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An empirical analysis of the off-balance sheet activities of Indian banks

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The paper traces the determinants of off-balance sheet activities in the Indian banking sector. Using data for the period 1996 to 2004, the paper finds that, not only regulatory factors, but also market forces, captured by banks-specific characteristics and macroeconomic conditions are at work in the diffusion pattern of OBS activities. From the regulatory standpoint, while capital adequacy is dominant in case of public sector banks, non-performing assets seem to a prime concern for foreign banks, in addition to the public sector banks. Among others, at the bank-specific level, size is an important consideration for public sector and foreign banks, while profits are a prime mover only for new private banks. Finally, the macroeconomic environment seems to have played an important role in affecting OBS diffusion, more so for public sector and new private banks.

JEL Classification: C33, G21

Key words: Off-balance sheet, regulatory pressure, interest spread, India

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1. Introduction

The world of finance, throughout its history has typified the well-known adage 'nothing is permanent, except change'. The last three decades in particular have been witness to fundamental, one may even say cataclysmic, upheavals in financial innovations. As Santemero and Trester (1998) have observed, the financial sector is increasingly viewed as critical to enhancing economic growth.

An important dimension of this financial innovations process has been an upsurge in off-balance sheet (OBS) activities of banks[2]. Such activities, though not entirely new from a historical perspective, have expanded considerably in range and scope in recent years. Several empirical studies pertaining to OBS activities are available in the U.S. context, where the phenomenon seems to be most widespread (Jagtiani *et al*., 1995a, b). However, OBS activities have also registered a significant presence in European banking and, to a lesser extent, in banking systems of Asian economies (Fung and Cheng, 2004).

Despite the emerging literature in this area for developed banking markets, limited evidence seems to have been forthcoming for emerging markets. The paper attempts to bridge this gap in the literature by focusing on Indian banking sector as a case study. We focus on India for three main reasons. First, with the dismantling of the erstwhile administered rate regime, market risks have come to the fore in business decisions of corporates and financial institutions. More specifically, with growing integration of the Indian forex market with its global counterparts, and simultaneously with banks being allowed to create liabilities and assets in multi-currencies, foreign exchange risks have become prominent. Accordingly, instruments that allow for hedging of such risks have also gained in popularity. Second, given the growing competition and the pressure on their bottomlines, banks have increasingly made forays into newer domains of operation in order to augment their fee income and as a consequence, OBS business has gained in prominence. Finally and most importantly, over the past several years, significant policy initiatives have been undertaken by the authorities which have provided a boost

[2]Broadly speaking, OBS products comprise of four categories *viz*., (i) swap and hedging transactions (ii) bank guarantees (iii) loan commitments and (iv) investment banking activities.

for banks to engage in OBS activities.[3] In view of this slew of developments, OBS activity by commercial banks increased significantly. These developments make the Indian banking sector an ideal ground for empirically exploring the factors influencing OBS activities.

The remainder of the paper is organized as follows. In Section 2, we provide a brief survey of the relevant literature and explain the position of the present paper in this context. Subsequently, the framework of the empirical analysis is presented. A basic equation is postulated, which models OBS items as financial innovations subject to a *logistic diffusion* pattern. The variables which may affect the diffusion of OBS activities such as bank characteristics, regulatory factors and macroeconomic variables are also discussed. The data sources are explained in section 4, while section 5 discusses the empirical results. The concluding remarks are gathered in the final section.

2. Existing Literature

It is postulated that while OBS activities generate fee income for banks, they also potentially increase bank risk (Koppenhaver and Stover, 1991; Avery and Berger, 1991a). One popular hypothesis for the dramatic growth of bank OBS activities has been that banks may have used them as a means of augmenting earnings to offset reduced spreads on traditional on-balance sheet corporate lending business. Furthermore, the incentives to increase OBS risk may have been exacerbated by a flat-rate deposit insurance premium and capital requirements that did not take into OBS activities and risks.

There have been a number of studies that have examined the key motivations underpinning OBS activities of banks; however, the results have been mixed. One group of studies has investigated whether banks engage in OBS activities in order to reduce 'regulatory

[3]Salient policy initiatives that have been undertaken over the last several years and which provided impetus to the development of the derivatives market include the following. First, the Reserve Bank has imparted flexibility to asset-liability managers by introducing Forward Rate Agreements (FRAs) and Interest Rate Swaps (IRS) as risk mitigation strategies. Second, following the recommendations of the L.C.Gupta Committee, the Government has amended the *Securities Contract Regulation Act*, 1956 and recognized derivatives as securities. The amended definition is broad and covers securitisation instruments also. Third, in June 2000, both the Mumbai Stock Exchange and the National Stock Exchange have introduced Stock Index Futures. Effective March 1, 2000, the Government has lifted the ban on forward rate contracts and cleared the way for forward contracts in debt securities. This is the basis for index based futures in the debt market. A major bottleneck in the development of the derivatives market had been the absence of a reliable structure of benchmark interest rates, for different maturities. With a view to fill this gap, National Stock Exchange decided to experiment with the idea of ascertaining the expectations of major market participants in arriving at indicative benchmark rates. Based on a daily poll of over 25 market participants, NSE started disseminating since 1998 its overnight money market rates called NSE Mumbai Inter-bank Bid and Offer (MIBOR/MIBID) rates. These rates have since gained wide acceptance in the market. Subsequently, the Report of the Working Group on Rupee Derivatives recommended, *inter alia*, introduction of exchange-traded derivatives to supplement the OTC derivatives. It recommended four types of contracts for trading: (a) short-term MIBOR futures contract, (b) MIFOR futures contract based on 6-month LIBOR and Rupee-Dollar 6-month forward rate, (c) bond futures contract and (d) long-term bond index futures contract.

taxes'. Jagtiani (1995a) and Pavel and Philis (1987) find that banks with binding capital constraints are more likely to engage in swaps and loan securitization than banks with excess capital. These results are also consistent with Baer and Pavel (1987) who find that banks engage in loan securitization and standby letters of credit (SLCs) to avoid reserve requirements and deposit insurance premiums. However, these empirical findings are not consistent with those of Benveniste and Berger (1987) and Koppenhaver (1989), who find that binding capital constraints are not a significant factor in a bank's decision to engage in SLCs and other OBS guarantees.

A second group of studies has examined the relationship between bank OBS activities and risk. Thus, Avery and Berger (1991b) find that better-performing banks tend to issue more OBS commitments – a finding that is inconsistent with the capital avoidance hypothesis which suggests that banks with low capital (i.e., binding minimum capital constraints) are more likely to engage in OBS activities.

In a much-discussed contribution, Jagtiani *et al*. (1995) view OBS products as financial innovations subject to 'autonomous' *logistic diffusion* process. While each of these hypotheses has considerable intellectual appeal, it is doubtful whether any of them in isolation can explain such a complex phenomenon as OBS banking. Hence, attention has been devoted in recent years towards pursuing an eclectic approach, letting the data 'speak for itself' *via* a suitable econometric model.

This paper extends the work of Jagtiani *et al*. (1995) in several respects. First, the focus is on the determinants of diffusion pattern of OBS activities of banks in India. Second, a bank-level panel data is constructed and panel data estimation techniques are used. The third extension is that the empirical analysis considers not only bank-specific features, but also macroeconomic conditions and regulatory features as determinants of OBS diffusion. Moreover, the actual speed of diffusion of OBS activities for each bank group has also been estimated.

Even though the literature on OBS activities is extensive, empirical research with respect to Indian banks is scarce. In one of the earliest studies, Nachane and Ghosh (2002) observed that higher levels of capital and liquid assets lowered the incentive of banks to engage in OBS activities. However, the paper considered a limited time span and importantly, it confined itself only to public sector banks, which limited the empirical appeal of the model.

The purpose of this paper is to fill this void by empirically investigating OBS activities of the banking sector in India, both over a longer time span and across the banking system in its entirety. Empirical evidence and knowledge of the diffusion pattern of OBS activities in India is important for several reasons. First, prudential regulators need to be aware of the determinants of

OBS diffusion. Second, financial innovations, such as OBS activities, and their regulation affect the costs and scope of financial intermediation and therefore, the process of monetary policy transmission (Bernanke, 1986). Considering the fact that the most of the studies on OBS activities are confined to the OECD group of countries, a systematic investigation of these aspects in the context of emerging markets has been a long felt need. It is expected that the study will go some way towards addressing this deficiency.

3. Data Sources

The published sources of data in emerging markets rarely encompass bank-specific statistics in sufficient depth to enable a satisfactory panel data analysis. A considerable part of the effort was, therefore, devoted to the construction of a bank-level panel database from the balance sheets of individual banks. Such a database enables not only an identification of the determinants of OBS activities, but also an examination of the differing diffusion patterns of OBS items across the three major categories of banks in India.

The data for the study was primarily sourced from two annual RBI publications, the *Statistical Tables relating to Banks in India* and the *Report on Trend and Progress of Banking in India,* supplemented with information from the *Performance Highlights of Banks*, an yearly publication of Indian Banks' Association, the self-regulatory body of Indian banks. The former database provides bank-wise information on balance sheets and profit and loss accounts of commercial banks in India whereas the latter provides information about bank-wise prudential ratios like capital adequacy and non-performing loans. The choice of the sample banks proceeded in three steps. First, as a starting point, we chose all commercial banks over the sample period beginning 1996 through 2004.[4] This gave us a total of 90 banks over the sample period. In the second step, in view of the fact that the OBS activities of old private banks are negligible in magnitude *vis-à-vis* their new private/foreign counterparts, this category of banks were excluded from the analysis. In the third and final step, we deleted the 'outlier' foreign banks (those with exceedingly high capital adequacy ratio and/or single bank branches) and foreign banks which were not in existence over the entire sample period, (probably owing to the extensive mergers/acquisitions activity prevailing in this segment internationally). Accordingly, the final sample comprised of a balanced panel of 60 commercial banks over the sample period with 27 public sector banks, 8 new private banks and 25 foreign banks together accounting for about 90 % of the total assets of the Indian banking sector.

4. Methodology

As mentioned earlier, the present study adopts an eclectic approach. The variables selected as likely determinants of OBS activities fall into four broad categories: (a) autonomous diffusion, (b) bank-specific characteristics, (c) regulatory factors and (d) macroeconomic conditions

For the purpose of our analysis, we adopt the logistic diffusion model. Such a diffusion model has been employed by Jagtiani *et al*. (1995a) and has also been employed in other areas of financial innovation (Hannan and McDowell, 1987 for instance, studied the adoption of ATMs using this methodology). The underlying hypothesis of the logistic innovation model takes the form of equation (1) below.

$$m_{t+1} - m_t = \beta\,(n - m_t)\,m_t/n \quad (\beta>0) \tag{1}$$

Here m_t is the number of firms that have already adopted the innovation at time t and n is the total number of firms in the industry. The framework assumes that the number of banks that adopt an innovation between time t and t+1, is proportionate to the product of the number of non-adopting banks at time t and the *proportion* of banks that have already adopted the innovation at time t. The constant of proportion (β) represents the *speed of adoption* and depends on several factors such as the characteristics of the innovation and the features of banks in the industry.

If the period t to t+1 is small, the solution of the differential equation (1) can be written as (2) below.

$$P_t = m_t / n = 1/[1 + \exp(-\alpha - \beta t)] \tag{2}$$

where α is the constant of integration.

The equation represents the well-known logistic curve, which predicts that the proportion of the population having adopted the innovation will increase at an accelerating rate until 50 % adoption (half of the population) is attained at time $-(\alpha/\beta)$. Thereafter, adoption increases at a decelerating rate, and 100 % adoption is reached asymptotically. This logistic prediction of innovation adoption has been justified on imitative and bandwagon behaviour.

Given an appropriate transformation, the panel structure of the data yields the basic equation to estimate:

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[4] The starting point of the sample coincides with two important developments. First, the new private banks which were licensed post-reforms, became operational from this year onwards. Second, this was also the year the Reserve Bank of India, began publishing bank-wise prudential ratios.

$$Ln\left(\frac{P_{it}}{1-P_{it}}\right)=\alpha_i+\beta t+\xi_{it} \qquad (3)$$

In equation (3), P_{it} is defined as the amount of OBS items divided by the amount of total assets (total of on-balance sheet *plus* OBS items) of bank i at time t. The main argument for this step, also made by Jagtiani *et al*. (1995) is that it enables to take into account the scale on which banks introduce OBS items. The model we employ in the paper is an extension of (3) to incorporate the effects of regulatory factors.

Depending on the features of the unobservable bank-specific effect α_i, a two-way typology of error component regression models can be distinguished. In the fixed effects model (FEM), α_i is a separate constant term for each bank: $\alpha_i=\alpha_1 d_1+\alpha_2 d_2+\ldots+\alpha_j d_j$, with the d_j's being bank-specific dummy variables. In the random effects model (REM), α_i is a bank-specific disturbance: $\alpha_i=\alpha+u_i$ where $E(u_i)=0$ and $V(u_i)=\sigma^2$ and Cov (ξ_{it}, u_i)=0. Thus, FEM treats the α_i's as constants and the REM as mutually independent random variables that are independent of the error term. The question of whether the effect is fixed or random is statistically determined using the Hausman specification test.

In line with our eclectic approach, the study identifies, in the Indian context, several potential determinants of OBS activities based on the both the existing theoretical literature as well as those emanating from policy discussions (see endnote 2). The econometric model employed was specified to account for the relative importance of the aforesaid factors. Accordingly, the following modification of (3) was proposed:

$$LGTOBS_{it}=\ln\left[\frac{P_{it}}{1-P_{it}}\right]=\alpha_i+\beta t+\gamma X_{it}+\delta Y_t+\varepsilon_{it} \qquad \textbf{(4)}$$

where, i = 1,2,…,N denotes the number of banks and t = 1,2,…,T is the number of years and P_{it} is as described earlier. Following Jagtiani *et al*. (1995a), the dependent variable $LGTOBS_{it}$ is a logistic transformation of P_{it}. Let us refer to the model represented by (4) as Model I. The anlysis for this model could be done at the aggregate level (without distinguishing different categories of banks) or at the disaggregated level in which bank categories are distinguished using dummy variables DUMMY1 (for public sector banks) and DUMMY2 (for foreign banks). Needless to say the dummy coefficients have to be interpreted relative to the omitted variable (private banks). The latter results for Model I are reported in Table 3.

We also introduce a variant of (4), in which we allow the speed of diffusion to vary across bank categories, by introducing two dummy variables D1 and D2 to correspond respectively, to the categories of private sector and foreign banks. (The omitted dummy pertains to public sector

banks, where we thought the speed of diffusion could be slowest). This model is as described in (5) below and may be referred to as Model II.

$$LGTOBS_{it} = \ln\left[\frac{P_{it}}{1-P_{it}}\right] = \alpha_i + \sum_{k=1}^{2} \beta_k D_k t + \gamma X_{it} + \delta Y_t + \varepsilon_{it} \qquad (5)$$

The results for Model II are reported in reported in Table 4 .

The explanatory variables correspond to the three categories listed in Section 1.

(i) The time trend t accounts for the autonomous diffusion,

(ii) Y_t is a vector of general macroeconomic conditions,

(iii) X_{it} is a vector of bank-specific characteristics (classified into regulatory and non-regulatory variables),

(iv) The intercept α is a bank-specific constant, intended to capture bank-specific fixed effects.

The explanatory variables, their definitions and economic rationale are summarised in Table 1. A brief discussion of these points may, however, be in order.

The coefficient β on the time trend is intended to capture the autonomous speed of diffusion and depends on factors such as financial technology, learning, preferences and 'financial literacy' in general. The adoption of OBS items is more rapid, the larger the β.

4.1 Bank-specific factors

(i) The expected impact of *bank size* on OBS activities is ambiguous. On the one hand, a bank needs to be of a certain threshold size, before it can realize the scale and scope economies associated with OBS activities. Additionally, only large banks may be able to command the specialized management skills needed for handling OBS products. Large and sophisticated clients, who are most likely to demand OBS products, may also favour large banks on grounds of their perceived safety (the 'too-big-to-fail' syndrome). But it may be equally true, on the other hand, that large banks are more risk-diversified with less incentives to use OBS products.

(ii) The *loan ratio* (ratio of loans to total assets), tends to be directly related to OBS activities. A higher loan ratio increases interest rate risks, creating inducements for hedging *via* OBS products (Angbazo, 1997). There is an additional reason for the positive association between the loan ratio and OBS activities. In the process of sanctioning loans, banks get access to proprietary information on their loan customers, thereby facilitating the offer of relevant OBS risk management tools by banks to such customers.

(iii) An important role in attracting OBS activities is played by a bank's *creditworthiness.* In view of the difficulties in quantifying this concept, *profitability* (since it impinges favourably on *creditworthiness*), could stand in as a useful proxy. We expect *profitability* to positively affect the scale of OBS activities

4.2 Regulatory factors

In line with the analysis of Jacques and Nigro (1997), we introduce the concept of regulatory pressure both with regard to capital adequacy and non-performing assets (NPAs). As regards net NPAs to net advances ratio (NNPA), the Union Budget for 1998-99 provided certain functional autonomy to banks with regard to their personnel management policies. An important component of the autonomy process applied only to banks having a NNPA ratio not exceeding 9 %, which we adopt as the benchmark for computing regulatory pressure for NPAs. Specifically, the regulatory pressure variable is defined as the *difference between the inverse of the bank's actual NNPA and the inverse of the benchmark ratio of 9 %.* Because banks with NNPA above and below the 9 % stipulation may react differently, the study partitioned regulatory pressure into two variables: NPAH and NPAL.

NPAH = max {0, (1/9-1/NNPA)}

NPAL = max {0, (1/NNPA-1/9)}

NPAH applies to all banks with high NNPA (greater than 9 %). In their attempt to 'gamble for resurrection' by cutting back on loan portfolio (which attracts a risk weight), these banks might be tempted to indulge in greater OBS activity (which does not attract risk weights), giving rise to a positive relation between NPAH and OBS activity. Banks with low NNPAs might be under less pressure to engage in OBS activities but their capacity to indulge in OBS activities could be greater in view of their higher credit worthiness and hence the direction of relation between NPAL and OBS activities is uncertain.

The capital adequacy ratio (CAR) affects the diffusion pattern of OBS items in two opposite directions. On the one hand, OBS activities are expected to be larger for banks with a high capital adequacy ratio, since they are considered most creditworthy. Alternately, a high capital adequacy ratio reduces banks' marginal gain from increasing the risk in the asset portfolio (Furlong and Keeley, 1989). As bank capital increases, the ability to assume risks increases[5], but

[5]The evidence on this point is by no means unequivocal. In a series of papers, Kim and Santomero (1988) and Koehn and Santomero (1980) have shown that increasing regulatory capital standards may have the effect of causing utility (shareholder value) maximizing banks to increase portfolio risk. Under these conditions, changes in capital and portfolio risk would be positively correlated. More recently, Jeitschko and Jeung (2005) derive the conditions under which bank risk and capitalization would be related by incorporating the incentives of three sets of agents: deposit insurer, shareholder and the manager. In order to address the ambiguity of the relation between capital and bank risk

the need for OBS products to hedge risk exposure may decrease. Accordingly, the second set of regulatory pressure variables is defined in respect of capital adequacy. In particular, the focus is on the response of banks to the 8% risk-based capital standards.[6] In this case, we introduce analogous ratios CARL and CARH to signal the degree of regulatory pressure for low-capitalized (less than 8% CAR) and adequately capitalized (in excess of 8% CAR) banks respectively. High regulatory pressure with respect to capital implies low creditworthiness and can be expected to translate into lower OBS activity. On the other hand, low regulatory pressure, as implied by CARH, signifies comfortable capital position and (accompanied with a high credit rating) makes a bank an active supplier of OBS products (Koppenhaver and Stover, 1991). Alternately, low regulatory pressure also reduces the marginal bank of the bank from increasing the risk in its asset portfolio (Furlong and Keeley, 1989) and therefore, can be expected to act as a moderating influence on OBS activity. Thus the impact of CARH on OBS activity could go either way.

4.3 Macroeconomic factors

Two macroeconomic variables are considered in the empirical analysis: the growth rate g of real Gross Domestic Product (GDP) and the difference between the long and the short-term interest rate[7], termed as interest spread (INTSPRD). Real GDP growth captures the effects triggered by fluctuations in general economic activity. The demand for OBS products reacts positively to the stage of the business cycle due to a transactions motive. But obversely, it could also be argued that business risk decreases in periods of real growth, leading to less demand for risk management techniques.

A high and positive INTSPRD signals both, a high degree of uncertainty about future interest rates and that short-term interest rates are expected to rise in the future. High interest rate risk and future interest rate rises imply a relatively high demand for OBS products. On the other hand, the spread also measures the substitution between OBS activities and traditional banking activities, i.e., between short-term funding and long-term lending. Periods with high and positive spreads thus favour traditional *on-balance sheet activities* and in such periods, bank managers will be less focused on earning profits with OBS activities.

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taking, following Jacques and Nigro (1997), we classify banks as those subject to high and low regulatory pressure with respect to capital.

[6] Upto end-March 1999, scheduled commercial banks had to comply with a stipulated CAR of 8 %. This ratio has been raised to 9 % effective April 1, 2000.

[7]The long-term interest rate is proxied as the weighted average interest rate on 10-year Government paper, the weights being equal to the face value of bids received. The short-term interest rate is proxied as the weighted average on 91-day Treasury Bills, the weights being equal to the face value of the bids received.

5. Results and Discussion

Table 2 lists the bank-group wise characteristics of the variables mentioned earlier in the study. Three major features emerge from an examination of different bank groups. First, OBS activity, on average, tends to be the highest for foreign banks, followed by new private and public sector banks. Secondly, public sector banks are dominant in terms of size, although the loan portfolio is the highest for new private banks, with pronounced variability. Foreign banks are smallest in terms of size but display the highest variability, with respect to this variable. Thirdly, foreign banks, registered the highest profits, and also showed high CARs, with marked variability evident in both; their CARs, though highest on average, also exhibited the greatest variability.

So far as Model I is concerned (Table 3), we find that firstly, the trend variable was found to be positive and significant at conventional levels across all bank groups, its magnitude being the highest for the foreign bank group. This suggests that the diffusion of OBS activities has been particularly rapid for this bank group, and in terms of magnitude, the lowest for public sector banks.

At the bank-specific level, bank size has a significantly negative impact in public sector and foreign banks, attesting to lack of economies of scale with respect to OBS activities. Second, significant informational diseconomies of scope between loans and OBS activity exist, especially for the new private and foreign bank groups. Finally, the profitability variable is significant for public sector and new private banks, attesting to the fact that higher OBS activity for these bank groups is derived more from profitability considerations than for foreign bank group.

Among the regulatory variables, the coefficients found for the capital adequacy ratio indicate that capital constrained banks (CARH), especially those which are public sector, assume greater OBS risk and have an incentive to supply a larger volume of OBS items. On the other hand, new private and foreign banks with limited capital constraint are induced to supply a larger volume of OBS items. Likewise, banks with low NNPA, especially the public sector and foreign banks, were found to have a positive effect on OBS diffusion. On the other hand, new private banks with high regulatory pressure with respect to NNPA tend to have limited effect on OBS diffusion.

Finally, both macro variables considered contributed significantly to the OBS diffusion pattern. Higher real GDP growth does not necessarily imply increasing OBS activity, at least for public sector and new private banks. This might be attributed to the fact that an upturn in economic activity lowers business risk and there is an incentive to supply a smaller volume of OBS items. On the other hand, the term INTSPRD has a negative and significant impact on OBS

diffusion for public sector banks, suggesting substitution between traditional (on-balance sheet) bank activities and OBS activities.

The fit of the estimated equations seems to be good: the model explains anywhere between 69-81 % of the variance of the dependent variable. We also analyze the random effects model under the assumption of no bank-specific effect. The Chi-Square statistic convincingly rejects the null hypothesis, suggesting that the fixed effects setup is quite apt in the present context.

In order to allow for the possibility that OBS diffusion differs across different bank type, we also estimate the base model, after incorporating dummies for new private and foreign bank groups. Given that the supply of OBS items is the lowest for public sector banks, this bank group is taken as the omitted category. The results of the analysis, presented in Table 4, broadly lend support to the earlier analysis of bank-specific analysis. As in the earlier case, the coefficient on the profit variable is insignificant, whereas size is found to exert a negative (and significant) effect on OBS diffusion. Informational diseconomies exist between loans and OBS diffusion as evidenced from the (negative) sign of the loan ratio. Not surprisingly, the macroeconomic variables, GDP and INTSPRD are also significant in the present analysis. This would seem to suggest that while these variables might be exerting a certain degree of influence on bank groups (*viz*., public sector and new private banks), as regards their OBS diffusion, even at the aggregate level, such influences turn out to be quite significant. Finally, both the dummy variables are positive and significant at conventional levels, suggesting that the effect of OBS diffusion has been significant for both these groups of banks. The sign on these coefficients indicate that relative to the public sector banks, OBS activity of the other two bank groups have been higher, particularly for the foreign bank segment. All in all, the results suggest that OBS activity has gained prominence in the Indian banking sector and, in turn, is a function of not only bank-specific and regulatory factors, but also conditioned by the overall macroeconomic environment.

6. Concluding Remarks

The empirical research reported in the literature has almost exclusively documented evidence on OBS diffusion in the US. The present study fills the existing gap in the literature regarding empirical evidence and knowledge of OBS activity in India.

In summary, the estimation results show that bank-specific factors, regulatory factors and general macroeconomic conditions-all significantly affect the diffusion process of OBS items in India. In public sector and foreign banks, bank size seems to impose constraints on engaging in OBS products. The evidence shows significant diseconomies of scope between aggregated OBS

items and loans in the new private and foreign bank groups. The hypothesis that bank profitability (as a proxy for creditworthiness) is conducive to OBS activity is rejected in case of foreign banks. Regulatory factors seem to be an important consideration influencing OBS activity. Finally, the empirical results show that for the public sector banks, real GDP growth is a crucial variable, whereas the term spread affects OBS activities for public sector and new private banks.

The empirical findings imply that not only regulation, but also market forces, captured by bank-specific characteristics and macroeconomic conditions are at work in the diffusion pattern of OBS activities in India. From the policy angle, the study shows that different sets of bank-specific, regulatory and macroeconomic factors are influential in affecting OBS diffusion. From the regulatory standpoint, while high regulatory pressure in respect of capital is dominant in case of public sector banks, non-performing assets seem to a prime concern across all bank groups. Among others, at the bank-specific level, size is an important consideration for all bank groups, while profits are a prime mover for public and new private banks. Finally, the macroeconomic environment seems to have played an important role in affecting OBS diffusion, more so for public sector and new private banks.

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Table 1: Variables in the Empirical Model

Variable	Expected sign	Economic Rationale
TIME	+	Time↑⇒OBS technology diffusion↑⇒OBS↑
I. *Bank-specific Variables*		
SIZE	+/-	Size ↑⇒ Scale economies↑⇒OBS↑ Size ↑⇒ Bank Risk↓⇒OBS↓
Loan ratio (LRATIO)	+	LOAN↑⇒Scope Economies and Risk↑ ⇒OBS↑
Profitability (PROFIT)	+	PROFIT↑ ⇒Creditworthiness↑⇒OBS↑
II. *Regulatory Variables*		
CARL	+/-	CARL↑⇒ Creditworthiness↑⇒OBS↑ CARL↑⇒Risk-taking capacity↑⇒OBS↓
CARH	-	CARH↑⇒ Creditworthiness↓⇒OBS↓
NPAL	+	NNPA↓⇒Creditworthiness↑⇒OBS↑
NPAH	+	NNPA↑⇒Gamble for Resurrection↑⇒OBS↑
III. *Macro-economic Variables*		
g	+/-	GDP↑⇒Economic Activity↑⇒OBS↑ GDP↑⇒Business Risk↓⇒OBS↓
INTSPRD	+/-	INTSPRD ↑⇒Uncertainty about interest rates↑⇒OBS↑ INTSPRD ↑⇒Traditional Banking ↑⇒OBS↓

Note: The variables are defined as follows:
SIZE = Ln (Total Asset);
LRATIO = (Loans/Total Assets)* 100;
PROFIT = (Net Profit/Total Assets)*100 ;
g = GDP growth rate
CARH = max {0, (1/8-1/CAR)}, where CAR is capital adequacy ratio of a bank
CARL = max {0, (1/CAR -1/8)}
NPAH = max {0, (1/9-1/NNPA)}, where
NNPA = [Net non-performing loans/Total net loans]
NPAL = max {0, (1/NNPA-1/9)}
INTSPRD = interest rate spread between long-term and short-term interest rate (see Endnote 7)

Table 2: Summary Statistics for Bank Groups: 1995-96 to 2002-03

Variable	Mean			Standard Deviation			Maximum			Minimum		
	Public	New Pvt	Foreign	Public	New Pvt.	Foreign	Public	New Pvt	Foreign	Public	New Pvt	Foreign
LGTOBS	0.249	0.828	4.287	0.130	0.634	5.191	0.774	2.939	0.002	0.025	0.121	48.430
SIZE	4.331	3.695	3.041	0.374	0.533	0.693	5.610	5.098	4.536	3.494	2.108	1.484
LRATIO	40.978	43.242	39.28	5.536	8.802	17.53	55.637	62.686	92.372	22.331	28.644	0.185
PROFIT	0.562	0.849	0.932	0.973	1.797	3.972	1.761	2.862	37.659	-7.511	-11.27	-25.41
CAR	10.725	15.386	22.09	4.354	19.09	26.69	20.120	22.380	44.340	-18.81	1.45	7.12
NNPA	7.370	3.258	5.762	4.292	4.230	9.320	26.010	27.990	61.410	0.001	0.001	0.001

For definitions of the variables occurring in the first column, see Notes to Table 1

Table 3: Empirical Estimation of OBS Activity for Banks (Model I)
(Bank Group –wise Analysis)

Variable/ Bank Group	Public sector	New Private	Foreign
Trend	0.012 ***	0.021***	0.218 **
	(0.003)	(0.005)	(0.103)
Bank-specific Variables			
SIZE	-0.080*	-0.356*	-0.458***
	(0.048)	(0.211)	(0.109)
LRATIO	0.007	-0.026***	-1.056**
	(0.005)	(0.008)	(0.434)
PROFIT	0.019***	0.128***	0.101
	(0.008)	(0.071)	(0.086)
Regulatory Variables			
CARL	0.186	-8.379**	-32.623*
	(0.518)	(3.973)	(19.262)
CARH	0.044***	0.004	4.991
	(0.012)	(0.006)	(9.352)
NPAL	-0.006***	-0.0007	-0.002**
	(0.002)	(0.0009)	(0.001)
NPAH	0.008	-0.155**	0.005
	(0.039)	(0.075)	(0.160)
Macroeconomic Variables			
G	-0.003***	-0.041**	0.356
	(0.001)	(0.023)	(0.212)
INTSPRD	-0.005***	-0.054	0.038
	(0.001)	(0.068)	(0.235)
Adjusted R^2	0.685	0.786	0.811
Number of banks	27	8	23
Number of observations	243	72	203
Hausman Test (p-value)	0.008	0.005	0.004

***, ** and * indicate significance at 1, 5 and 10 %, respectively.
Figures in brackets indicate standard errors.

Table 4: Empirical Estimation of OBS Activity for Banks (Model II)

Variable/ Bank Group	Coefficients
Trend	0.156 ***
	(0.070)
Bank-specific Variables	
SIZE	-0.365***
	(0.041)
LRATIO	-0.032**
	(0.014)
PROFIT	0.088
	(0.058)
Regulatory Variables	
CARL	23.688***
	(8.138)
CARH	-0.017
	(0.023)
NPAL	-0.008***
	(0.001)
NPAH	0.069
	(0.096)
Macroeconomic Variables	
g	0.154*
	(0.091)
INTSPRD	-0.020**
	(0.009)
D1 (dummy variable)	0.511***
(New private banks=1)	(0.196)
D2 (dummy variable)	3.804***
(Foreign banks=1)	(1.036)
Adjusted R^2	0.557
No. of banks	58
No. of Observations	518
Hausman test (p-Value)	0.006

***, ** and * indicate significance at 1, 5 and 10 %, respectively.
Figures in brackets indicate standard errors.