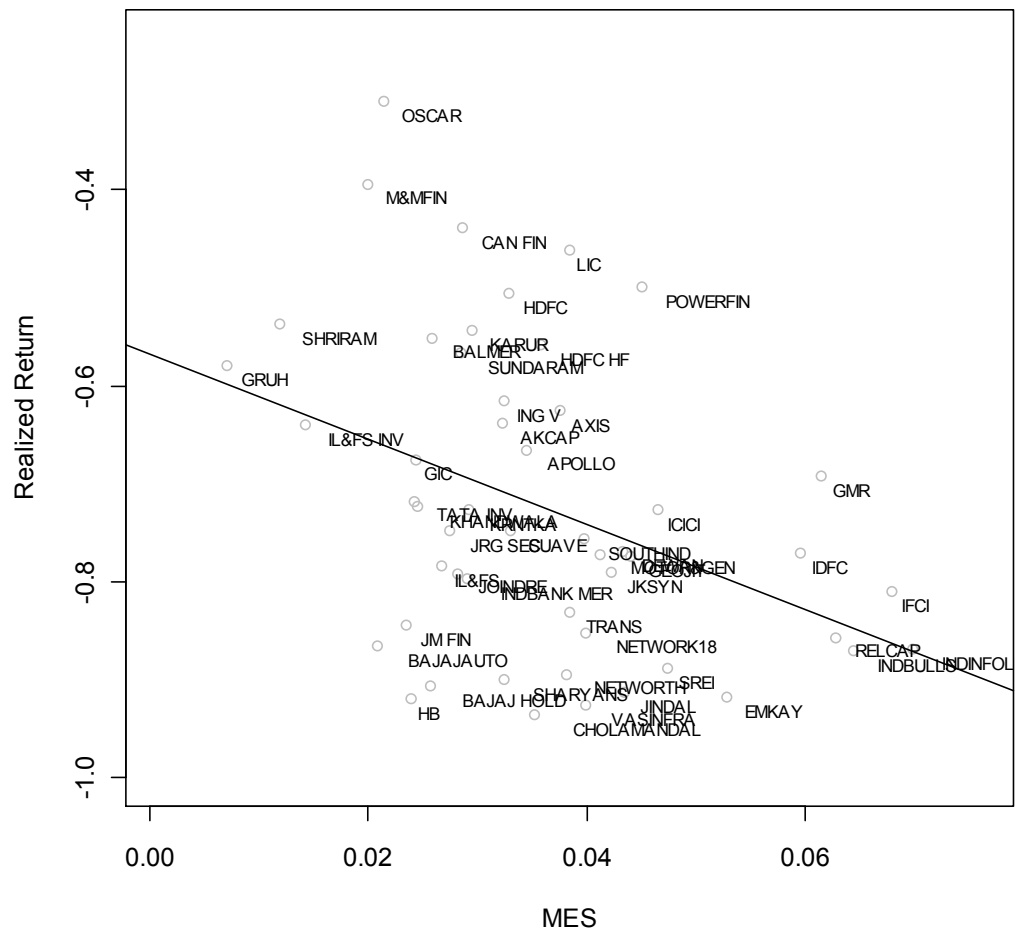
Figure 7: Event Return versus MES for public sector banks

The graph below shows the scatter plot of the MES computed during the period 1st January, 2007 to 31st December, 2007 period versus the total realized return for the public sector banks during 1st January, 2008 to 24th February, 2009. MES is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile during the period 1st January, 2007 to 31st December, 2007. Market return is based on the S&P CNX NIFTY for the pre-crisis period from January 2007 to December 2007. Realized return or event return is the actual stock return during the crisis period from January 2008 to February 2009. The top 50 firms with the highest $MES were used in the analysis. Graph B shows the scatter plot of the MES versus the total realized return for all public sector banks. Graph B shows the scatter plot of the MES versus the total realized return for public sector banks excluding the outlier IDBI.

Graph A: Realized Returns versus MES
Regression Statistics
Realized Return=-0.71 + 2.65* MES
R-squared = 4.69%;
T-statistic = 1.37
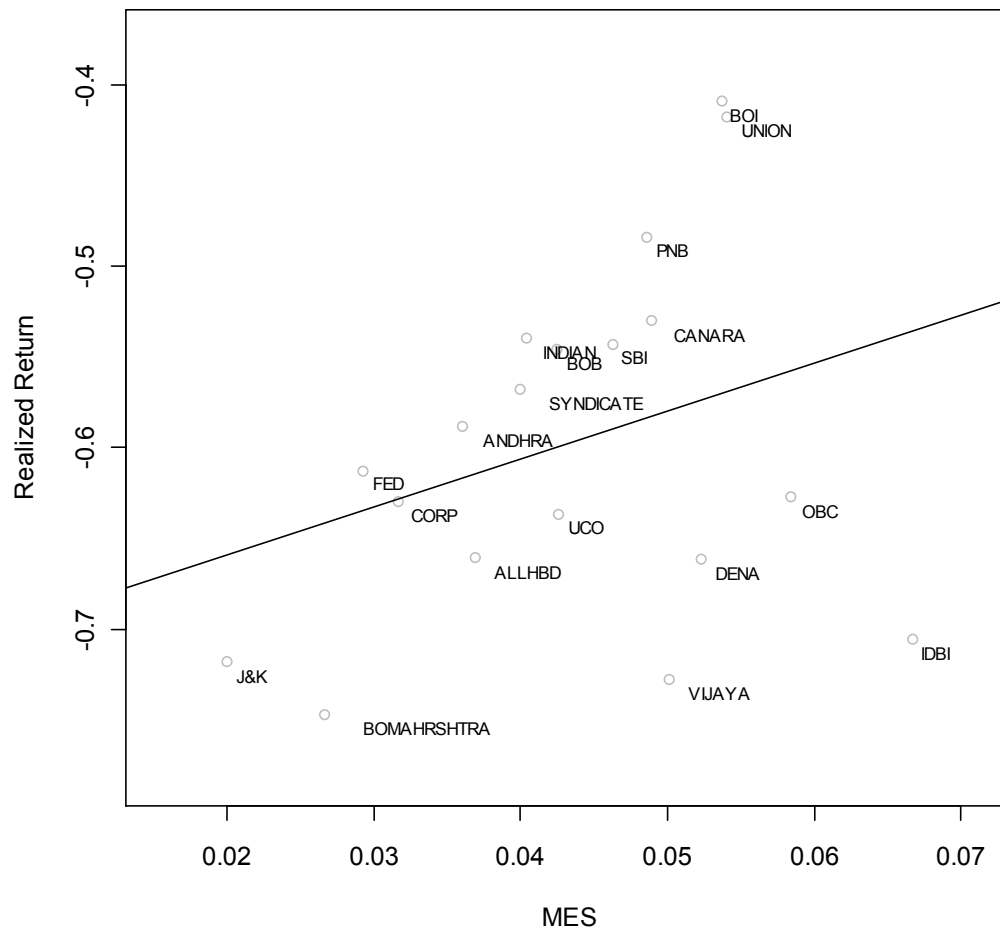
Graph B: Realized Returns versus MES excluding IDBI

Regression Statistics
Realized Return = -0.80 + 4.86 * MES
Adjusted R-squared = 23.27%
T-statistic = 2.48
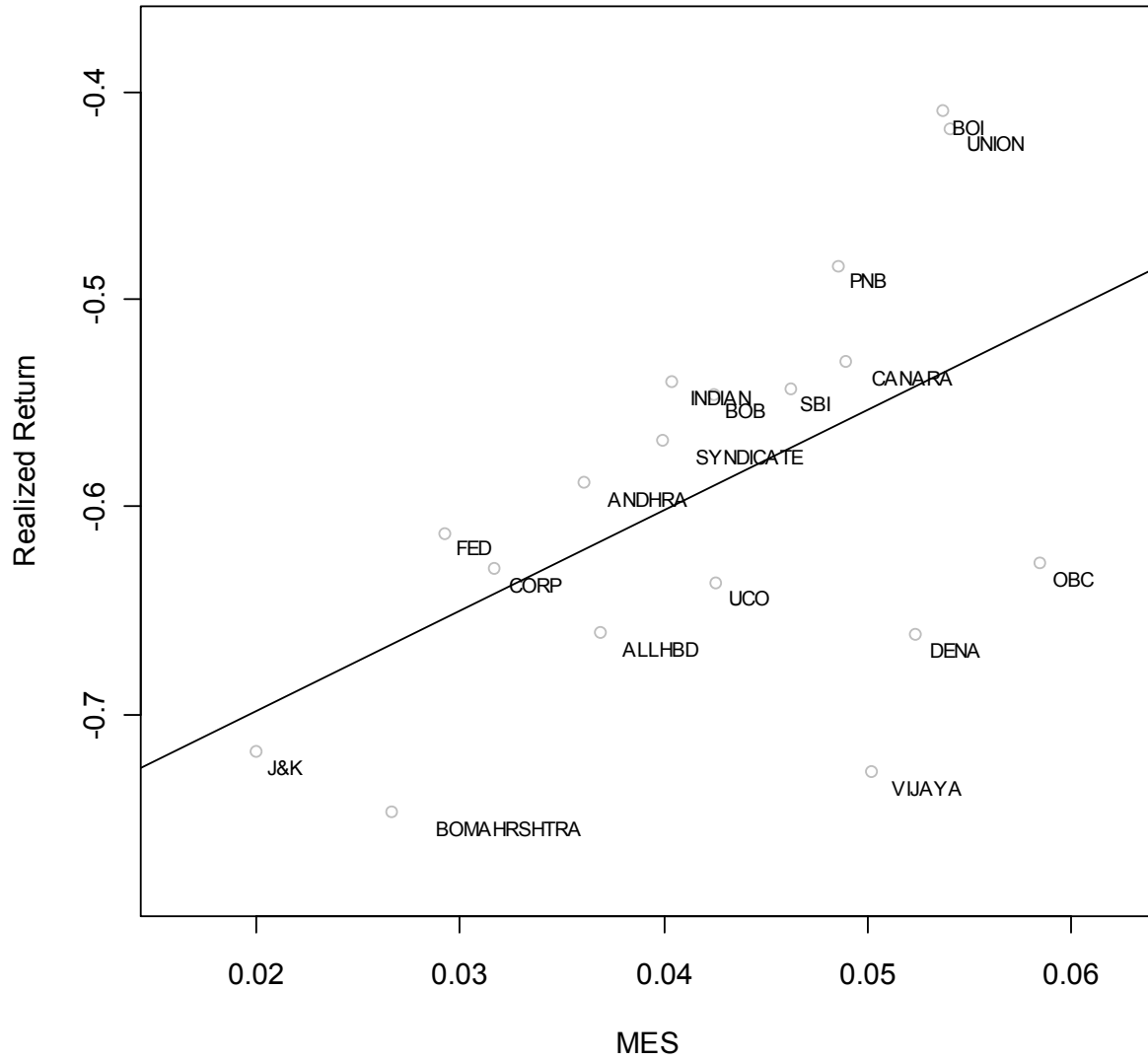
Figure 8: MES Rank for Jan '06 - Dec '06 versus MES Rank for Jan '07- Dec '07

The graph below shows the scatter plot of the MES Rank computed during the period 1st January, 2007 to 31st December, 2007 period versus the MES Rank computed during the 1st January, 2006 to 31st December, 2006 period. MES for a period is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile during the same period. Market return is based on the S&P CNX NIFTY. "MES Rank" ranks firms in descending order of MES values (assigns rank 1 to the firm with the largest MES). The firms used in the analysis are based on the intersection of banks that appear in both periods. The 2006 data was ranked first. Then, the ranks for 2006 corresponding to the firms with used for 2007 data (corresponding to Table 2) are used in the regression.

Regression Statistics
Realized Return = 18.97 + 0.43 * MES
Adjusted R-squared = 17.55%
 T-statistic = 3.85
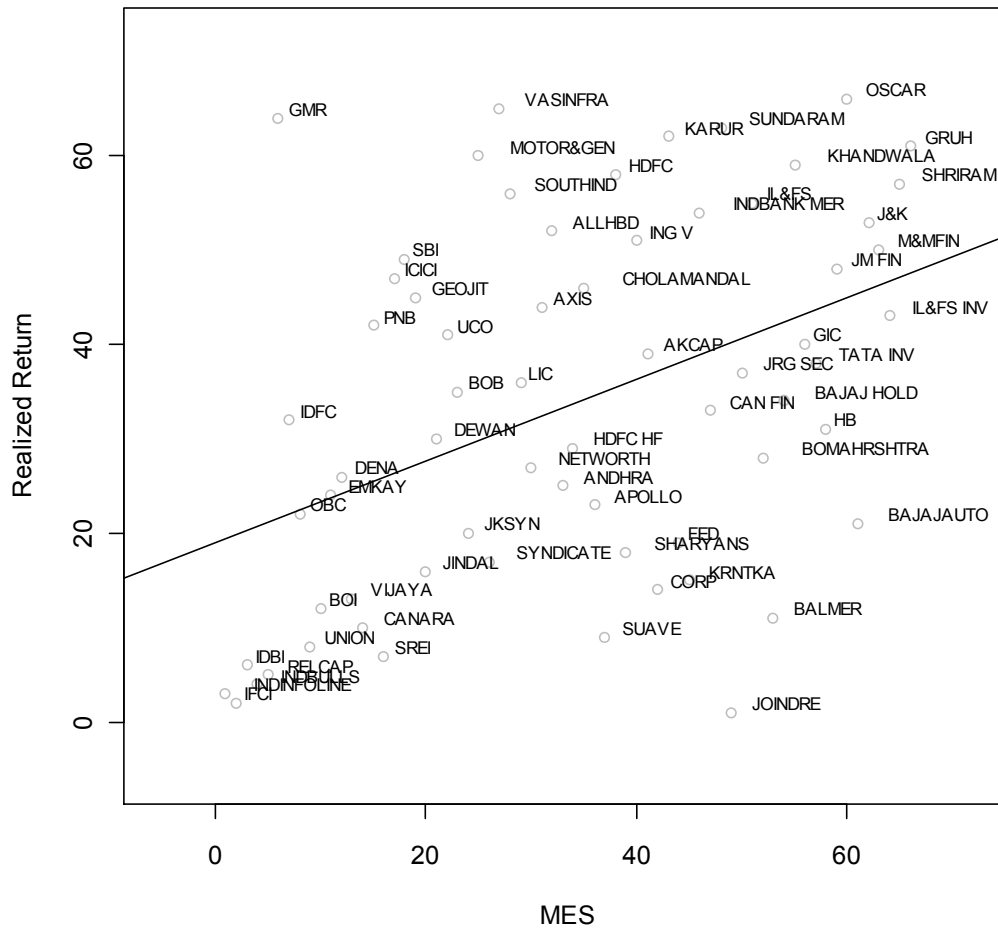
Figure 9: $MES Rank for Jan '06 - Dec '06 versus $MES Rank for Jan '07-Dec '07

The graph below shows the scatter plot of the $MES rank computed during the 1st January, 2007 to 31st December, 2007 period versus the $MES rank computed during the 1st January, 2006 to 31st December, 2006 period. MES for a period is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile during the same period. Market return is based on the S&P CNX NIFTY. $MES (in INR crores) is MES multiplied by the market capitalization at the beginning of the measurement period. $MES Rank ranks firms in descending order of $MES values (assigns rank 1 to the firm with the largest $MES). The 2006 data was ranked first. Then, the ranks for 2006 corresponding to the firms with used for 2007 data (corresponding to Table 2) are used in the regression.

Regression Statistics
Realized Return = 1.26 + 0.96 * MES
Adjusted R-squared = 92.53%
T-statistic = 28.39
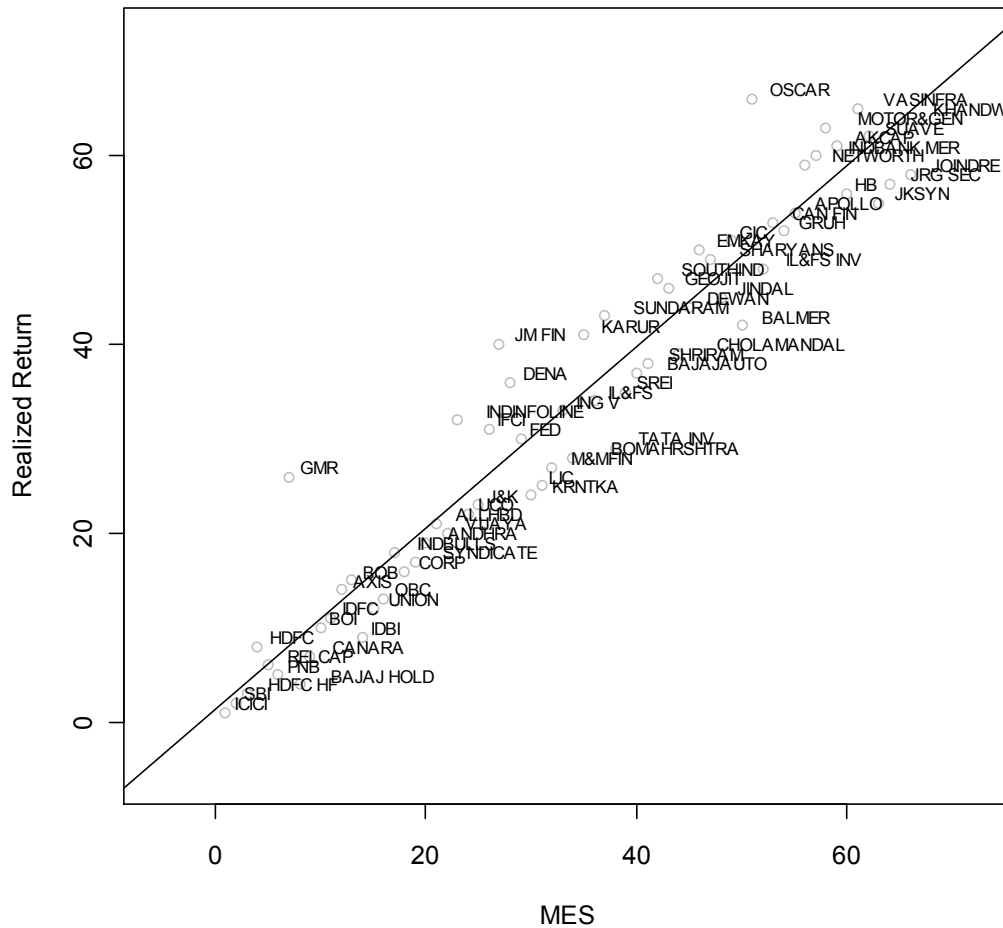
Figure 10: Deposit growth versus MES for Private and Public Banks

The graphs below shows the scatter plot of the MES computed during the period 1st January, 2007 to 31st December, 2007 period versus the deposit growth for public sector banks from 31st March, 2008 to 31st March, 2009. MES is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile during the period 1st January, 2007to 31st December, 2007. Market return is based on the S&P CNX NIFTY for the pre-crisis period from January 2007 to December 2007. Deposit growth for the crisis period is measured from 31st March, 2008 to 31st March, 2009. The 39 firms for which both MES data and RBI deposit growth estimates are available were used in this analysis.

Graph A: Private Banks

Graph B: Public Banks

Graph C: Public Banks without IDBI
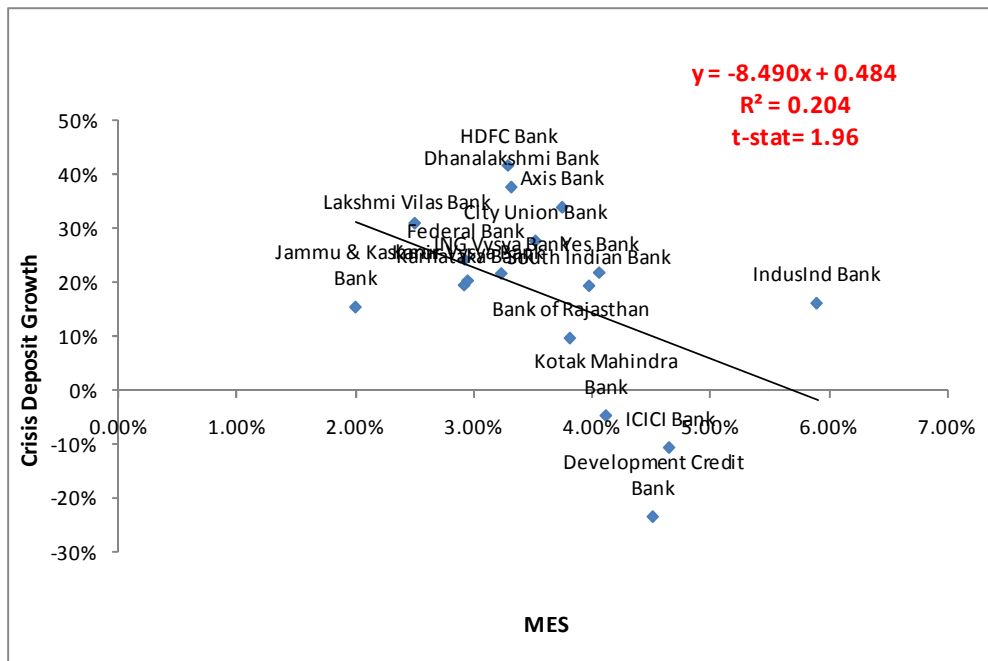
Figure 11: Q-o-Q Deposit Amounts and Growth for public and private banks
The graph below shows the quarter over quarter changes in deposit amounts for public and private sector banks. Deposit amount data is in INR crores for the period Q1 2007 to Q1 2009.
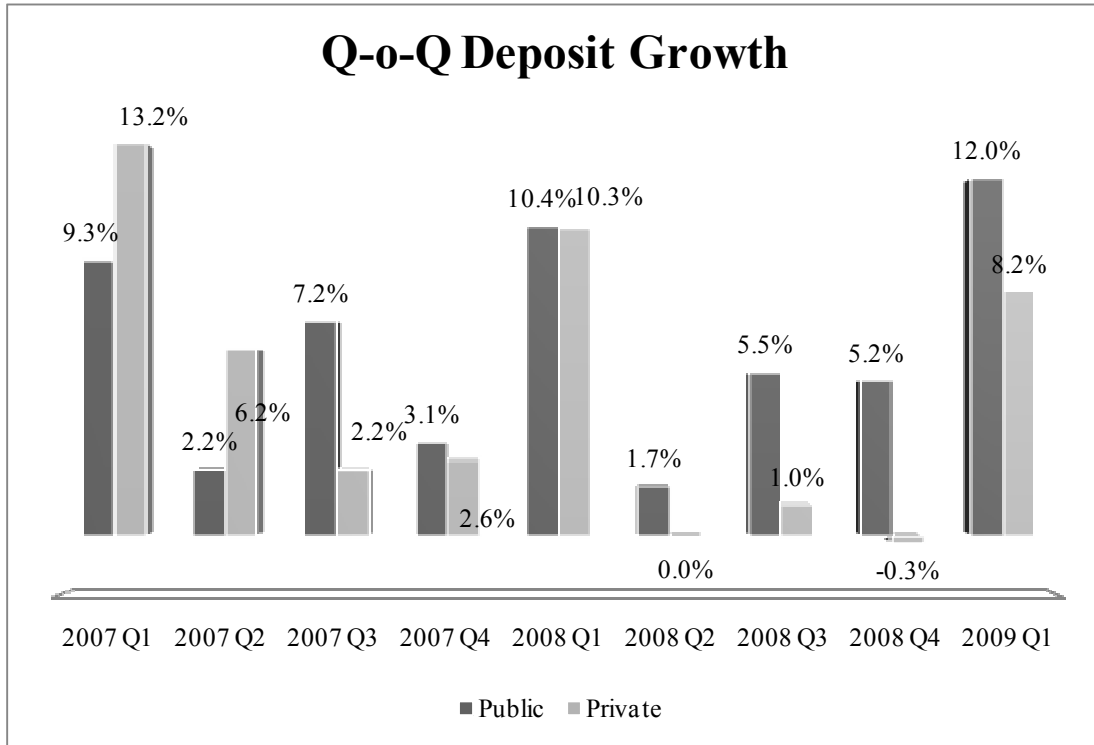
Source: (RBI)

Appendix A: MES and $MES measures by institution type for the period Jan 2007-Dec 2007

This table contains the MES, $MES, MES Rank and $MES Rank for the financial firms used in our analyses. The firms are listed for each institution type. Pre-crisis period measurements are market capitalization, MES, MES Rank, $MES, $MES Rank and % $MES contribution. Market Capitalization (in INR crores) is for the individual firms as of January 2007. MES is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile. Market return is based on the S&P CNX NIFTY for the pre-crisis period from January 2007 to December 2007. MES Rank ranks firms in descending order of MES values (assigns rank 1 to the firm with the largest MES). $MES (in INR crores) is the MES multiplied by the market capitalization at the beginning of the measurement period, January 2007. $MES Rank ranks firms in descending order of $MES values (assigns rank 1 to the firm with the largest $MES). Total Stock Return or realized return is the stock return for the individual firms during the crisis period from January 2008 to 24th February, 2009. Banks are classified as public sector banks and private sector banks. Private sector banks are further classified into (i) Private Banking Services, (ii) Brokers, and securities and stock traders and (iii) housing finance, non-banking financial companies (NBFCs), and other financial services.

I.   Public Sector Banking Services

	Pre-Crisis Period						Crisis Period
Name	Market Cap (INR crores)	MES (in %)	MES Rank	$MES (INR crores)	$MES Rank	% $MES Contribution	Total Stock Return
STATE BANK OF INDIA	65974	4.63%	18	3053.3	2	16.09%	-54.29%
PUNJAB NATIONAL BANK	16131	4.86%	6	783.2	7	4.13%	-48.38%
CANARA BANK	11355	4.89%	19	555.6	9	2.93%	-53.00%
BANK OF INDIA	10145	5.37%	10	544.6	11	2.87%	-40.89%
I D B I BANK LTD.	5512	6.67%	24	367.6	14	1.94%	-70.59%
BANK OF BARODA	8815	4.24%	3	374.1	15	1.97%	-54.58%
UNION BANK OF INDIA	6205	5.41%	8	335.5	17	1.77%	-41.77%
ORIENTAL BANK OF COMMERCE	5709	5.84%	4	333.6	18	1.76%	-62.72%
SYNDICATE BANK	3902	4.00%	27	156.0	19	0.82%	-56.82%
CORPORATION BANK	5048	3.17%	46	159.9	20	0.84%	-62.97%
INDIAN BANK	4227	4.04%	28	170.8	21	0.90%	-53.98%
ALLAHABAD BANK	3982	3.69%	37	146.9	22	0.77%	-66.10%
ANDHRA BANK	4207	3.61%	36	151.7	23	0.80%	-58.87%
VIJAYA BANK	2044	5.02%	13	102.5	24	0.54%	-72.80%
UCO BANK	1715	4.26%	29	73.0	26	0.38%	-63.66%
JAMMU & KASHMIR BANK LTD.	3061	2.01%	66	61.4	28	0.32%	-71.79%
DENA BANK	1068	5.23%	63	55.9	30	0.29%	-66.20%
FEDERAL BANK LTD.	1903	2.93%	12	55.7	31	0.29%	-61.27%
BANK OF MAHARASHTRA	1746	2.66%	67	46.5	35	0.25%	-74.71%

II.   Private Sector Banks

i.   Private Banking Services

Name	Pre-Crisis Period						Crisis Period
	Market Cap (INR crores)	MES (in %)	MES Rank	$MES (INR crores)	$MES Rank	% $MES Contribution	Total Stock Return
I C I C I BANK LTD.	80232	4.66%	17	3735.0	1	19.68%	-72.66%
H D F C BANK LTD.	33721	3.29%	42	1110.7	4	5.85%	-50.59%
AXIS BANK LTD.	13157	3.75%	35	493.7	13	2.60%	-62.61%
KARNATAKA BANK LTD.	1842	2.92%	49	53.9	33	0.28%	-72.66%
I N G VYSYA BANK LTD.	1456	3.24%	56	47.1	37	0.25%	-61.53%
KARUR VYSYA BANK LTD.	1454	2.95%	55	43.0	39	0.23%	-54.38%
SOUTH INDIAN BANK LTD.	614	3.98%	31	24.4	45	0.13%	-75.71%

ii.   Brokers and Securities and Stock traders

Name	Pre-Crisis Period						Crisis Period
	Market Cap (INR crores)	MES (in %)	MES Rank	$MES (INR crores)	$MES Rank	% $MES Contribution	Total Stock Return
INDIABULLS FINANCIAL SERVICES LTD.	5152	6.44%	9	331.9	16	1.75%	-87.15%
INDIA INFOLINE LTD.	1461	6.99%	1	102.1	25	0.54%	-86.96%
GEOJIT FINANCIAL SERVICES LTD.	536	4.41%	20	23.6	46	0.12%	-77.46%
EMKAY GLOBAL FINANCIAL SERVICES LTD.	192	5.28%	11	10.1	49	0.05%	-91.92%
APOLLO SINDHOORI CAPITAL INVSTS. LTD.	81	3.45%	70	2.8	57	0.01%	-66.59%
NETWORTH STOCK BROKING LTD.	67	3.81%	32	2.5	59	0.01%	-89.51%
INDBANK MERCHANT BANKING SERVICES LTD.	84	2.91%	50	2.4	61	0.01%	-79.78%
J R G SECURITIES LTD.	44	2.75%	54	1.2	68	0.01%	-74.86%
KHANDWALA SECURITIES LTD.	27	2.45%	59	0.7	69	0.00%	-72.34%
JOINDRE CAPITAL SERVICES LTD.	14	2.82%	53	0.4	70	0.00%	-79.19%
RELIANCE CAPITAL LTD.	13893	6.28%	5	872.8	5	4.60%	-85.72%
G M R INFRASTRUCTURE LTD.	12363	6.15%	15	760.5	6	4.01%	-69.33%
BAJAJ HOLDINGS & INVST. LTD.	27745	2.57%	58	714.3	8	3.76%	-90.70%
NETWORK 18 MEDIA & INVST. LTD.	1832	4.00%	23	73.2	27	0.39%	-85.23%
J M FINANCIAL LTD.	2478	2.35%	2	58.2	29	0.31%	-84.54%
TATA INVESTMENT CORPN. LTD.	1329	2.42%	52	32.1	40	0.17%	-71.81%
SHARYANS RESOURCES LTD.	299	3.25%	43	9.7	50	0.05%	-90.05%
JINDAL SOUTH WEST HOLDINGS LTD.	170	4.34%	21	7.4	51	0.04%	-91.35%
BALMER LAWRIE INVSTS. LTD.	227	2.58%	60	5.9	52	0.03%	-55.12%
OSCAR INVESTMENTS LTD.	263	2.14%	57	5.6	53	0.03%	-30.92%

iii. Housing finance services, Non-banking financial corporations (NBFCs) and other financial services

Name	Pre-Crisis Period						Crisis Period
	Market Cap (INR crores)	MES (in %)	MES Rank	$MES (INR crores)	$MES Rank	% $MES Contribution	Total Stock Return
HOUSING DEVELOPMENT FINANCE CORPN. LTD.	40497	3.57%	38	1447.3	3	7.63%	-55.80%
L I C HOUSING FINANCE LTD.	1379	3.84%	33	52.9	34	0.28%	-46.16%
DEWAN HOUSING FINANCE CORPN. LTD.	381	4.34%	22	16.5	48	0.09%	-77.00%
G I C HOUSING FINANCE LTD.	250	2.44%	68	6.1	55	0.03%	-67.55%
CAN FIN HOMES LTD.	144	2.86%	51	4.1	56	0.02%	-43.93%
GRUH FINANCE LTD.	472	0.71%	34	3.4	60	0.02%	-57.98%
POWER FINANCE CORPN. LTD.	12815	4.50%	14	577.0	10	3.04%	-49.97%
INFRASTRUCTURE DEVELOPMENT FINANCE CO. LTD.	8818	5.96%	7	525.8	12	2.77%	-77.18%
I F C I LTD.	859	6.80%	48	58.4	32	0.31%	-81.10%
MAHINDRA & MAHINDRA FINANCIAL SERVICES LTD.	2421	1.99%	44	48.3	36	0.25%	-39.38%
SUNDARAM FINANCE LTD.	1177	2.84%	61	33.4	41	0.18%	-56.63%
SHRIRAM TRANSPORT FINANCE CO. LTD.	2077	1.19%	16	24.8	42	0.13%	-53.68%
S R E I INFRASTRUCTURE FINANCE LTD.	582	4.74%	65	27.6	43	0.15%	-88.96%
BAJAJ AUTO FINANCE LTD.	1212	2.08%	69	25.2	44	0.13%	-86.65%
CHOLAMANDALAM D B S FINANCE LTD.	535	3.53%	39	18.9	47	0.10%	-93.63%
I L & F S INVESTSMART LTD.	1359	2.67%	47	36.2	38	0.19%	-78.41%
I L & F S INVESTMENT MANAGERS LTD.	326	1.42%	64	4.6	54	0.02%	-64.02%
TRANSWARRANTY FINANCE LTD.	66	3.84%	40	2.6	58	0.01%	-83.18%
MOTOR & GENERAL FINANCE LTD.	57	4.12%	26	2.3	62	0.01%	-77.23%
A K CAPITAL SERVICES LTD.	65	3.22%	45	2.1	63	0.01%	-63.88%
VAS INFRASTRUCTURE LTD.	42	3.99%	62	1.7	64	0.01%	-92.75%
H B STOCKHOLDINGS LTD.	70	2.39%	30	1.7	65	0.01%	-92.07%
J K SYNTHETICS LTD.	33	4.22%	41	1.4	66	0.01%	-79.10%
SUAVE HOTELS LTD.	45	3.30%	25	1.5	67	0.01%	-74.82%

Appendix B: Systemic Risk Ranking of Financial Firms during Jan 2007 to Dec 2007 based on BSE SENSEX returns

Table 1: Systemic Risk Ranking

This table contains the list of Indian financial firms used in our analysis corresponding to Table 1. The firms are listed in descending order based on their dollar Marginal Expected Shortfall at the 5% level ($MES). Pre-crisis period measurements are market capitalization, MES, MES Rank, $MES and $MES Rank. Market Capitalization (in INR crores) is for the individual firms as of January 2007. MES is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile. Market return is based on the BSE Sensex for the pre-crisis period from January 2007 to December 2007. MES Rank ranks firms in descending order of MES values (assigns rank 1 to the firm with the largest MES). $MES (in INR crores) is the MES multiplied by the market capitalization at the beginning of the measurement period, January 2007. $MES Rank ranks firms in descending order of $MES values (assigns rank 1 to the firm with the largest $MES). Total Stock Return is the stock return for the individual firms during the crisis period from January 2008 to 24th February, 2009.

Name	Type of Financial Institution	Public/ Private Sector	Pre-Crisis Period						Crisis Period
			Market Cap (INR crores)	MES	MES Rank	$MES (INR crores)	$MES Rank	%MES Contrib ution	Total Stock Return
I C I C I BANK LTD.	Private Banking services	Private	80232	4.56%	21	3659.3	1	19.18%	-72.66%
STATE BANK OF INDIA	Public Sector Banking services	Public	65974	4.59%	20	3025.2	2	15.86%	-54.29%
HOUSING DEVELOPMENT FINANCE CORPN. LTD.	Housing finance services	Private	40497	3.55%	39	1436.6	3	7.53%	-55.80%
H D F C BANK LTD.	Private Banking services	Private	33721	3.18%	46	1072.7	4	5.62%	-50.59%
RELIANCE CAPITAL LTD.	Securities and stock traders	Private	13893	6.55%	5	909.4	5	4.77%	-85.72%
G M R INFRASTRUCTUR E LTD.	Securities and stock traders	Private	12363	6.34%	16	783.2	6	4.10%	-69.33%
PUNJAB NATIONAL BANK	Public Sector Banking services	Public	16131	4.86%	6	783.7	7	4.11%	-48.38%
BAJAJ HOLDINGS & INVST. LTD.	Securities and stock traders	Private	27745	2.69%	55	747.6	8	3.92%	-90.70%
CANARA BANK	Public Sector Banking services	Public	11355	5.20%	13	590.6	9	3.10%	-53.00%
POWER FINANCE CORPN. LTD.	NBFC	Private	12815	4.50%	22	577.0	10	3.02%	-49.97%
BANK OF INDIA	Public Sector Banking services	Public	10145	5.42%	11	550.2	11	2.88%	-40.89%
INFRASTRUCTUR E DEVELOPMENT FINANCE CO.	NBFC	Private	8818	5.79%	7	511.0	12	2.68%	-77.18%

Name	Type of Financial Institution	Public/ Private Sector	Pre-Crisis Period						Crisis Period
			Market Cap (INR crores)	MES	MES Rank	$MES (INR crores)	$MES Rank	%MES Contrib ution	Total Stock Return
AXIS BANK LTD.	Private Banking services	Private	13157	3.58%	37	470.5	13	2.47%	-62.61%
I D B I BANK LTD.	Public Sector Banking services	Public	5512	7.16%	1	394.4	14	2.07%	-70.59%
BANK OF BARODA	Public Sector Banking services	Public	8815	4.24%	27	374.0	15	1.96%	-54.58%
INDIABULLS FINANCIAL SERVICES LTD.	Brokers	Private	5152	6.88%	3	354.5	16	1.86%	-87.15%
UNION BANK OF INDIA	Public Sector Banking services	Public	6205	5.54%	9	343.6	17	1.80%	-41.77%
ORIENTAL BANK OF COMMERCE	Public Sector Banking services	Public	5709	5.17%	14	295.1	18	1.55%	-62.72%
SYNDICATE BANK	Public Sector Banking services	Public	3902	4.73%	18	184.4	19	0.97%	-56.82%
CORPORATION BANK	Public Sector Banking services	Public	5048	3.54%	40	178.6	20	0.94%	-62.97%
INDIAN BANK	Public Sector Banking services	Public	4227	4.04%	32	170.8	21	0.90%	-53.98%
ALLAHABAD BANK	Public Sector Banking services	Public	3982	4.16%	28	165.6	22	0.87%	-66.10%
ANDHRA BANK	Public Sector Banking services	Public	4207	3.73%	36	157.0	23	0.82%	-58.87%
VIJAYA BANK	Public Sector Banking services	Public	2044	5.11%	15	104.4	24	0.55%	-72.80%
INDIA INFOLINE LTD.	Brokers	Private	1461	6.59%	4	96.3	25	0.50%	-86.96%
UCO BANK	Public Sector Banking services	Public	1715	4.66%	19	80.0	26	0.42%	-63.66%
NETWORK 18 MEDIA & INVST. LTD.	Securities and stock traders	Private	1832	4.34%	26	79.5	27	0.42%	-85.23%
JAMMU & KASHMIR BANK LTD.	Public Sector Banking services	Public	3061	2.32%	61	71.0	28	0.37%	-71.79%
J M FINANCIAL LTD.	Securities and stock traders	Private	2478	2.65%	58	65.6	29	0.34%	-84.54%
DENA BANK	Public Sector Banking services	Public	1068	5.74%	8	61.4	30	0.32%	-66.20%
FEDERAL BANK LTD.	Public Sector Banking services	Public	1903	3.22%	45	61.2	31	0.32%	-61.27%
I F C I LTD.	NBFC	Private	859	7.04%	2	60.5	32	0.32%	-81.10%
KARNATAKA BANK LTD.	Private Banking services	Private	1842	3.12%	48	57.4	33	0.30%	-72.66%
L I C HOUSING FINANCE LTD.	Housing finance services	Private	1379	4.05%	30	55.8	34	0.29%	-46.16%
BANK OF MAHARASHTRA	Public Sector Banking services	Public	1746	2.86%	52	49.9	35	0.26%	-74.71%
MAHINDRA & MAHINDRA FINANCIAL SERVICES LTD.	NBFC	Private	2421	1.95%	66	47.3	36	0.25%	-39.38%
I N G VYSYA BANK LTD.	Private Banking services	Private	1456	3.12%	47	45.4	37	0.24%	-61.53%

Name	Type of Financial Institution	Public/ Private Sector	Market Cap (INR crores)	MES	MES Rank	$MES (INR crores)	$MES Rank	%MES Contrib ution	Crisis Period Total Stock Return
			Pre-Crisis Period						**Crisis Period**
I L & F S INVESTSMART LTD.	Other financial services	Private	1359	3.30%	44	44.8	38	0.23%	-78.41%
KARUR VYSYA BANK LTD.	Private Banking services	Private	1454	3.02%	49	43.9	39	0.23%	-54.38%
TATA INVESTMENT CORPN. LTD.	Securities and stock traders	Private	1329	2.57%	59	34.1	40	0.18%	-71.81%
SUNDARAM FINANCE LTD.	NBFC	Private	1177	2.84%	53	33.4	41	0.18%	-56.63%
SHRIRAM TRANSPORT FINANCE CO. LTD.	NBFC	Private	2077	1.59%	69	33.0	42	0.17%	-53.68%
S R E I INFRASTRUCTUR E FINANCE LTD.	NBFC	Private	582	5.49%	10	32.0	43	0.17%	-88.96%
BAJAJ AUTO FINANCE LTD.	NBFC	Private	1212	2.06%	64	25.0	44	0.13%	-86.65%
SOUTH INDIAN BANK LTD.	Private Banking services	Private	614	4.05%	31	24.8	45	0.13%	-75.71%
GEOJIT FINANCIAL SERVICES LTD.	Brokers	Private	536	4.44%	23	23.8	46	0.12%	-77.46%
CHOLAMANDAL AM D B S FINANCE LTD.	NBFC	Private	535	3.56%	38	19.0	47	0.10%	-93.63%
DEWAN HOUSING FINANCE CORPN. LTD.	Housing finance services	Private	381	4.37%	25	16.6	48	0.09%	-77.00%
EMKAY GLOBAL FINANCIAL SERVICES LTD.	Brokers	Private	192	5.30%	12	10.2	49	0.05%	-91.92%
SHARYANS RESOURCES LTD.	Securities and stock traders	Private	299	2.93%	51	8.8	50	0.05%	-90.05%
JINDAL SOUTH WEST HOLDINGS LTD.	Securities and stock traders	Private	170	4.43%	24	7.5	51	0.04%	-91.35%
BALMER LAWRIE INVSTS. LTD.	Securities and stock traders	Private	227	2.67%	57	6.1	52	0.03%	-55.12%
OSCAR INVESTMENTS LTD.	Securities and stock traders	Private	263	2.14%	68	5.6	53	0.03%	-30.92%
I L & F S INVESTMENT MANAGERS LTD.	Other financial services	Private	326	1.73%	63	5.7	54	0.03%	-64.02%
G I C HOUSING FINANCE LTD.	Housing finance services	Private	250	1.98%	65	4.9	55	0.03%	-67.55%
CAN FIN HOMES LTD.	Housing finance services	Private	144	2.94%	50	4.2	56	0.02%	-43.93%
APOLLO SINDHOORI CAPITAL INVSTS.	Brokers	Private	81	3.39%	42	2.8	57	0.01%	-66.59%

Name	Type of Financial Institution	Public/ Private Sector	Pre-Crisis Period						Crisis Period
			Market Cap (INR crores)	MES	MES Rank	$MES (INR crores)	$MES Rank	%MES Contrib ution	Total Stock Return
TRANSWARRAN TY FINANCE LTD.	Other financial services	Private	66	3.84%	34	2.6	58	0.01%	-83.18%
NETWORTH STOCK BROKING LTD.	Brokers	Private	67	3.78%	35	2.5	59	0.01%	-89.51%
GRUH FINANCE LTD.	Housing finance services	Private	472	0.52%	70	2.4	60	0.01%	-57.98%
INDBANK MERCHANT BANKING SERVICES LTD.	Brokers	Private	84	2.83%	54	2.4	61	0.01%	-79.78%
MOTOR & GENERAL FINANCE LTD.	Other financial services	Private	57	4.12%	29	2.3	62	0.01%	-77.23%
A K CAPITAL SERVICES LTD.	Other financial services	Private	65	3.46%	41	2.3	63	0.01%	-63.88%
VAS INFRASTRUCTUR E LTD.	Other financial services	Private	42	3.99%	33	1.7	64	0.01%	-92.75%
H B STOCKHOLDING S LTD.	Other financial services	Private	70	2.30%	62	1.6	65	0.01%	-92.07%
J K SYNTHETICS LTD.	Other financial services	Private	33	4.78%	17	1.6	66	0.01%	-79.10%
SUAVE HOTELS LTD.	Other financial services	Private	45	3.30%	43	1.5	67	0.01%	-74.82%
J R G SECURITIES LTD.	Brokers	Private	44	2.69%	56	1.2	68	0.01%	-74.86%
KHANDWALA SECURITIES LTD.	Brokers	Private	27	2.44%	60	0.7	69	0.00%	-72.34%
JOINDRE CAPITAL SERVICES LTD.	Brokers	Private	14	1.76%	67	0.3	70	0.00%	-79.19%

*NBFC, non-banking financial corporation

Table 2: Descriptive Statistics

This table contains the summary statistics for MES and $MES for the banks used in our analyses. MES is the marginal expected shortfall of a stock given that the market return is below its 5th-percentile. Market return is based on the BSE SENSEX for the pre-crisis period from January 2007 to December 2007. $MES (in INR crores) is MES multiplied by the market capitalization at the beginning of the measurement period i.e. in January 2007. Realized return is the actual stock return during the crisis period from January 2008 to February 2009. Panel A provides overall descriptive statistics of the measures MES, $MES and realized return. Panel B gives the descriptive statistics for each category of banks. Banks are classified as public sector banks and private sector banks. Private sector banks are further classified into (i) Private Banking Services, (ii) Brokers and securities and stock traders and (iii) housing finance, non-banking financial companies (NBFCs), and other financial services. The descriptive statistics are for the 70 firms used in our analysis.

Panel A: Descriptive statistics of the measures MES and $MES

Summary- Overall			
Number of banks	70		
	Realized Return	MES	$MES (INR crores)
Mean	-68.96%	4.25%	380.41
Median	-71.19%	4.20%	88.13
Std	15.31%	1.40%	691.83
Min.	-93.63%	1.59%	8.77
Max.	-30.92%	7.16%	3659.32
Value Weighted	-63.37%	4.36%	1581.40

Panel B: Descriptive statistics of the measures MES and $MES by institution type.

	I. Public Sector Banks			II. Private Sector Banks		
Number of banks	19			51		
	Realized Return	MES	$MES (INR crores)	Realized Return	MES	$MES (INR crores)
Mean	-59.76%	4.54%	402.16	-72.39%	3.63%	224.29
Median	-61.27%	4.66%	178.57	-75.71%	3.39%	24.84
Std	9.80%	1.13%	667.69	15.64%	1.46%	583.53
Min.	-74.71%	2.32%	49.92	-93.63%	0.52%	0.25
Max.	-40.89%	7.16%	3025.19	-30.92%	7.04%	3659.32
Value Weighted	-54.93%	4.70%	1464.23	-68.34%	4.14%	1635.85

	II. Private Sector Banks								
	Private Banking Services			Brokers + Securities & Stock traders			Housing Finance + NBFCs + Other Financial Services		
Number of banks	7			20			24		
	Realized Return	MES	$MES (INR crores)	Realized Return	MES	$MES (INR crores)	Realized Return	MES	$MES (INR crores)
Mean	-64.31%	3.52%	767.72	-78.03%	3.87%	157.10	-70.05%	3.46%	121.78
Median	-62.61%	3.18%	57.45	-82.16%	3.16%	9.46	-75.91%	3.51%	17.83
Std	9.72%	0.59%	1331.96	14.80%	1.65%	295.00	16.53%	1.49%	317.43
Min.	-75.71%	3.02%	24.84	-91.92%	1.76%	0.25	-93.63%	0.52%	1.49
Max.	-50.59%	4.56%	3659.32	-30.92%	6.88%	909.44	-39.38%	7.04%	1436.63
Value Weighted	-65.74%	4.06%	2537.89	-84.22%	4.60%	665.17	-58.56%	3.86%	932.36

Table 3: Quarter over quarter Event Return versus MES for public and private sector financial firms

The table below shows the regression results of the MES computed during the period 1st January, 2007 to 31st December, 2007 period versus the total realized return each quarter for the period 1st January, 2008 to 24th February, 2009. MES is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile during the period 1st January, 2007 to 31st December, 2007. Market return is based on the BSE SENSEX for the pre-crisis period from January 2007 to December 2007. $MES (in INR crores) is MES multiplied by the market capitalization at the beginning of the measurement period, January 2007. Realized return or event return is the actual stock return during the crisis period for each quarter from January 2008 to December 2009. Q1 2008 returns are from January 2008 to March 2008, Q2 2008 returns are from April 2008 to June 2008, Q3 2008 returns are from July 2008 to September 2008 and Q4 2008 returns are from October 2008 to December 2008. 70 firms were used in the analysis. The regressions are carried out for both private sector and public sector financial firms.

	Overall	
	Public Sector Banks	Private Sector Bank
Intercept	-0.70	-0.57
t-stat	7.39	10.40
MES	2.26	-4.12
t-stat	1.11	2.92
Adj. R-squared	1.31%	13.07%
Degrees of freedom	17	49

	Q1 2008		Q2 2008		Q3 2008		Q4 2008		Q1 2009	
	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank	Public Sector Banks	Private Sector Bank
Intercept	-0.23	-0.33	-0.23	0.19	-0.09	-0.16	-0.30	-0.21	-0.18	-0.08
t-stat	3.16	5.13	2.62	1.22	0.48	2.01	2.95	3.65	2.29	1.49
MES	-2.84	-2.84	-0.36	-8.07	6.80	1.92	4.50	-1.35	-0.82	-3.09
t-stat	1.80	1.72	0.19	2.08	1.76	0.97	2.07	0.91	0.48	2.37
Adj. R-squared	11.14%	3.76%	-5.65%	6.21%	10.50%	-0.13%	15.47%	-0.35%	-4.49%	8.42%
Degrees of freedom	17	49	17	49	17	49	17	49	17	49

Appendix C: Systemic risk ranking of financial firms during January 2006 to December 2006

This table contains the list of Indian financial firms used in our analyses. The firms are listed in descending order according to their dollar Marginal Expected Shortfall at the 5% level ($MES). MES is the marginal expected shortfall of a stock given that the market return is below its 5th - percentile for the pre-crisis period from January 2007 to December 2007. Market return is based on the S&P CNX NIFTY for the pre-crisis period from January 2007 to December 2007. MES Rank ranks firms in descending order of MES values (assigns rank 1 to the firm with the largest MES). $MES (in INR crores) is the MES multiplied by the market capitalization at the beginning of the measurement period, January 2007. $MES Rank ranks firms in descending order of $MES values (assigns rank 1 to the firm with the largest $MES).

Name	Market Cap (INR crores)	MES Rank (Jan'06-Dec'06)	MES	$MES Rank(Jan'06-Dec'06)	$MES (INR crores)	% MES Contribution
I C I C I BANK LTD.	53098	3.56%	47	1892.32	1	14.62%
STATE BANK OF INDIA	47625	3.50%	49	1669.10	2	12.89%
HOUSING DEVELOPMENT FINANCE CORPN. LTD.	29703	4.51%	29	1339.51	3	10.35%
BAJAJ HOLDINGS & INVST. LTD.	20285	4.36%	34	883.85	4	6.83%
PUNJAB NATIONAL BANK	14882	4.05%	42	602.48	5	4.65%
RELIANCE CAPITAL LTD.	9146	6.54%	5	598.19	6	4.62%
CANARA BANK	9752	5.98%	10	583.10	7	4.50%
H D F C BANK LTD.	22273	2.12%	58	472.45	8	3.65%
I D B I BANK LTD.	7113	6.53%	6	464.65	9	3.59%
BANK OF INDIA	6110	5.88%	12	359.30	10	2.78%
INFRASTRUCTURE DEVELOPMENT FINANCE CO. LTD.	8177	4.38%	32	358.56	11	2.77%
UNION BANK OF INDIA	5535	6.32%	8	349.64	12	2.70%
ORIENTAL BANK OF COMMERCE	6697	5.02%	22	336.10	13	2.60%
AXIS BANK LTD.	8031	3.93%	44	315.59	14	2.44%
BANK OF BARODA	7094	4.33%	35	306.95	15	2.37%
CORPORATION BANK	5165	5.65%	14	291.97	16	2.26%
SYNDICATE BANK	4416	5.50%	17	242.75	17	1.87%
INDIABULLS FINANCIAL SERVICES LTD.	3069	6.95%	4	213.33	18	1.65%
ANDHRA BANK	3752	4.75%	25	178.19	19	1.38%
VIJAYA BANK	2647	5.70%	13	150.90	20	1.17%
ALLAHABAD BANK	3748	3.29%	52	123.22	21	0.95%
UCO BANK	2118	4.12%	41	87.22	22	0.67%
JAMMU & KASHMIR BANK LTD.	2353	3.27%	53	77.05	23	0.60%
KARNATAKA BANK LTD.	1341	5.53%	15	74.14	24	0.57%
L I C HOUSING FINANCE LTD.	1686	4.27%	36	72.05	25	0.56%
G M R INFRASTRUCTURE LTD.	6966	0.99%	64	68.71	26	0.53%
MAHINDRA & MAHINDRA FINANCIAL SERVICES LTD.	2000	3.35%	50	66.95	27	0.52%

Name	Market Cap (INR crores)	MES Rank (Jan'06-Dec'06)	MES	$MES Rank(Jan'06-Dec'06)	$MES (INR crores)	% MES Contribution
BANK OF MAHARASHTRA	1427	4.56%	28	65.09	28	0.50%
TATA INVESTMENT CORPN. LTD.	1539	4.23%	38	65.06	29	0.50%
FEDERAL BANK LTD.	1188	5.18%	19	61.54	30	0.48%
I F C I LTD.	655	8.10%	2	53.02	31	0.41%
INDIA INFOLINE LTD.	696	7.40%	3	51.53	32	0.40%
I N G VYSYA BANK LTD.	1487	3.29%	51	48.92	33	0.38%
I L & F S INVESTSMART LTD.	1480	3.19%	55	47.17	34	0.36%
S R E I INFRASTRUCTURE FINANCE LTD.	717	6.40%	7	45.89	35	0.35%
DENA BANK	967	4.70%	26	45.45	36	0.35%
BAJAJ AUTO FINANCE LTD.	742	5.11%	21	37.95	37	0.29%
SHRIRAM TRANSPORT FINANCE CO. LTD.	1443	2.61%	57	37.61	38	0.29%
CHOLAMANDALAM D B S FINANCE LTD.	781	3.71%	46	29.00	39	0.22%
J M FINANCIAL LTD.	660	3.54%	48	23.32	40	0.18%
KARUR VYSYA BANK LTD.	980	1.70%	62	16.69	41	0.13%
BALMER LAWRIE INVSTS. LTD.	279	5.91%	11	16.50	42	0.13%
SUNDARAM FINANCE LTD.	984	1.43%	63	14.10	43	0.11%
DEWAN HOUSING FINANCE CORPN. LTD.	316	4.44%	30	14.01	44	0.11%
JINDAL SOUTH WEST HOLDINGS LTD.	253	5.50%	16	13.94	45	0.11%
GEOJIT FINANCIAL SERVICES LTD.	302	3.92%	45	11.85	46	0.09%
SOUTH INDIAN BANK LTD.	313	2.94%	56	9.19	47	0.07%
I L & F S INVESTMENT MANAGERS LTD.	231	3.97%	43	9.16	48	0.07%
SHARYANS RESOURCES LTD.	173	5.28%	18	9.13	49	0.07%
EMKAY GLOBAL FINANCIAL SERVICES LTD.	162	4.90%	24	7.94	50	0.06%
G I C HOUSING FINANCE LTD.	141	4.14%	40	5.84	51	0.05%
GRUH FINANCE LTD.	234	2.01%	61	4.70	52	0.04%
CAN FIN HOMES LTD.	101	4.37%	33	4.40	53	0.03%
APOLLO SINDHOORI CAPITAL INVSTS. LTD.	65	4.95%	23	3.19	54	0.02%
J K SYNTHETICS LTD.	54	5.18%	20	2.79	55	0.02%
H B STOCKHOLDINGS LTD.	53	4.41%	31	2.32	56	0.02%
J R G SECURITIES LTD.	54	4.25%	37	2.28	57	0.02%
JOINDRE CAPITAL SERVICES LTD.	24	8.41%	1	2.03	58	0.02%
NETWORTH STOCK BROKING LTD.	43	4.63%	27	1.98	59	0.02%
INDBANK MERCHANT BANKING SERVICES LTD.	55	3.22%	54	1.78	60	0.01%
A K CAPITAL SERVICES LTD.	41	4.21%	39	1.74	61	0.01%
SUAVE HOTELS LTD.	15	6.22%	9	0.94	62	0.01%
MOTOR & GENERAL FINANCE LTD.	38	2.03%	60	0.78	63	0.01%
KHANDWALA SECURITIES LTD.	38	2.06%	59	0.78	64	0.01%

Name	Market Cap (INR crores)	MES Rank (Jan'06-Dec'06)	MES	$MES Rank(Jan'06-Dec'06)	$MES (INR crores)	% MES Contribution
VAS INFRASTRUCTURE LTD.	1	-0.36%	65	-0.01	65	0.00%
OSCAR INVESTMENTS LTD.	100	-0.42%	66	-0.42	66	0.00%

Name	Market Cap (INR crores)	MES Rank (Jan'06-Dec'06)	MES	$MES Rank(Jan'06-Dec'06)	$MES (INR crores)	% MES Contribution