

Eurasian Journal of Business and Economics 2009, 2 (4), 43-62.

The Impact of Internet Banking on Bank Performance and Risk: The Indian Experience

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Abstract

The paper describes the current state of Internet banking in India and discusses its implications for the Indian banking industry. Particularly, it seeks to examine the impact of Internet banking on banks' performance and risk. Using information drawn from the survey of 85 scheduled commercial bank's websites, during the period of June 2007, the results show that nearly 57 percent of the Indian commercial banks are providing transactional Internet banking services. The univariate analysis indicates that Internet banks are larger banks and have better operating efficiency ratios and profitability as compared to non-Internet banks. Internet banks rely more heavily on core deposits for funding than non-Internet banks do. However, the multiple regression results reveal that the profitability and offering of Internet banking does not have any significant association, on the other hand, Internet banking has a significant and negative association with risk profile of the banks.

Keywords: Banking, Internet banking, performance, risk, India

JEL Classification Codes: G21, O33, L25, G32, O53

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1. Introduction

Internet technology holds the potential to fundamentally change banks and the banking industry. An extreme view speculates that the Internet will destroy old models of how bank services are developed and delivered (DeYoung, 2001a). The widespread availability of Internet banking is expected to affect the mixture of financial services produced by banks, the manner in which banks produce these services and the resulting financial performances of these banks. Whether or not this extreme view proves correct and whether banks take advantage of this new technology will depend on their assessment of the profitability of such a delivery system for their services. In addition, industry analysis outlining the potential impact of Internet banking on cost savings, revenue growth and risk profile of the banks have also generated considerable interest and speculation about the impact of the Internet on the banking industry (Berger, 2003).

Banking through internet has emerged as a strategic resource for achieving higher efficiency, control of operations and reduction of cost by replacing paper based and labour intensive methods with automated processes thus leading to higher productivity and profitability. However, to date researchers have produced little evidence regarding these potential changes. Nonetheless, recent empirical studies indicate that Internet banking is not having an independent effect on banking profitability, although these findings may change as the use of the Internet becomes more widespread.

More recently in India too, a wider array of financial products and services have become available over the Internet (Malhotra and Singh, 2004), which has thus become an important distribution channel for a number of banks. Banks boost technology investment spending strongly to address revenue, cost and competitiveness concerns. For some activities, banks hope to see a near-term impact on profitability. Other investments are motivated more by a desire to establish a competitive position or avoid falling behind the competition. The purpose of present study is to analyze such effects of Internet banking in India, where no rigorous attempts have been undertaken to understand this aspect of the banking business.

The primary aim is to advance the understanding of how Internet banks are different from the non-Internet banks in terms of profitability, cost efficiency, asset quality and other characteristics by examining bank financial statements from year end 1998 to year end 2006. The present study tests not only whether the Internet delivery channel affected the financial performance of the commercial banks in our sample, but also how these changes happened. The study examines a comprehensive set of 10 measures of financial performance that allow us to “look inside the black box” of bank performance. By developing a deeper understanding of these phenomena, we can draw more insightful inferences about the impact of

the Internet on banking business strategies, production processes and financial performance. Increasing this type of knowledge is vital for both academic literature and also for bank marketers who cannot count on the initial success achieved by the Internet banking investment.

The paper is organized as follows. The next section reports a brief review of the literature on Internet Banking, comparing and contrasting conclusions of previous research. Section 3 describes the data and current status of Internet banking in India. Section 4 explores whether there is a financial gap between the Internet and non-Internet banks in India by using univariate analysis on banks' balance-sheet data collected by various regulatory authorities (Reserve Bank of India and Indian Banks Association). Section 5 explores whether Internet banking has had a noticeable impact on Indian Banks' performance and risk, using multivariate (OLS model) analysis. Section 6 concludes the paper.

2. Review of Existing Literature

A few empirical studies exist in the literature, which have examined the relative performance of banks offering Internet banking services. Table 1 summarizes the previous research done on the performance of Internet banks. The table also includes the studies which have examined the financial performance of Internet-only banks that do not operate any physical branches.

Egland et al. (1998) was the first important study, which estimated the number of US banks offering Internet banking and analyzed the structure and performance characteristics of these banks. It found no evidence of major differences in the performance of the group of banks offering Internet banking activities compared to those that do not offer such services in terms of profitability, efficiency or credit quality. However, transactional Internet banks differed from other banks primarily by size.

In contrast to the results of Egland et al. (1998), Furst et al. (2000a, 2000b, 2002a and 2002b) found that banks in all size categories offering Internet banking were generally more profitable and tended to rely less heavily on traditional banking activities in comparison to non-Internet banks. An exception to the superior performance of Internet banks was the de novo (new start-ups) Internet banks, which were less profitable and less efficient than non-Internet de novos. The authors concluded that Internet banking was too small a factor to have affected banks' profitability. Sullivan (2000) found that click and mortar banks in the 10th Federal Reserve District incurred somewhat higher operating expenses but offset these expenses with somewhat higher fee income. On average, this study found no systematic evidence that banks were either helped or harmed by offering the Internet delivery channel. Similar to the results of Furst et al., this study also found that de novo click and mortar banks performed significantly worse than de novo brick and mortar banks.

Table 1: International Studies on Internet Banking and Performance

	Study	Country and sample size analyzed	Sample Period	Results
1	Egland <i>et al.</i> (1998)	U.S., 8983 banks	1998	No evidence of differences in the performance of the Internet and non-Internet banks.
2	Furst <i>et al.</i> (2000a, 2000b, 2002a and 2002b)	U.S., 2,517 National Banks	Q3, 1999	Internet banks outperformed non-Internet banks in terms of profitability. Offering Internet banking didn't have a statistically significant impact on profitability.
3	Sullivan (2000)	Tenth Federal Reserve District, 1618 banks	First Q, 2000	Measures of profitability for Internet banks are similar to those of the non-Internet banks.
4	Carlson <i>et al.</i> (2001)	U.S., 2517 National Banks	Q2, 1998 - Q4, 2000	Internet banking is not having an independent impact on bank profitability.
5	DeYoung (2001a)	U.S., 6 pure play Internet banks and 522 benchmark banks.	1997:Q2 - 2000:Q2.	Poor financial performance of pure play Internet banks.
6	DeYoung (2001b)	U.S., 10 Internet-only and 569 benchmark banks	1997: Q2-2000: Q4	Poor financial performance but higher assets growth of pure-play Internet banks.
7	DeYoung (2001c and 2005)	U.S., 12 Internet only banks and 644 benchmark banks	1997: Q2-2001: Q2	Poor financial performance but higher assets growth of pure play Internet banks.
8	Hasan <i>et al.</i> (2002)	Italy, 105 banks	1993-2000	In respect of almost all performance variables, the Internet group outperformed the non-Internet group. Highly significant relationship between offering of Internet banking and bank profitability.
9	Delgado <i>et al.</i> (2004)	European Union, 13 Primarily Internet banks and 335 established traditional banks	1994-2004	Lower profitability of primarily-Internet banks as compared to newly chartered non-Internet banks. Evidence of technology based scale efficiencies to Internet banks but not of technology based learning effects.
10	Hernando and Nieto (2005)	Spain, 72 commercial banks	1994-2002	Performance of Multichannel banks is better in terms of ROE, higher commission income and lower general expenses. The adoption of the Internet as a delivery channel has a positive impact on banks' profitability measured both in terms of <i>ROA</i> and <i>ROE</i> and no statistically significant impact on risk.
11	Sathye, M (2005)	Australia, 61 Credit Unions	1997-2001	Internet banking doesn't have a significant impact on performance and risk profile of banks.
12	Delgado <i>et al.</i> (2006)	15 E.U. Countries, 15 Primarily-Internet banks and 335 Traditional banks	1994-2002	Lower profitability of Primarily-Internet banks as compared to newly chartered non-Internet banks. The adoption of Internet banking affects profitability negatively

13	DeYoung <i>et al.</i> (2006)	U.S., 424 Internet banks and 5175 non-Internet banks	1999-2001	Click and mortar banks became more profitable (ROA and ROE) relative to their brick and mortar rivals between 1999 and 2001. Internet adoption improved bank profitability, particularly through increased revenues from deposit service charges.
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Using information drawn from banks in Italy, Hasan et al. (2002) found that the Internet banking institutions were performing significantly better than the non-Internet groups. Additionally, the risk variables associated with the Internet group continued to be lower relative to the non-Internet group. The asset-liability variables revealed that on average the banks in this Internet group were larger and had significantly higher trading and investment activities and less dependent on retail deposits (both demand and saving deposits) relative to the non-Internet group. The only category where the Internet group showed a lower performance was the noninterest expense category. It found a significant and positive link between offering of Internet banking activities and banks' profitability and a negative but marginally significant association between the adoption of Internet banking and bank risk levels particularly due to increased diversification.

Hernando and Nieto (2005) examined the performance of multichannel banks in Spain between 1994 and 2002. The study found higher profitability for multichannel banks through increased commission income, increased brokerage fees and (eventual) reductions in staffing levels and concluded that the Internet channel was a complement to physical banking channels. In contrast to earlier studies, the multichannel banks in Spain relied more on typical banking business (lending, deposit taking and securities trading). The adoption of the Internet as a delivery channel had a positive impact on banks' profitability after one and a half years of adoption. It was explained by the lower overhead expenses and in particular, staff and IT costs after the same period.

Sathye (2005) investigated the impact of the introduction of transactional Internet banking on performance and risk profile of major credit unions in Australia. Similar to the results of Sullivan (2000), the Internet banking variable didn't show a significant association with the performance as well as with operating risk variable. Thus, Internet banking didn't prove to be a performance enhancing tool in the context of major credit unions in Australia. It neither reduced nor enhanced risk profile.

DeYoung et al. (2006) observed the change in financial performance of Internet community banks in U.S. during 1999-2001. The results found that Internet adoption improved community banks' profitability, particularly through increased revenues from deposit service charges. Internet adoption was also associated with movements of deposits from checking accounts to money market deposit accounts, increased use of brokered deposits and higher average wage rates for bank employees. It found little evidence of changes in loan portfolio mix. The findings

suggested that Internet adoption was associated with an economically and statistically significant improvement in bank profitability.

DeYoung (2001a, 2001b, 2001c and 2005) analyzed systematically the financial performance of pure-play Internet banks in U.S. The study found relatively lower profits at the Internet-only institutions than the branching banks, caused in part by high labour costs, low fee based revenues and difficulty in generating deposit funding. However, consistent with the standard Internet banking model, the results indicated that Internet-only banks tended to grow faster than traditional branching banks. Internet-only banks have access to deeper scale economies than branching banks and because of this, they are likely to become more financially competitive over time as they grow larger. Delgado et al. (2004 and 2006) found similar results for Internet-only banks in the EU. Nevertheless, the magnitude of technology based scale economies found in Delgado et al. (2004 and 2006) was substantially larger than that estimated by DeYoung studies.

The evidence of the impact of the adoption of Internet as a delivery channel on financial performance is mixed at both sides of the Atlantic. Nevertheless, the latest studies seem to find a positive relationship with profitability. It can be argued that as the intensity and experience in the usage of Internet increases, the financial performance of multichannel banks is likely to improve. In Indian context, many publications throw light over the importance of Internet banking and also its prospects for the Indian banking industry. However these studies don't depict any empirical relationship between banks' profitability and Internet banking. The purpose of this paper is to study the same correlation applicable in Indian context. This paper also proposes and tests the existence of financial gaps between Internet banks and non-Internet banks in India.

3. Data and Profile of Banks

3.1 Data

The primary data set comes from the publicly available data source on bank's financial statements and income-expense reports sent to the regulators and banking associations. The Reserve Bank of India (RBI), provided the data. The data was matched with Indian Banking Associations data source, IBA Bulletin and Center for Monitoring Indian Economy (CMIE) data source PROWESS, for additional variables. The Internet related details were drawn from a survey of commercial banks' Websites during the period of June 2007. The banks whose home pages were not discovered despite of best efforts were assumed to be banks with no Website.

The data set is limited to the banks that are operating as commercial banks as on March end 2006. In doing so, the banks that are acquired by other banks or have closed down their operations during the period are not included. Finally, a panel

data of 85 commercial banks turned out to be the sample of the study over the period 1998-2006 which represented nearly 39 percent of total scheduled commercial banks in India. As all the banks in sample are not observed in the entire period, the study has used an unbalanced panel data for the empirical work. The 85 banks consisted of 28 public sector banks (8 banks in State Bank of India (SBI) group) and 20 nationalized banks), 28 private sector banks (21 old and 7 new private sector banks) and 29 foreign banks. The sample includes 49 Internet banks and 36 non-Internet banks. Table 2 reports the description of sample banks.

Table 2: Adoption Rates of Internet banks

Bank	Number of Banks	Number of Banks With Websites	Number of Internet Banks	Internet banks as a percentage of banks in category
Private Sector Banks	28	27	17	60.7
New ¹	7	7	7	100.0
Old ²	21	20	10	47.6
Public Sector Banks	28	28	26	92.8
SBI Group ³	8	8	8	100.0
Nationalized ⁴	20	20	18	90.0
Foreign Banks	29	29	6	20.7
All Banks	85	84	49	57.6

Source: Web sites of the individual banks [accessed during June 2007], annual reports of the respective banks and bank communications.

The survey results reveal that, during the period of June 2007, 84 banks in India had Web sites, of which 49 allowed transactions to be initiated through the Internet. However, the adoption rates across individual bank categories are not uniform. Adoption rates for transactional Web sites are highest in public sector and are lowest in foreign banks. Among the sub-categories, the adoption rates for transactional Web sites are highest in new private sector banks and SBI group (Table 2).

4. Internet and Non-Internet Banks: Comparison of Performance

Evaluating bank performance is a complex process that involves assessing interaction between the environment, internal operations and external activities. In

¹ Includes banks established after the liberalization reforms as recommended by Narsimham Committee in 1991.

² Includes banks established before the liberalization reforms as recommended by Narsimham Committee in 1991.

³ Includes State bank of India and its seven subsidiaries.

⁴ Includes banks nationalized by the government in 1969 and 1980 and also includes IDBI Bank Ltd. Earlier it was a private sector bank. It has been merged with its parent IDBI Ltd. and the latter has been included in the Public sector bank category with effect from 11th October 2004.

general, a number of financial ratios are usually used to assess the performance of banks. Financial performance has been studied under different yardsticks of performance i.e., size, profitability, financing pattern, economic efficiency, operational efficiency, asset quality, diversification and cost of operations.

This section reports the results of univariate analysis to differentiate the Internet and non-Internet banks. The null hypothesis regarding the financial performance of Internet and non-Internet banks is:

H1: The financial performance of banks adopting Internet banking is not different from those of banks choosing not to adopt Internet banking, in terms of size, profitability, operating capability, financing, asset quality, diversification and cost of operations.

The decision to accept or reject null hypothesis is made on the basis of the value of the test statistic obtained from the data at hand. In the present study, the statistical significance of the means of various test statistics is determined by using the two independent samples t-statistic. For each pair of observations in a table, a probability (p) value is provided for the hypothesis that the means in the Internet and non-Internet samples are the same. A lower p-value indicates a greater likelihood that the two figures compared represent real differences between the two categories of banks (Internet vs. non-Internet, etc.).

Tables 3 to Table 6 show the univariate statistics for the Internet group as well as the non-Internet group across 10 financial performance measures. In these tables, the performance of an Internet group with non-Internet banking group and separately for public sector banks (SBI group and nationalized banks), private sector banks (new and old private sector banks) and foreign banks has been analyzed.

4.1 Size

Table 3 shows the size variables for the Internet and non-Internet banking group. Internet banks are statistically and significantly larger than non-Internet banks in terms of total assets and employees. The results are similar to Furst et al. (2000a, 2000b, 2002a and 2002b), Hasan et al. (2002) and Hernando and Nieto (2005). Table 3 shows that Internet banks are larger in almost every category of bank.

Table 3: Size of Internet and Non-Internet Banks (1998-2006)

	Assets (Rs Crores)			Employees		
	Internet Banks (N ₁)	Non-internet Banks (N ₂)	Statistical Significance of the Difference Between the Two Means	Internet Banks (N ₁)	Non-internet Banks (N ₂)	Statistical Significance of the Difference Between the Two Means
	Mean	Mean	"t"-statistics	Mean	Mean	"t"-statistics
All Banks (N₁=143) (N₂=596)	50283.67	11829.13	5.65*** (.000)	17854	9091	2.63*** (.009)
Public Sector (N₁=58) (N₂=187)	87391.85	31787.80	3.84*** (.000)	38450	26563	1.58 (.116)
SBI Group (N ₁ =17) (N ₂ =55)	142023.121	30096.89	2.44** (.026)	68313	26963	1.75* (.094)
Nationalized (N ₁ =41) (N ₂ =132)	64739.85	32492.34	5.82*** (.000)	26068	26396	-.121 (.904)
Private Sector (N₁=58) (N₂=180)	26919.62	3916.89	3.99*** (.001)	4541	2174	3.85*** (.000)
New Private (N ₁ =35) (N ₂ =15)	37472.78	5264.75	3.52*** (.001)	4814	610	4.37*** (.000)
Old Private (N ₁ =23) (N ₂ =165)	10860.45	3794.36	5.35*** (.000)	4126	2316	4.47*** (.000)
Foreign Banks (N₁=27) (N₂=229)	20759.27	1750.23	7.25*** (.000)	2207	260	6.26*** (.000)

Sources: Statistical Tables relating to banks available at www.rbi.org.in and various Issues of IBA Bulletin
N1 = No. of observations for Internet banks

N2 = No. of observations for non-Internet banks

*** = Significant at the 1 percent or better level; ** = significant at the 5 percent level; and * = significant at the 10 percent level.

4.2. Profitability, Operating Efficiency and Financing

Table 4 compares the profitability, operating efficiency and financing pattern of Internet banks with non-Internet banks. On an average, Internet banks are more profitable than non-Internet banks and are operating with lower cost as compared to non-Internet banks, thus, representing the efficiency of the Internet banks. The results are similar to Furst et al. (2000a, 2000b, 2002a and 2002b) and Hernando and Nieto (2005).

Internet banks in public sector, particularly, in nationalized bank category are more profitable than non-Internet banks. Comparatively, both the categories of private sector Internet banks are less profitable than non-Internet banks but the difference is not statistically significant. The lower profitability of these banks may be due to higher operating expenses, both fixed cost as well as labour cost.

Table 4: Profitability, Operating Efficiency and Financing Pattern of Internet and Non-Internet Banks (1998-2006)

	Profitability (Return on Assets) (%)			Operating Efficiency (Operating Cost) (%)			Financing Pattern (Deposits) (%)		
	Mean (N ₁)	Mean (N ₂)	"t"	Mean (N ₁)	Mean (N ₂)	"t"	Mean (N ₁)	Mean (N ₂)	"t"
All Banks (N₁=143) (N₂=596)	.898	.697	2.06** (.039)	50.790	56.448	-3.07*** (.002)	77.441	71.144	4.17*** (.000)
Public Sector (N₁=58) (N₂=187)	.935	.647	4.65*** (.000)	48.766	59.764	-7.25*** (.000)	82.177	85.354	-2.00** (.050)
SBI Group (N ₁ =17) (N ₂ =55)	.870	.924	-.76 (.450)	47.885	51.680	-1.97* (.054)	80.419	79.863	.69 (.491)
Nationalized (N ₁ =41) (N ₂ =132)	.962	.531	5.35*** (.000)	49.132	63.132	-7.28*** (.000)	82.907	87.643	-2.15** (.037)
Private Sector (N₁=58) (N₂=180)	.714	.694	.162 (.871)	53.584	55.320	-.57 (.567)	79.095	86.182	-4.36*** (.000)
New Private (N ₁ =35) (N ₂ =15)	.806	.866	-.24 (.809)	51.772	44.859	1.17 (.247)	74.154	79.086	-1.81* (.076)
Old Private (N ₁ =23) (N ₂ =165)	.575	.678	-.56 (.575)	56.340	56.271	.01 (.988)	86.614	86.827	-.215 (.830)
Foreign Banks (N₁=27) (N₂=229)	1.212	.740	1.83* (.070)	49.136	54.626	-1.35 (.176)	63.714	47.720	5.03*** (.000)

Sources: Statistical Tables relating to banks available at www.rbi.org.in and various Issues of IBA Bulletin

N1 = No. of observations for Internet banks

N2 = No. of observations for non-Internet banks

*** = Significant at the 1 percent or better level; ** = significant at the 5 percent level; and * = significant at the 10 percent level.

Table 4 also shows major financing characteristics of Internet and non-Internet banks. The Internet banks in India are able to generate more deposits or customer accounts than non-Internet banks. The results are consistent with Hernando and Nieto (2005). Internet banks in India rely more on traditional source of financing i.e. deposits as compared to borrowing financing which is inconsistent with previous studies (e.g., Furst et al., 2000a, 2000b, 2002a and 2002b; Sullivan, 2000; Hasan et al., 2002; DeYoung et al., 2006).

As far as categories of the banks are concerned, the private sector Internet banks fund less of their assets from traditional sources, such as deposits. Internet banks in public sector, particularly in nationalized bank category have also shown the same preference. It appears as these banks have begun to view the addition of Internet banking as a way to offer products that will reduce their dependence on core deposits. On the other hand, foreign Internet banks rely more on generating deposits, consistent with overall results.

4.3. Asset Quality and Diversification

Asset quality indicators measure the changes in the bank's loan quality. The Internet banks show higher asset quality as compared to non-Internet banks (Table 5). Internet banks are having lower net Non Performing Assets (NPAs) to net advances as compared to non- Internet banks. Differences in the business strategies of Internet and non-Internet banks also are evident in Table 5. The second column shows the ratio of non-interest income to total income, which is a rough proxy for the amount of revenue generated by "nontraditional" activities. Internet banks generated a lower proportion of their income from non-traditional activities compared to non-Internet banks. However, the difference is not statistically significant. Internet banks in public sector particularly nationalized banks and banks in private sector particularly new private sector rely more heavily on non-traditional sources of income.

Table 5: Asset Quality and Diversification Statistics for Internet and Non-Internet Banks (1998-2006)

	Asset Quality (Net NPAs to Net Advances) (%)			Diversification (Non-Int Income/Total Income) (%)		
	Mean (N ₁)	Mean (N ₂)	"t"	Mean (N ₁)	Mean (N ₂)	"t"
All Banks (N ₁ =143) (N ₂ =596)	2.497	6.889	-9.64*** (.000)	18.747	18.902	-.19 (.848)
Public Sector (N ₁ =58) (N ₂ =187)	2.010	7.013	-9.70*** (.000)	15.985	14.249	2.81*** (.005)
SBI Group (N ₁ =17) (N ₂ =55)	2.136	5.920	-6.28*** (.000)	16.312	16.632	-.28 (.776)
Nationalized (N ₁ =41) (N ₂ =132)	1.957	7.468	-8.05*** (.000)	15.850	13.256	3.79*** (.000)
Private Sector (N ₁ =58) (N ₂ =180)	2.474	6.705	-9.91*** (.000)	19.163	15.254	3.89*** (.000)
New Private (N ₁ =35) (N ₂ =15)	1.899	4.238	-3.93*** (.000)	21.504	15.962	4.06*** (.000)
Old Private (N ₁ =23) (N ₂ =165)	3.349	6.929	-5.86*** (.000)	15.600	15.190	.27 (.786)
Foreign Banks (N ₁ =27) (N ₂ =229)	3.594	6.933	-2.22** (.031)	23.786	25.570	-.78 (.434)

Sources: Statistical Tables relating to banks available at www.rbi.org.in and various Issues of IBA Bulletin

N1 = No. of observations for Internet banks

N2 = No. of observations for non-Internet banks

*** = Significant at the 1 percent or better level; ** = significant at the 5 percent level; and * = significant at the 10 percent level

4.4. Cost of Operations

In addition to revenue enhancement, Internet banking may enable banks to reduce costs of operation, in particular, by allowing them to reduce expenditures on "brick and mortar." To the extent this may be so, Internet banking could be considered a

causal factor in generating lower expenses related to maintaining physical branches. On the other hand, banks with relatively high expenses in maintaining their branch networks may be expected to have the incentive to adopt Internet banking. The adoption of Internet banking would thus be the effect of existing characteristics of banks (Furst et al., 2002). The data in Table 6 shows that, consistent with the first hypothesis, overall Internet banks had lower expenses for building and equipment. While, nationalized Internet banks and Internet banks in private sector follow the second hypothesis. This difference may indicate that these banks with high costs of maintaining a branch network are motivated to adopt Internet banking by the prospect of future cost savings.

Table 6: Cost of Operations of Internet and Non-Internet Banks (1998-2006)

	Labour Cost (Salary exp/Employees) (Rs Crs)			Financing Cost (Cost of Funds =Interest expended/ Total Funds) (%)			Fixed Cost (Expenses on Fixed Assets/Fixed Asset) (%)		
	Mean (N ₁)	Mean (N ₂)	"t"	Mean (N ₁)	Mean (N ₂)	"t"	Mean (N ₁)	Mean (N ₂)	"t"
All Banks (N ₁ =143) (N ₂ =596)	0.0427	0.0461	-1.01 (.312)	5.153	8.003	-1.23 (.219)	106.04	155.79	-3.8*** (.001)
Public Sector (N ₁ =58) (N ₂ =187)	0.0324	0.0228	8.96*** (.000)	4.942	6.691	-11.29*** (.000)	98.926	93.409	.94 (.345)
SBI Group (N ₁ =17) (N ₂ =55)	0.0312	0.0211	6.77** (.000)	5.243	6.805	-4.84** (.000)	126.054	139.958	-1.47 (.146)
Nationalized (N ₁ =41) (N ₂ =132)	0.0329	0.0235	6.80*** (.000)	4.817	6.644	-10.54*** (.000)	87.678	74.014	2.35** (.021)
Private Sector (N ₁ =58) (N ₂ =180)	0.0339	0.0202	7.32*** (.000)	5.241	7.306	-8.04*** (.000)	78.716	64.238	2.82*** (.005)
New Private (N ₁ =35) (N ₂ =15)	0.0357	0.0198	3.62*** (.001)	5.048	7.773	-4.77*** (.000)	80.373	51.695	3.44*** (.001)
Old Private (N ₁ =23) (N ₂ =165)	0.0311	0.0202	6.87*** (.000)	5.534	7.264	-6.11*** (.000)	76.193	65.378	2.08** (.044)
Foreign Banks (N ₁ =27) (N ₂ =229)	0.0837	0.0853	-.18 (.855)	5.418	9.621	-.48 (.625)	180.009	278.689	-2.69*** (.008)

Sources: Statistical Tables relating to banks available at www.rbi.org.in and various Issues of IBA Bulletin

N1 = No. of observations for Internet banks

N2 = No. of observations for non-Internet banks

*** = Significant at the 1 percent or better level; ** = significant at the 5 percent level; and * = significant at the 10 percent level

Table 6 also shows that the Internet banks in public and private sector are generating higher labour cost. The results are expected as the Internet banks involve the higher salaries for computer professionals and other trained staff. The Internet banks enable themselves to lower the financing cost (low Interest paid on deposits and borrowings).

5. Multivariate Analysis

Although, the univariate analyses depict a tremendously higher performance by banks in the Internet group(s) relative to non Internet bank group, however, it is hard to make any conclusive statement on the actual impact of the Internet adoptions on firm performance without a multivariate analysis. Here a multivariate regression model is estimated to investigate whether there is a link between offering Internet banking and bank's performance and risk.

The focus of the investigation is to see if Internet banking has an effect on bank performance and risk. A dummy variable (INTERNET) was created that takes a value of 1 if the bank has adopted Internet banking activities; otherwise it takes a value of zero. The coefficient associated with this Internet Adoption dummy will indicate the possible association between the Internet adoption by banks and their overall performance. The other variables affecting the banks' performance have been developed from the available literature on determinants of banks' performance (e.g. Scholtens, 2000; Naceur, 2003; Camilleri, 2005; Demirgüç-Kunt and Huizinga, 1999; Athanasoglou et al., 2005; Shanmugam and Dass, 2004; Barth et al., 1997; Goddard et al., 2004; Alzaidanin, 2003; Hassan and Bashir, 2003; Claeys and Vennet, 2004; DeYoung and Rice, 2003; Buser et al., 1981; Bashir, 2000; Caprio and Summers, 1993; Stiglitz and Marilou, 1996; Short, 1979; Bourke, 1989; Molyneux and Thornton, 1992; Demirguc-Kunt and Huizinga, 2000 and many more) and literature on Internet banking performance (Furst et al., 2002a; Carlson et al., 2001; DeYoung, 2001c and 2005; Hasan et al., 2002; Delgado et al., 2004 and 2006; Hernando and Nieto, 2005; Sathye, 2005; DeYoung et al., 2006).

Return on Assets and Return on Equity are used as performance measures and Ratio of Net NPAs to net advances has been used as a measure of bank risk. In selecting potential factors associated with performance and risk, various bank characteristics are used as proxies for the banks' internal measures, e.g., size, capital, risk management and expenses management ratios and bank ownership dummies while macro-economic indicators are used to represent the external measures.

A linear equation, relating the performance measures to a variety of financial indicators is specified. Following model has been used to examine the relationship between the performance of banks and adoption of Internet banking after controlling the other variables affecting the performance and risk.

$$Y_{it} = c + \alpha * INTERNET_{it} + \sum \beta_j X_{it} + \epsilon_{it} \quad (1)$$

Where Y_{it} presents profitability and bank risk measures of bank i at time t , c is a constant term, the X_{it} are explanatory variables and ϵ_{it} is the disturbance term. The subscript i indexes bank level observations and the subscript t indexes time in years. INTERNET is a dummy variable equal to 1 for Internet banks and the

coefficient α provides the main static test. A statistically significant value for α indicates a financial performance gap between the Internet banks and the non-Internet banks at the means of the data. The coefficients are estimated by employing OLS regressions on a sample of all banks as well as samples of different categories of banks.

The explanatory variables with their labels and definitions that have been used to examine the relationship between the performance of banks and adoption of Internet banking are given in the Table 7

Table 7: Description of Variables Affecting the Bank Performance and Risk

Label	Name	Definitions
Dependent Variables		
Y ₁	ROA	The ratio of Average Net Profits to Average Assets
Y ₂	ROE	The ratio of Average Net Profits to Average Equity
Y ₃	NPA	The ratio of net NPAs to Net Advances
Independent Variables		
X ₁	INTERNET	Dummy for the banks who have adopted Internet banking
X ₂	SIZE	The natural log of the Total Assets.
X ₃	EQUITY	The ratio of Equity Capital to Total Assets
X ₄	LOANS	The ratio of Total Loans to Total Assets
X ₅	OPCOST	The ratio of Non-interest Expense to Net Operating Revenue Where, Net Operating Revenue = Net Interest Income + Non-interest income
X ₆	NIINCOME	The ratio of Non-interest income to total income
X ₇	NPA	The ratio of net NPAs to Net Advances
X ₈	DEMAND	The ratio of demand and saving deposits to total funds
X ₉	SPREAD	The ratio of Net Interest Margin to NOR Where, Net Interest Margin = Total Interest Income minus Interest Expense
X ₁₀	OWNPUB	Dummy for the Banks in Public sector
X ₁₁	OWNPVT	Dummy for the Banks in private sector.
X ₁₂	INF	The Annual Inflation Rate

5.2 Empirical Analysis

Tables 8, Table 9 and Table 10 presents the results of 24 ordinary least square regressions for all Indian banks, and separately for public sector (nationalized and SBI group), private sector (new and old private) and foreign banks. The data from the sample of 85 Indian banks are pooled for all nine years (1998-2006). As stated above, in addition to bank-level variables, the explanatory variables used include control variables like macroeconomic indicators. The estimation technique used is panel data methods. Tables 8 through Table 10 report the estimated coefficients of the panel regressions for ROA, ROE and NPA, respectively.

Table 8: Internet Adoption and Performance Correlates OLS Pooled Estimate of Active Internet Banks 1998-2006

Variables	Dependent Variable - ROA							
	All Banks	Public Sector Banks			Private Sector Banks			Foreign Banks
		All	Nationalized	SBI Group	All	New	Old	
	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)
Intercept	1.027** (.011)	2.65*** (.000)	3.16*** (.000)	-.387 (.500)	2.52*** (.000)	1.11 (.153)	2.94*** (.000)	.321 (.704)
SIZE	1.806E-02 (.648)	-3.459E-02 (.249)	-5.906E-02 (.316)	-1.771E-03 (.947)	-5.944E-02 (.151)	9.138E-02 (.158)	-8.477E-02* (.089)	6.202E-02 (.490)
EQUITY	1.623E-02*** (.000)	-2.336E-02** (.015)	-2.681E-02** (.017)	.170*** (.000)	3.700E-03 (.803)	5.070E-03 (.867)	-1.018E-02 (.560)	2.341E-02*** (.000)
LOANS	-5.347E-03 (.130)	1.956E-03 (.613)	1.842E-03 (.731)	5.415E-03 (.323)	3.369E-03 (.459)	5.884E-04 (.936)	5.221E-03 (.364)	-4.726E-03 (.467)
OPCOST	-2.932E-02*** (.000)	-2.901E-02*** (.000)	-3.061E-02*** (.000)	-1.150E-02*** (.007)	-2.712E-02*** (.000)	-2.583E-02*** (.000)	-2.892E-02*** (.000)	-3.107E-02*** (.000)
NIINCOME	3.145E-02*** (.000)	-8.785E-03 (.173)	-1.735E-02* (.051)	3.193E-02*** (.000)	-3.504E-03 (.614)	1.228E-02 (.427)	-8.487E-03 (.295)	3.771E-02*** (.000)
NPA	-5.957E-02*** (.000)	-1.096E-02** (.014)	-9.995E-02** (.045)	1.916E-02 (.225)	-7.187E-02*** (.000)	-.209*** (.000)	-6.502E-02*** (.000)	-6.881E-02*** (.000)
INTERNET	-.160 (.203)	-2.116E-02 (.754)	3.613E-02 (.679)	-3.538E-02 (.631)	-.203* (.079)	-.485** (.014)	-.243 (.113)	.444 (.300)
OWNPUB	.605*** (.000)							
OWNPVT	.497*** (.000)							
INF	.133*** (.000)	6.519E-02*** (.000)	5.871E-02** (.010)	4.507E-02*** (.021)	.100*** (.001)	.148*** (.005)	8.853E-02** (.011)	.163** (.048)
R-Squared	.552	.659	.682	.655	.513	.779	.498	.592
F-Statistics	89.77*** (.000)	57.02*** (.000)	44.02*** (.000)	14.95*** (.000)	30.16*** (.000)	18.06*** (.000)	22.21*** (.000)	44.74*** (.000)
Number	739	245	173	72	238	50	188	256

Note: *** = Significant at the 1 percent or better level; ** = significant at the 5 percent level; and * = significant at the 10 percent level

Table 9: Internet Adoption and Performance Correlates OLS Pooled Estimate of Active Internet Banks 1998-2006

Variables	Dependent Variable - ROE							
	All Banks	Public Sector Banks			Private Sector Banks			Foreign Banks
		All	Nationalized	SBI Group	All	New	Old	
	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)
Intercept	-8.033* (.052)	34.62*** (.000)	27.71*** (.007)	16.69 (.152)	56.20*** (.000)	18.45 (.220)	69.63*** (.000)	-16.15** (.013)
SIZE	1.22*** (.003)	-.529 (.280)	.398 (.678)	-.152 (.777)	-1.88** (.010)	.727 (.559)	-2.23*** (.009)	1.61** (.020)
EQUITY	4.507E-02 (.229)	-.876*** (.000)	-.738*** (.000)	-.575 (.293)	-1.22*** (.000)	-1.30** (.031)	-1.57*** (.000)	9.215E-02* (.058)
LOANS	2.268E-02 (.530)	7.037E-02 (.265)	8.493E-02 (.331)	9.140E-02 (.407)	-6.215E-03 (.938)	.113 (.433)	-3.513E-02 (.719)	5.143E-02 (.302)
OPCOST	-.112*** (.000)	-.327*** (.000)	-.335 (.000)	-.271*** (.002)	-.513*** (.000)	-.429*** (.000)	-.58*** (.000)	-4.330E-02** (.021)
NIINCOME	.241*** (.000)	.193* (.067)	-5.967E-02 (.678)	.653*** (.000)	5.471E-02 (.654)	.329 (.275)	-9.538E-02 (.488)	.277*** (.000)
NPA	-.307*** (.000)	-9.467E-02 (.193)	-.108 (.183)	.410 (.198)	-.802*** (.000)	-3.28*** (.000)	-.658*** (.002)	-.322*** (.000)
INTERNET	-.686 (.592)	-.703 (.524)	-.413 (.771)	-.682 (.646)	-.126 (.950)	-3.150 (.398)	-.993 (.703)	5.34 (.105)
OWNPUB	9.09*** (.000)							
OWNPVT	7.47*** (.000)							
INF	.968*** (.003)	.814*** (.005)	.681* (.065)	.777** (.048)	2.16*** (.000)	3.38*** (.001)	1.84*** (.002)	.592 (.348)
R-Squared	.305	.595	.588	.478	.488	.717	.508	.288
F-Statistics	31.97*** (.000)	43.30*** (.000)	29.22*** (.000)	7.21*** (.000)	27.26*** (.000)	12.99*** (.000)	23.11*** (.000)	12.51*** (.000)
Number	739	245	173	72	238	50	188	256

Note: *** = Significant at the 1 percent or better level; ** = significant at the 5 percent level; and * = significant at the 10 percent level

Table 10: Internet Adoption and Performance Correlates OLS Pooled Estimate of Active Internet Banks 1998-2006

Variables	Dependent Variable - NPA							
	All Banks	Public Sector Banks			Private Sector Banks			Foreign Banks
		All	Nationalized	SBI Group	All	New	Old	
	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)	Parameters (β)
Intercept	25.89*** (.000)	13.40 (.177)	-.650 (.964)	35.55*** (.000)	36.34*** (.000)	13.48*** (.002)	40.99*** (.000)	27.61*** (.000)
SIZE	-.503** (.042)	-.154 (.729)	.474 (.614)	-.777*** (.000)	-1.03*** (.000)	-3.668E-02 (.989)	-1.00*** (.000)	-.687 (.214)
EQUITY	.152*** (.000)	-.168 (.229)	-.111 (.530)	-.546*** (.008)	.181** (.024)	-7.863E-02 (.562)	.118 (.188)	.158*** (.000)
LOANS	-8.209E-02*** (.000)	-5.490E-02 (.331)	-4.066E-02 (.632)	-.126*** (.004)	-1.078E-02 (.666)	2.316E-02 (.450)	-7.349E-02** (.017)	-8.813E-02** (.022)
OPCOST	2.977E-02*** (.001)	.144*** (.000)	.162*** (.000)	.111*** (.000)	2.264E-02** (.044)	1.623E-02 (.234)	2.566E-02** (.050)	2.476E-02 (.104)
NIINCOME	-.282*** (.000)	-.210 (.217)	-3.443E-02 (.885)	-.567*** (.000)	-.409*** (.000)	-.219** (.022)	-.402*** (.000)	-.265*** (.000)
DEMAND	-4.229E-02** (.028)	1.377E-02 (.748)	-1.359E-02 (.799)	.133*** (.001)	-3.445E-02 (.183)	-3.529E-02 (.179)	-.133*** (.000)	-5.771E-02 (.101)
SPREAD	-.162*** (.000)	-.105 (.178)	-4.569E-02 (.646)	-.223** (.011)	-.260*** (.000)	-8.263E-02* (.055)	-.253*** (.000)	-.151*** (.000)
INTERNET	-1.82** (.019)	-2.58*** (.009)	-3.26** (.019)	-1.20** (.025)	-1.25** (.026)	-1.14 (.110)	-.255 (.723)	2.268 (.395)
OWNPUB	3.83*** (.000)							
OWNPVT	1.65** (.034)							
INF	-.131 (.505)	-.114 (.656)	-.106 (.766)	-.137 (.341)	-7.737E-02 (.604)	-.318* (.099)	-1.846E-02 (.910)	-.397 (.420)
R-Squared	.270	.300	.258	.850	.564	.593	.597	.268
F-Statistics	24.47*** (.000)	11.19*** (.000)	6.31*** (.000)	39.01*** (.000)	32.77*** (.000)	6.48*** (.000)	29.24*** (.000)	9.99*** (.000)
Number	739	245	173	72	238	50	188	256

Note: *** = Significant at the 1 percent or better level; ** = significant at the 5 percent level; and * = significant at the 10 percent level

The estimation results indicate no statistically significant relationship between INTERNET and performance measures in terms of ROA and ROE. The results are similar to the results of Sullivan (2000), Carlson et al. (2001), Furst et al. (2002a) and Sathye (2005). However, the INTERNET is showing some sort of negative and significant impact upon performance (in terms of ROA) in case of all private sector banks and its sub-category new private sector banks only. (Similar to DeYoung,

2001a, 2001b, 2001c and 2005; Delgado et al., 2004) Thus, Internet banking is having a negative impact on profitability of private sector banks. A notable result reveals that Internet banking affects positively the performance of foreign banks in terms of ROE at nearly 10 percent of level of significance.

On the other hand, the INTERNET is negatively and significantly associated with risk variable NPA. Hence, Internet banking has helped the banks in reducing the risk profile.

6. Conclusions

The present study is an attempt to present the present status of Internet banking in India and its implications for Indian banking industry. A survey of the bank websites during the period of June, 2007 reveals that only 57 percent of the commercial banks operating in India as on March end 2006 offer Internet banking. Using data on the financial performance, the present study also analyzed the performance of an Internet group in comparison to non-Internet banking group and impact of Internet banking on banks' performance and risk. A panel data of 85 banks (operating as on March end 2006) was taken for the period of 1998-2006.

The analysis indicates several significant differences in the profile of banks that offer Internet banking and banks that do not. Broadly speaking, on an average, Internet banks are larger, more profitable and are more operationally efficient than non-Internet banks. Internet banks have higher asset quality and are better managed to lower the expenses for building and equipment. In contrast to developed countries Internet banks in India rely substantially on deposits, the traditional source of financing.

Last, but not the least, attempt was made to see if there is any association between adoption of Internet banking and the banks' performance and risk. The evidence reveals no significant association between adoption of Internet banking by banks and their performance. However, Internet banking has a negative and significant impact on profitability of private sector banks particularly new private sector banks. Thus, adoption of Internet banking was a reason behind the lower profitability of these banks, as Internet banks in new private sector were operating with higher cost of operations, including fixed cost and labour cost, thus affecting negatively the profitability of these banks. On the other hand, internet banking has a negative and significant impact on risk, which shows that, the adoption of Internet banking has not increased the risk profile of banks.

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