Derivative use and its impact on Systematic Risk of Indian Banks: Evidence using Tobit model

Sinha, Pankaj and Sharma, Sakshi

Faculty of Management Studies, University of Delhi, Faculty of Management Studies, University of Delhi

8 March 2016

Derivative use and its impact on Systematic Risk of Indian Banks: Evidence using Tobit model

Pankaj Sinha, Sakshi Sharma

Faculty of Management Studies, University of Delhi

Abstract

The use of derivatives by Indian banks has increased in the recent past. Derivatives are complicated assets, and many characteristics of these relatively new assets have been evolving day by day. The fast growth of bank involvement in derivative markets has raised concerns about the potential hazards of this activity. On the flipside, certain characteristics of derivatives make them highly useful in hedging risks. It is a well-known fact that derivative activity is concentrated among relatively larger banks. However, very little is known about other factors that govern the decisions regarding derivative usage by banks. In theory, an exposure of bank to interest rate risk should impact the derivative transaction volume. Furthermore, the use of derivative will vary according to bank capital, bank size and its use of alternatives to hedge. The paper uses the financial characteristics of banks those trade in derivatives and banks those do not trade in derivatives , by using bank level data for 46 Indian Scheduled Commercial banks for the year 2013. A Tobit Model is used to analyse censored data on notional amount of derivative use and its relationship with various financial characteristics of banks. These financial characteristics include bank size, capital adequacy, exposure to credit and interest rate risk, profitability and liquidity. We find that derivative user banks have higher liquidity, lower interest margins, are larger. Additionally, there is evidence in support of the "assurance" capital hypothesis highlighting the use of derivatives by large well capitalised banks. The larger banks exposed with lower interest margins and higher capital ratios are more likely to use derivatives to hedge their interest rate risk. Using an augmented market model, we further calculate systematic risk exposure of banks for the year 2013 and test whether usage of derivatives and interest rate derivatives contribute towards an aggravation in the systematic risk exposure of banks. The results point towards a significant decrease in exchange rate riskiness using derivatives as well as a significant decline in the long term interest risk as well. It implies and motivates banks to indulge in derivative trading, as the systemic risk do not seem to be potentially aggravated by using

them. Nevertheless, derivative activity is be concentrated among well capitalised banks which can safely manage risks.

Keywords: derivatives , systematic risk, hedging, exchange rate exposure, interest rate risk

1. Introduction

Banks often need a way to manage interest rate risk without additional capital on their balance sheet. Financial derivatives seem to be a relatively common solution. Usage of derivatives by Indian Banks has grown immensely in the past few years and it is expected to increase in the years to come, as they leverage their products and focus more on cross selling. Derivatives are an effective risk management tool for both financial and non-financial companies. They effectively transfer financial risks borne by a risk averse party to another who is willing to bear the attached risk . Participants are either market makers or users. A user engages in a transaction to manage an underlying risk whereas a market maker provides a platform for users to participate in these transactions. Market maker offers continuous bid and offer prices and hence makes the market. A market maker might not necessary have a risk to transfer but is necessary for a derivative transaction. Typically users participate in a derivative transaction to reduce or eliminate a determined risk on a continuing basis until the expiry of the underlying contract. They are also used to transform the risk exposure of the party as per RBI guidelines. Market makers act as counter parties to every contract with participating users and among themselves.

RBI has currently permitted usage of following derivative instruments by banks:

Interest rate derivatives – Interest Rate Swaps(IRS), Forward Rate Agreements (FRA), and Interest Rate Futures

Foreign Currency derivatives – Foreign Currency Forwards, Currency Swaps and Currency Options

Generally banks use FRA/ IRS to hedge the risk borne by them due to variations in interest rates due to an item of asset or liability in their balance sheet. They also use interest rate futures to hedge risk on their investments in government securities in AFS and HFT portfolios.

1.1 Derivatives Users in India

The use of derivatives by the Indian banks has seen a tremendous rise in the past 15 years. Derivatives trading for banks are an effective risk management tool by transferring financial risks borne by a risk averse party to another who is willing and better prepared to bear the risk. The Reserve Bank of India (Amendment) Bill, 2006 has legalised all derivatives trading where at least one of the parties in a transaction is a RBI regulated entity.

The interest rate deregulation coupled with operational elasticity for Indian banking sector has fuelled the need for banks to hedge against any risk arising out of interest rate fluctuations. An immediate short term impact would be the thinning or expanding of net interest margins The fluctuation in interest rates causes changes in market value of assets as well.

In view of the interest rate risk as well as a string of other risks faced by the banks, they need to safeguard themselves from any kind of unexpected future events which might strain their profit levels. Therefore banks use derivatives as users and dealers to mitigate the risk levels. As users they will hedge against any unanticipated changes in interest rates or even foreign exchange rates with use of derivative products. As another strategy they could even speculate the movements of the economic variables in future and enter into derivative market. As dealers, larger banks may provide over the counter (OTC) derivative products to other banks or non financial firms.

However financial users have not extensively used exchange traded derivatives. Their contribution to total value of NSE trades has been far lesser than retail investors. However, financial institutions have used OTC fixed income instruments to manage their risk. Market for interest rate derivatives has largely seen banks as users with state-owned banks showing little interest. MNCs and large corporations are keen on currency derivatives and swaps majorly bought from banks. This lack of interest in derivative markets is primarily due to the. However banks are again regulated from having substantial exposure to equity markets and as per the RBI directive ,which prevents banks from using derivatives for anything more than hedging existing positions in spot markets Hence there ares less incentives for banks in trading in derivatives. With the opening of economy the significance of risk administration in banking has happened to central significance. In India, financial institutions have not been primary users of exchange-traded derivatives so far, and their contribution to total NSE as on

October 2005 was less than 8% (Asani Sarkar,2005). It has been pointed out in previous studies that transactions between banks dominate the market for interest rate derivatives, while presence of state-owned banks remains small(Chitale, 2003).

Table 1 shows the growth of the derivative transactions over the last 15 years. The total number of derivative contracts that were traded in 2000-01 was 90850 in number which increased to 795,751,261 in 2013-14.

Table 1: Growth of derivative transactions over the last 15 years

Year	Number of Contracts	Total Turnover (inRs. billions)	Average Daily Turnover (in Rs. billions)
2013-14	795,751,261	229,788.02	1573.89
2012-13	1,131,467,418	315,330.04	1266.38
2011-12	1,205,045,464	313,497.32	1259.02
2010-11	1,034,212,062	292,482.21	1151.50
2009-10	679,293,922	176,636.64	723.92
2008-09	657,390,497	110,104.82	453.12
2007-08	425,013,200	130,904.78	521.53
2006-07	216,883,573	73,562.42	295.43
2005-06	157,619,271	48,241.74	192.20
2004-05	77,017,185	25,469.82	101.07
2003-04	56,886,776	21,306.10	83.88
2002-03	16,768,909	4398.62	17.52
2001-02	4,196,873	1019.26	4.10
2000-01	90,580	23.65	0.11

Source: Author's compilation from annual reports of banks

For our analysis SBI and associates, Nationalised banks, Old Private banks and New Private banks were chosen.

1..2 Why would banks use derivatives?

In view of the above risks faced by the banks, they need to safeguard themselves from any kind of unexpected future events which might strain their profit levels. Therefore banks use

derivatives as users and dealers. As users theyl hedge against any unanticipated changes in interest rates or even foreign exchange rates with use of derivative products. As another strategy they could even speculate the movements of these economic variables in future and enter into derivative market. As dealers larger banks may provide over the counter (OTC) derivative products to other banks or non financial firms.

1.3 Diversification

Banks have been moving away from their traditional business activity of lending and deposits. Early studies point out towards the growing importance of "other services" in commercial banks. The motivation for banks in participating in derivative market could be two fold. One, they would benefit from reducing the risk exposure to their customers, secondly they could reduce their probability of financial instability.

Researchers have suggested that innovations in banking may lead to higher costs associated with new products. As such derivative usage could imply higher costs.

Only a handful of banks are dealers in the international market, rest of the banks are only end users. This implies that they use derivatives to hedge against any unanticipated changes in the economic environment. G´eczy, Minton, and Schrand (1997) point out that banks need many more incentives to hedge rather than just market imperfections.

Smith and Stulz (1985) argue that banks which have a high probability of book value insolvency and are most likely to benefit from hedging and will therefore use derivatives.

Banks may also use derivatives to hedge against their credit risk exposure, if that be the case there should be some relationship between the level of credit risk loan loss provisions to derivative usage.

It has been found out that costs related with the level of bankruptcy are higher for firms which are smaller in size(Gruber et al.,1977) implying a higher motivation for smaller banks to use derivatives. However there may be costs associated with implementing a risk management program which may discourage them from using derivatives. Booth et al. (1984) indicate that smaller banks have to bear high costs of hiring expertise for an effective risk management program.

2. Review of literature

We find abundant literature, largely theoretical on the usage of derivatives by financial institutions. One strand of literature supports the argument that the use of derivatives is related to hedging (Smith& Stulz (1985),Duffee(1996)).The other strand argue that derivative can be regarded as instruments that reform the risks in trading into manageable risks (Duffee and Zhou,2001). Kamau and Rwegasira (2014) study the extent to which multilateral banks use currency derivatives.

The empirical literature related to the present study includes some of the new studies made in this regard. Ashraf.et al (1997) examine the determinants of the use of credit derivatives among a sample of 336 large US Bank holding companies. Yong etal (2005) study the disclosure practices among the Asia Pacific banks with respect to derivatives and conclude that developed countries have higher levels of disclosure as compared to developing nations. Broccardo et al (2014) analyse the extent of usage of derivatives by banks and also analyse the difference between users and non users, the underlying motivations to use them.

Various researchers have identified bank specific balance sheet variable and hypothesise its relationship with the use of derivatives. Prior research has also documented the importance of size in banks' use of futures (Koppenhaver, 1990), swaps (Koppenhaver, 1993). In general it might be expected that larger banks may have may participate in derivatives indicating a positive relationship between derivative usage and size of banks Derivatives reduce the likelihood of financial distress by decreasing the variability in firm value, thus reducing the expected costs of financial distress (Smith and Stulz, 1985; Mayers and and Smith, 1987). Sinkey Carter (2000) provide similar evidence on the characteristics of banks that undertake risk management using derivatives which indicates that smaller banks are more likely to hedge. On the other hand, some studies argue that large firms have more resources to set up a hedging program and employ personnel with expertise in derivatives than do small firms and hence are more likely to use derivatives (Hoyt, 1989; Colquitt and Hoyt, 1997); (Cummins et al. 1997; Cummins et al., 2001). In line with the scale and informational economies argument, Sinkey and Carter (2000) arguethat affiliated banks have access to the resources necessary to be active derivative users. They find that affiliated banks are more likely to use derivatives due to the existence of barriers to entry in banks' derivatives activities. They also argue that banks that generate higher profitability from intermediation are more likely to undertake derivatives hedging programs to lock in profits, while those with lower profitability are more likely to assume risks or speculate using derivatives.

Merton and Bodie (1992) give an assurance capital hypothesis and document that capital acts as a buffer to absorb shocks and acts as a cushion. This could in turn suggest a positive relationship between derivative usage and capital.

Banks may also choose to invest in liquid assets rather than hedging, an on balance sheet risk management technique(Nance, Smith & Smithson, 1993). Liquid assets may be easily converted into cash whenever a bank is in a difficult situation. Dividend payout may also be limited during difficult times. Together, these may be an alternative to hedging or derivative participation and can be assuring to cover debt obligations.

There are direct and indirect costs arising out of financial distress. Law suits and related costs can be considered direct costs. Indirect costs can have a lasting impact on ??. The companies, when perceived to be unsound financially, will find it difficult to raise capital. Potentially it might result in foregoing a profitable venture. In this angle, derivatives which stabilise cash flow of a company can be considered a substitute for equity capital.

Many researchers have been done in this regard and they point towards a causal relation between capital structure and derivatives usage. As said above if derivatives were used as a substitute of equity then former should alleviate the pressure on a company using high leverage. Dolde (1996) and Love and Argawa (1997) have found the same. Mixed results were reported by other researchers in this area >??.

Variables that signify debt levels of a firm should have an impact on the derivatives usage. Studies in the past have also proved the same. Froot et al. (1993) have found that usage of derivatives will lower prospect of a financial distress for a given debt ratio. Debt ratio plays a significant role in ascertaining quantum of derivatives usage. Studies have indicated that there is a positive relationship between financial distress and usage of derivatives. Financial distress is more probable when leverage increases and interest coverage ratio is reduced. In such a scenario hedging with derivatives is advisable as it can stabilise the cash flows and maintain the value of the company. Winata and Heaney (2005) also support the view that there is a causal relation between debt level and derivatives usage.

Brewer, Jackson, and Moser (2001) examine the major differences in financial characteristics of banking organizations that use derivatives relative to those that do not use derivatives. They find that banks that use derivatives grow their business-loan portfolio faster than banks

that do not use derivatives. Purnanandam (2004) also reports that the derivative users make more C&I loans than non-users.

In addition to the above mentioned factors, Geczy et al. (1997), suggest that foreign exchange risk is an important determinant to compel banks to enter into the derivative market.With the globalisation of the Indian economy banks face increased level of exchange rate exposure as well.

A bank's profit takes a hit when there are adverse movements in interest rates. In the current volatile environment interest rates changes are hard to predict. In the long run interest rate change affects bank's assets, liabilities and in turn their net worth. Hence it is always prudent to have a risk management mechanism in place. Banks resort to interest rate derivatives to reduce interest rate risk. Also they use forward and future contracts, swaps and options to hedge the interest rate risk and protect its interest income margin.

With respect to the latest changes in the The Reserve Bank of India (Amendment) Bill (2006), RBI has legalised all derivatives trading where at least one of the parties in a transaction is a RBI regulated entity. To start with, RBI has allowed all scheduled commercial banks (SCBs) excluding Regional Rural Banks, primary dealers (PDs) and all-India financial institutions to use IRS and FRA for their own balance sheet management and non-financial corporations to use IRS and FRA to hedge their exposures, it provides some kind of transparency in the market and enables the regulator to assess the level of leverage from the mandatory disclosure of the regulated entities.

3. Data and Methodology usedin the study

3.1 Extent of derivative activity (Dependent Variable)

The extent of derivative activity in our model is measured by the notional amount of derivative contracts which includes both interest rate derivatives and foreign currency derivatives As suggested by Demsetz and Strahan (1997) and Sinkey Jr. and Carter (2000) that although this indicatordoes not measure the risk of contracts, but is an acceptable measure of extent of involvement of banks in derivative market.

3.2 Independent Variable.

Size

Bank size is the fundamental control variable. We quantify size with total assets in the univariate analysis. In our regression models, we utilize the natural logarithm of aggregate

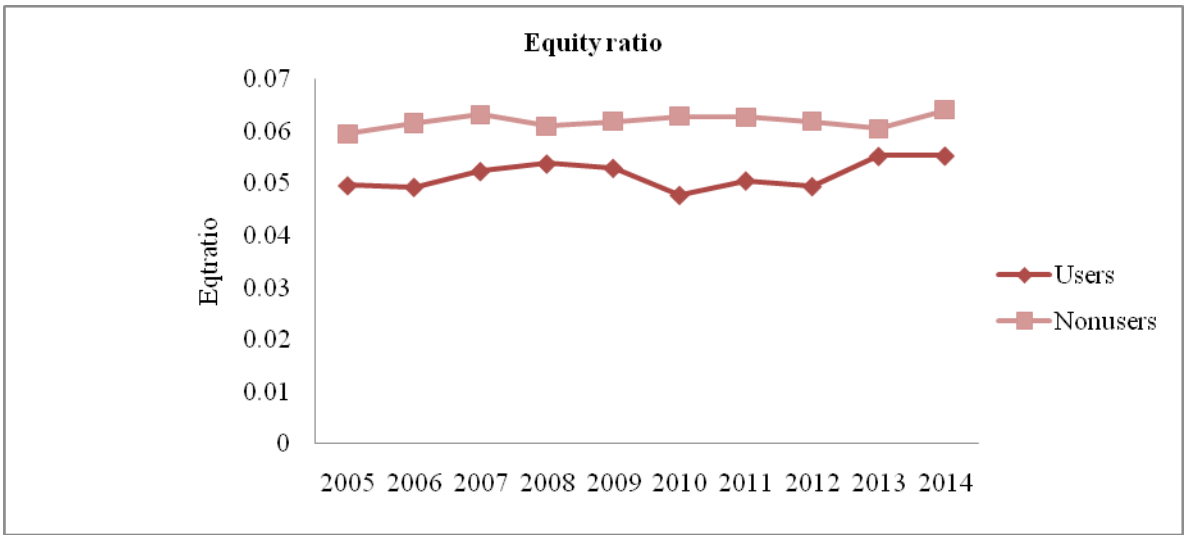
resources, measured in millions (lntass). In the event that economies of scale or scope exist in banks' derivatives exercises, a positive relationship ought to exist between the utilization of derivatives by commercial banks and size as measured by total assets.Large well-diversified banks have a lesser chance to fail than smaller banks. Total asset size also functions as a stand by for a bank's capacity to diversify since bigger banks have superior and diversified asset portfolios. Asset size accounts for variations in business of small and big banks. It would require considerable investment in capital, skill development and reputation for dealing and trading in derivatives market which act as barriers to entry for smaller banks. Hogan and Malmquist (1999) point out that smaller bank have higher transaction costs in using over the counter derivatives. Large size and economies of scale allow big firms to have an advantage when it comes to innovation in trading whereas market activities will be limited for small banks. Hence small banks are incompetent to provide full scale risk management services and derivative products to their customers. In this case the experimental expectation would be that the relationship between financial derivatives is stronger for bigger banks.

Equity ratio

To observe the relationship of equity ratios on banks decision to use derivatives, we incorporate the ratio of equity capital to total assets. A positive relationship would recommend that banks just utilize derivatives when they have sufficient capital to meet administrative prerequisites. A negative connection could recommend that banks use derivatives to diminish the probability of default when obligation levels are high or essentially that the utilization of derivatives is connected with a higher likelihood of default or imaginative strategies of risk administration. Merton and Bodie (1992) point out that banks which adhere to regulatory capital requirements in banks, have an 'assurance capital' to engage in various activities. According to them, assurance capital acts as a buffer during

adverse situation. Jagtiani (1996) argues that higher levels of capital are required for participation in the market for swaps because banks with more capital are viewed as being more credit worthy. The same should be true for other over-the counter instruments (Carter and Sinkey Jr., 1998). However, there could also exist an opposite relationship between relationship between capital and derivative activities of banks because of moral hazard behaviour, where banks with relatively lower capital ratios tend to be involved in greater derivative activities

Figure 1: Equity ratio of Indian Banks (2005-14)



Source: *Authors own compilation*

Risk Exposure (GAP) and interest rate risk

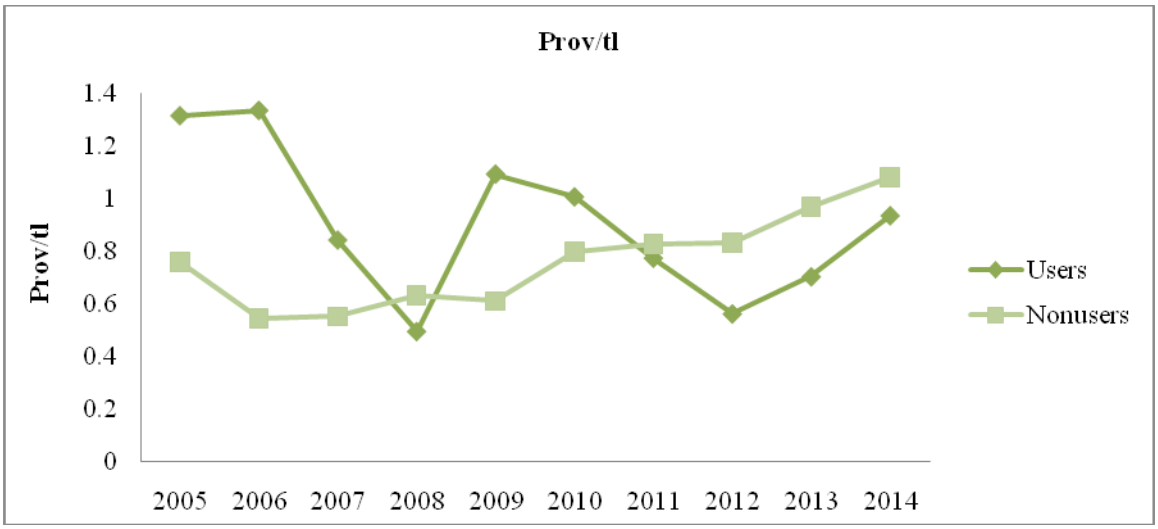
A bank's utilization of interest rate derivatives is identified with its reaction to interest rate changes. Despite the fact that term gap is a vital hypothetical measure of a bank's on balance sheet interest rate risk, it is hard to gauge this factor from bank's annual reports because of the absence of data.(e.g., interest rates, repayment schedules, and so on.). Sinkey and Carter(2013), utilize gap (one year) as an intermediary for a bank's stand-in to interest rate risk. Gap is unquestionably the estimation of the distinction between resources repricing or maturing inside 12 months and liabilities repricing or maturing inside 12 months, scaled by total assets.banks with a more prominent exposure to interest rate changes are relied upon to utilize derivatives to a more prominent degree. In the event that banks are honing coordinated risk administration, then the utilization of derivatives to fence interest rate risk may be identified with a bank's credit exposure

Credit Risk

We use the ratio of loan loss provisions as a measure for credit risk. In the event that banks use derivatives (to support or estimate) as a part of their coordinated risk management, a positive relationship is expected to exist between loan losses and derivatives utilization. Alternatively, a bank's credit risk exposure may have no effect on its usage of derivatives. It

might be interesting to see the if credit risk exposure, which forms a part of on balance sheet risk is significant enough to make banks use derivatives or not.

Figure 2: **Provisions to Total Assets for Indian Banks (2005-14)**



SourceAuthor's Compilation based on data

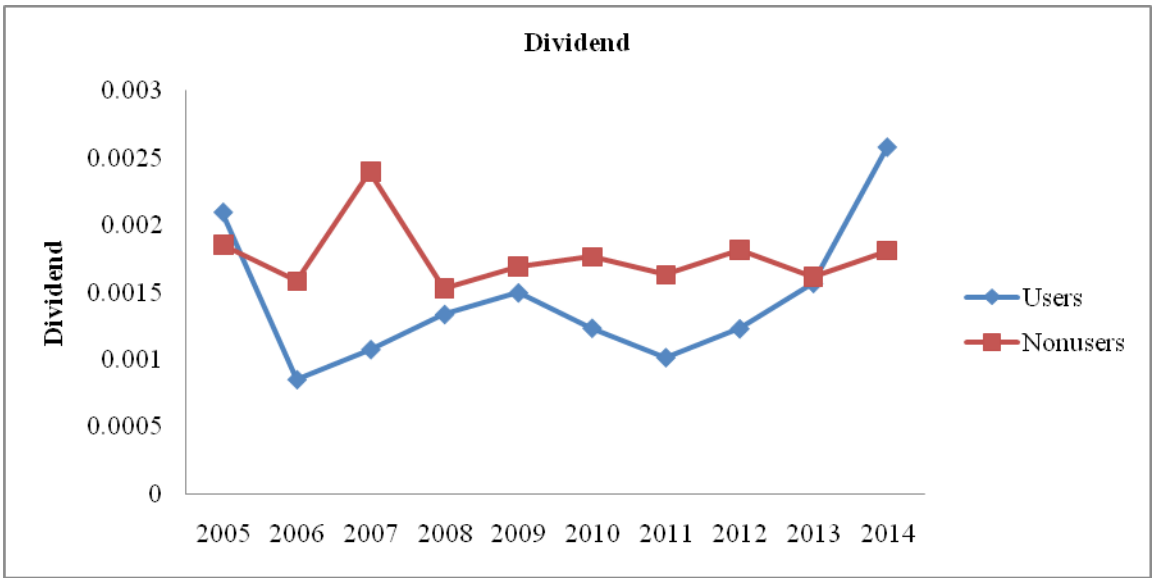
Measure of profitability

Return on assets is measured by profit after tax scaled by total assets. In addition to Net interest margins, this factor might be of significant interest in determining the volume of derivative use.

Alternatives to hedge

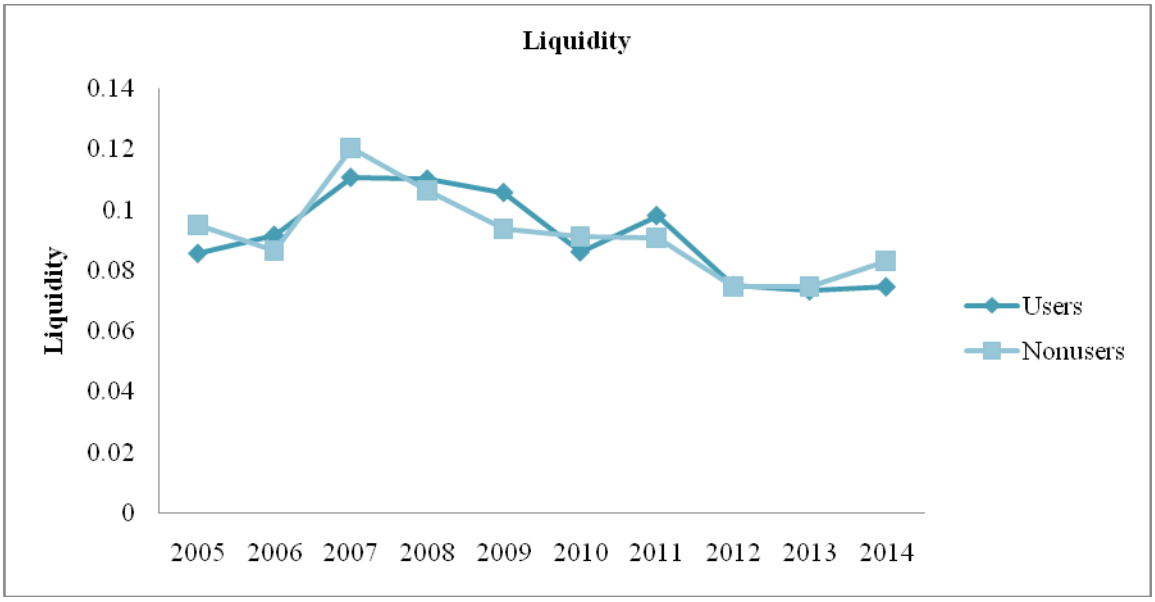
To account for alternatives to hedging, we utilize two variables: dividends (div) and asset or stored liquidity (liquid). The previous is measured by dividends paid scaled by total assets, while liquidity is computed by scaling a bank's liquid resources by total assets. On the off chance that these variables reflect alternatives to hedging, banks will be less inclined to utilize derivatives to hedge as they put resources into more liquid assets and have smaller dividend pay-outs. Such banks, nonetheless, could even now utilize derivatives to hypothesize or to offer risk-administration services to customers

Figure 3: **: Dividends paid as a percentage of total assets by Indian Banks (2005-14)**



Source:Author's own compilation

Figure 4 ; Liquid resources as a percentage of total assets of Indian Banks (2005-14)



Source:Author's own compilation

We use a dummy variable dealer which is coded as one if the bank is a member of ISDA and zero otherwise.

Econometric Specification:

$$y_{it} = c + \beta_1 CreditRisk_i + \beta_2 NIM_i + \beta_3 Liquidity_i + \beta_4 Size_i + \beta_5 Eqtratio_i + \beta_6 Dividends_i + \beta_7 Gap_i + \beta_8 Dealer_i + \beta_6 Ownership_i + \varepsilon_i$$

Equation 1

Where y_{it} is the notional amount of total derivative contracts of bank i .

Credit Risk – is the on balance sheet risk components ,which are loan loss provisions to total loans and difference between asset and liability in short term

NIM – is the intermediation profitability variable NIM

Dividends – Dividends paid to total assets

Liquidity- includes cash and marketable securities,

Size – natural logarithm for total assets,

Eqtratio - the ratio of total equity to total assets of bank i,

Dealer - Dummy variable based on whether a bank is a dealer bank or not.

ε_i = random disturbance term

We estimate Equation 1 using a tobit model, which is an appropriate model in this context. We notice that our data for derivatives usage is limited or censored at a point which was the case with Tobin's data on household expenditures. We empirically wish to determine the characteristics of banks which trade in derivatives and those that do not trade in derivatives or their derivative usage is near zero. To this end, employing ordinary least square method may produce biased results (Maddala ,1983), mainly due to the fact that values for derivative usage for banks which do not trade in derivatives are censored at zero. Therefore, the appropriate methodology in this context seems to be the Tobit Model which is used in the present paper.

We notice that the value of dependent variable which is the notional amount of derivative contract is zero for many banks which do not use derivatives .As a result OLS estimation will produce biased results (Maddala,1983).If we include the censored observation as y=0 the observation which are censored on the left will result in the underestimation of the intercept and overestimation of the slope.if we exclude the censored observations from the sample and

use only the observation for which y>0 , it will lead to overestimation of the intercept and underestimation of the slope.The tobit model uses all the information of censored as well as uncensored observation thereby leading to consistent estimates.The Tobit model is similar to the classical linear regression models, except for the estimation of two additional parameters:

$$y_i^* = \beta' x_i + \varepsilon_i$$ **Equation 2**

In this case if $y_i^* > 0 \; then \; y_i = y_i^*$ and ,

If $y_i^* \leq 0$ then $y_i = 0 \;\; and \;\; \varepsilon_i$ ~ IIDN(0, σ^2)

Where $y_i = notional \; amount \; of \; derivative \; usgae$,

$\beta' = matrix \; of \; coefficients$,

$x_i = matrix \; of \; all \; the \; independent \; factors \; and \; the \; constant$,

$\varepsilon_i = ith \; error \; term$,

The Tobit model is a model proposed by James Tobin (1958) to depict the relationship between a non-negative dependent variable yi and an independent variable (or vector) xi. In case of the tobit model the actual value of the dependent variable is observed if latent variable y* is above limit .This is known as the Tobit model. The Tobit model, additionally called a censored regression model, because some observations on y are censored. It is similar to the classical linear regression models , except for the fact that it requires estimation of two additional parameters or components..

As it were, the latent variable y* is observed just observed if y* > 0. Specifically, the dependent variable can be expressed as: $y = \max(y^*, 0)$.the major uniqueness of this model lies in censored normal distribution of y_i^*.In addition to one normal continuous density function

$$f(y_i ; \beta' x_i, \sigma) = (\frac{1}{\sigma})\phi[(y_i - \beta' x_i/\sigma],$$ Equation 3

Where $\phi(.) is\ the\ standard\ normal\ probability\ density\ function$

This unique distribution also includes a discrete part that implies to the probability that $y_i^* \leq 0 , or\ y_i = 0$,

Hence, the tobit model is a combination of 2 models:

Probit model for discrete decision of whether y is 0 or positive

$$Prob(y > 0) = \emptyset(x'\beta),$$

$\emptyset$ is the scale factor

Truncated regression model for continuous decision (for the quantity y,(y>0)

$$E(y, y > 0) = x'\beta + \sigma\lambda(x'\beta/\sigma),$$

Where E the expected value of is y, given y is positive, λ is the adjustment factor as we have truncated the sample

Similarly, we can calculate the marginal effects of each of the independent variables on y_i , in a censored sample. Therefore, the coefficient β becomes,

$$\frac{\partial E[y_i/x_i]}{\partial x_i} = \beta,$$

However the censored sample the above equation will be adjusted as the following (Greene,1993)

$$\Phi(\beta' x_i/\sigma) \times \beta = \frac{\partial E[y_{i/x_i}]}{\partial x_i} \quad ,$$

The above equations show that a change in the independent variable can bring to effect two types of changes : a change in the mean of the notional amount of derivative usage and also a change in the probability of using derivatives.

Therefore, it is a combination of conditional continuous part and the conditional discrete part with marginal effects.

It is otherwise called a censored regression model which is intended to gauge straight connections between variables when there is either left- or right censoring in the dependent variable (otherwise called editing from underneath or more, separately)

4. Data Description and Methodology

The empirical study takes place in two stages .The first stage is the estimation of the tobit model to analyse the characteristics of banks which do and the banks which do not use derivatives.In the second stage we wish to estimate whether the use of derivatives leads them towards systematic risk or not .For the stage 2 estimation of the model we use the augmented market model to analyse the relationship between systematic risk and derivative use.

5. Empirical results

We estimate a tobit model with our dependent variable as notional value of total derivatives usage by banks. The total marginal effects in the model are the values which are transformed from the MLE (maximum likelihood estimates) coefficients. The overall significance of the model is tested through likelihood test .it has a chi-square distribution with k degrees of freedom. The overall model is significant at 1% , while the significance of each parameter is tested thereby obtaining t ratios and corresponding p-values. The variables have no multicollinearity probelm

We also use interaction terms in our model as we find out that economies of scale do exist. We therefore build a dummy variable for size based on total assets, as for banks with larger value assets are coded as 1 and 0 otherwise. We construct variables using interaction of size with each independent factor.

Table 2: Tobit estimates of regression analysis

	Model I -All banks (NIM)		Model II - All banks (RoA)	
Independent factors	***Coefficient***	***S.E***	***Coefficient***	***S.E***
Provisions to total loans	0.000685	0.00648	-0.0000198	5.32E-05
Liquidity to assets	3.882515***	1.5264	3.981969***	1.508006
Dividends to assets	-0.5154727	0.579696	-1.029396**	0.49801
Capital to assets	7.732232***	1.673654	9.154982***	1.676722
GAP	0.04493	1.200459	-0.1438238	1.169246
NIM	-2.161653**	0.860066		
ROA			-3.152017	1.041757
Dealer	4.398052***	1.41388	3.917034***	1.36884
Ownership	2.193832***	1.136533	0.8816633	1.220198
Constant				
Log likelihood	-82.669842		-81.31124	
Pseudo R-square	*0.2595*		*0.2717*	
LR (chi square)	57.95		LR (chi square)	60.67
p-value	0.00000		*p-value*	0.0000

Our results in Model 1, show that on balance sheet credit risk is not a significant factor to govern the use of derivatives by banks. Estimates of net interest margin indicate towards a negative and significant relationship between interest spreads and derivative usage. As (Sinkey and Carter, 2000) point out that banks may wish to lock in their spreads by using derivatives as means to hedge. However , our results point out that financial institutions with low NIMs may try to build "other" income by speculating and offering derivative products

Banks associated with derivatives have significantly higher equity ratios which implies that we find support in favour of assurance capital hypothesis of (Merton and Bodie,1989) suggesting that banks, not having stronger capital positions ,may also invest in derivatives.

GAP is insignificant which indicates that increase or decrease in credit and interest rate risk may not be a driving force behind indulging in derivative activity.

Liquidity is significant at 5% with a positive sign, which indicates that it is inconsistent with the previous hypothesis on hedging according to which lower liquidity position of a bank may force banks to enter into derivative market. This hypothesis has previously been rejected in various studies on US banks (Gunther and Seims, 1995).Dummy variable for ownership is found to be significant indicating that derivative activity is relatively concentrated among public sector banks as compared to private sector banks.Size is found to be positively affecting the derivative activity, and dummy variable for dealer is found to be significant at 5

% which points out, larger banks with greater value of assets are more likely to use derivatives. It clearly indicates towards economies of scale that persist and motivates bigger banks and hinders smaller banks from entering into the derivative market. When we replace profitability variable by return on assets the results are almost similar and returns on assets are found to be negatively affecting derivative usage.

Table 3: marginal effects after tobit(model I)

Independent factors	Marginal effects(dy/dx)	S.E
Provisions to total loans	0.00000	0.00001
Liquidity to assets	0.7400282***	0.28277
Dividends to assets	-0.124532	0.10566
Capital to assets	1.598521***	0.35121
GAP	-0.0395138	0.21144
ROA	-0.4430401**	0.22246
Size	0.1022143	0.08926
Dealer	0.4687818	0.46878
Ownership	0.2054111	0.20541

Marginal effects for varibales shown in italics represent discrete change of dummy variable from 0 to 1.*,**,*** denote significance at 10%,5%,1% respectively.

Table 4: estimation results (tobit model)

Model III (With interaction effect among variables)		
Independent factors	***Coefficient***	***S.E***
Provisions to total loans	7.76E-06	0.0000419
Liquidity to assets	12.18105***	2.261566
RoA	-1.924206**	0.9876763
Dividend to assets	-0.5115504	0.4630232
Ln(assets)	0.6194697*	0.5262989
Capital to assets	2.71732***	2.151216
Ownership	-0.3107782	0.9262974
GAP	-1.390954	1.391874
Dealer	5.138458***	1.188605
Size*capital	3.060681**	2.391533
Size*NIM	-0.3326268*	1.766762
Size*Liquidity	1.45252***	.2564139
Size*provisions	-0.176676	16.07679
Size*Gap	2.631595	2.013545
Size*Dividends	-0.5268884	0.9897785
Constant	-7.993013	6.532389
Log likelihood	-69.707082	

*,**,*** denote significance at 10%,5%,1% respectively.

We use the estimated β values to compute elasticities or marginal effects after tobit. We therefore multiply the tobit estimates with the adjustment factors as given in equations above. The marginal effects after tobit indicate that on the condition of derivative usage being positive, one percent increase in the capital ratios will increase the derivative usage by approximately 3%. Similarly, the effect of 1% increase of liquidity will increase the derivative notional amount by 1.61%.Re-estimating the same model with return on assets as the profitability indicator gives us similar results. It points out that banks with depleting profitability may take up derivative activity to increase their profit margins.

We find that the variable representing size is positive and significant (see table 2), which entails us to estimate the third model based on interaction among the independent variables with size (table 4). In this context, we first construct a dummy variable for size, which takes the value 1 if the total value of assets of a bank is greater than the median value of all the banks taken together and then build interaction variables by multiplying each of the independent variable with the size based dummy. The results are given Table no.2

Table 3 : Marginal effects after Tobit(model III)

Model III (With interaction effect among variables)		
Independent factors	***Coeffecient***	***S.E***
Provisions to total loans	7.76E-06	0.0000419
Liquidity to assets	12.18105***	2.261566
RoA	-1.924206**	0.9876763
Dividend to assets	-0.5115504	0.4630232
Ln(assets)	0.6194697*	0.5262989
Capital to assets	2.71732***	2.151216
Ownership	-0.3107782	0.9262974
GAP	-1.390954	1.391874
Dealer	5.138458***	1.188605
Size*capital	3.060681**	2.391533
Size*NIM	-0.3326268*	1.766762
Size*Liquidity	1.45252***	.2564139
Size*provisions	-0.176676	16.07679
Size*Gap	2.631595	2.013545
Size*Dividends	-0.5268884	0.9897785
Constant	-7.993013	6.532389
Log likelihood	-69.707082	
Pseudo R-Square	0.3756	
LR statistic(chi-sq)	83.88	

p-value	0.0000

*,**,*** denote significance at 10%,5%,1% respectively.

The results of model III (table 4) indicate that larger banks with lesser interest margins have higher investments in derivatives. The interaction term between large banks and credit risk is insignificant .We also find evidence in favour of derivative activity in larger banks with higher liquidity. Similarly, larger banks with higher capital ratios have higher incentives for derivative activity.

It may be mentioned that the for tobit the R- squared value is the square of the correlation coefficient between y_i and the expected y_i values.Based upon R square measure , it can be said that the Tobit conditional mean function fits the derivative data nicely. It may be recalled here that Tobit estimation will not maximise R square as in OLS, they will maximise the log-likelihood function.

The above table 5 depicts the marginal effects after the tobit estimation of variables with interaction effects it may be concluded that for larger banks, higher capital ratios and higher liquidity will lead to an increase in derivative activity. Precisely, 1% increase capital of larger banks will increase their derivative use by 0.72%.The major result of this analysis supports the fact that financial derivatives are used to hedge against interest rate risk. Our results majorly indicate that lower the bank's exposure to interest rate risk (measured by NIM), it is more likely that the banks will use derivatives.

The analysis has given us an insight about the on balance sheet factors that govern derivative usage .In the next stage we wish to determine the impact of derivative use on the systematic risk of the banks.

6. Section II:

Derivatives are complicated assets, and many characteristics of these relatively new assets have been evolving day by day. The fast growth of bank involvement in derivative markets has raised concerns about the potential hazards of this activity.On the flipside, certain characteristics of derivatices makes them highly useful in hedging risks.

In this section, we examine the impact derivative activity on the systematic risk of the publicly listed on sample of Indian banks for the year 2013. In previous section, we analysed the various balance sheet components to determine the determinants of derivative usage in

India .However, we wish to examine whether the usage of derivatives exposes banks towards further risks. Using an augmented market model, we categorically measure the exposures of banks to interest rate and exchange rate risk. Thereby, we first estimate the exchange rate, interest rate sensitivity of equity returns of the listed sample, we then analyse that whether the use of derivatives is related to risk exposures of banks towards systematic exchange rate risk and interest rate risk exposures.

We collect data on notional amount of interest rate contracts and the notional value of currency derivatives separately .Off balance sheet data is extracted from Bloomberg based on weekly stock prices of publicly traded Indian banks .To estimate the exposures for 2013 we use a three year estimation window as mentioned in previous studies.So to calculate the exposures for 2013 we collect weekly data from March 2010 to March 2013

To incorporate the interest rate exposure (both long term and short term) and the exchange rate exposures we employ an augmented market model. To estimate the exposure of a bank from the augmented market model, for the year 2013, we use weekly data of the following:

Returns of the stock price of bank, returns on closing value of Bankex[1], from March 2010 to March 2013 to estimate the exposures in 2013[2] and then use them in the following time series regression(augmented market model).This model is widely used in investigating the banks market , interest rate and exchange rate exposures (Choi and Elyasiani,1997).

$$R_{it} = \propto + \beta_{it} Bankex + \beta_{iLTexp} LTexp + \beta_{iSTexp} STexp + \beta_{iExchrt} Exchrt$$

Equation 4

R_{it} *is the rate of return on ith banks's stock at time t*

Bankex- is the rate of return on the market portfolio at time t

LTexp-is the long term interest rate on Governement Bond index

STexp-is the short term or 3 month T-bill rate

[1]Bankex-The BSE bankex index comprises the constituents of the BSE 500 that are classified as members of the banking sector .

[2]It has been shown in literature that the estimation window of 3 to 5 years is a good approximation of interest rate and exchange rate exposures

Exchrt- is the rate of change of INR against USD

To increase the accuracy of our estimations in this model we use the method proposed by Doidge et al. (2006) wherein the coefficients are standardised by the standard error as a few sample banks do not have a considerable exposure to interest rates in the regression model. An advantage of this method is that the betas estimated are more precise and they receive a heavier weight while entering the regression.

$$\beta_{iSTexp} = \gamma_i + \sum_f^{i=1} \delta_j X_{ji} + \sum_f^{i=1} \varphi_i Y_{ji} \quad \text{Equation 5}$$

$$\beta_{iExchrt} = \emptyset_i + \sum_f^{i=1} \lambda_j X_{ji} + \sum_f^{i=1} \varphi_i B_{ji} \quad \text{Equation 6}$$

X_{ji} are the bank specific control variables which include equity ratios ,bank size, dealer status and ownership.

Y_{ji} is the notional amount of interest rate derivatives if bank i's for year 2013

A_{ji} are the are the bank specific control variables which include equity ratios ,bank size, dealer status and ownership.

B_{ji} are the notional amount of currency derivatives for the year 2013

We hypothesise the relationship of the systemetic exchange rate risk and interest rate exposure with the use of currency derivatives as well interest rate derivatives respectively.

Table 4 :estimation results

Dependent Risk variable: Exchange rate exposure			**Long term interest rate exposure**	
Variable	***Coefficient***	***Std. Error***	***Coefficient***	***Std. Error***
Constant	-0.511822	1.131984	0.62936	1.306982
Ownership	0.222675	0.212299	-0.188069	0.245119
Size	0.002757	0.090639	-0.038375	0.104652
Derivative volume	-0.968828***	0.374822	-0.923322**	0.432767
Capital to Assets	1.308432**	0.506978	0.920849*	0.585354
R squared	0.251289		0.28809	
Prob(F-statistic)	0.068293		0.004706	

*,**,*** denote significance at 10%,5%,1% respectively.

The empirical analysis of Equation shows that there exists a negative relationship between exchange rate risk and derivative use. Higher the derivative activity lesser will be the

exchange rate exposure risk.Long term interest rate risk exposure has been estimated susing the standard augmented market model baseline equation. The results provide some useful insights when we replace the dependent variable by long term interest rate risk exposure .We document the evidence for a significant negative relationship in the interest rate risk exposure of banks as a result of the derivative activity. It may be noted that banks are effectively using derivatives to hedge against interest rate risk .This seems to be an important implication in light of the usage of derivatives by banks to hedge risk .It also indicates towards successful hedging of interest rate risk by banks with use of derivatives.

7. Concluding Remarks.

The rationale for the use of derivatives is well established; that for banks and other financial institutions less. Regulators and bankers are most concerned about the banks which are actively involved in derivative activities. The paper contributes to the existing literature by providing empirical evidence on Indian banks derivative activities. In this study, we analyze the underlying factors that govern the decision regarding the use of derivatives .Various determinants are identified which form the basis for participation and volume decisions for currency and interest rate derivatives. Our results indicate that bank-specific characteristics do influence participation. As with other studies, we find that the propensity to use derivatives is positively related to bank size and membership as a primary dealer of derivatives, liquidity and capital ratio. These findings suggest scale and informational economies and primary dealer advantage, which cannot be easily offset by alternative strategies, increase the need for off-balance-sheet hedging. We also find evidence for the assurance capital hypothesis that equity ratio, acting as proxy for debt level/ leverage, has an effect on derivatives activity. It may be suggested that a positive association between capital to asset ratio and derivative usage highlights that both regulators as well market discipline have been successful in warranting the use of derivatives by large well-capitalised banks

We also find some support for the motivations given in the literature for risk management using derivatives. In addition, we find strong support for the arguments that banks with lesser NIM are highly active in derivatives market. Alternatively, banks with lesser spreads or duration mismatches try to build in their spreads and other income by using hedging instruments in the derivative market. Some on-balance-sheet hedging instruments, such as the diversification of loan portfolio, serve as alternatives to reduce bank risks. There is strong support for argument that large size banks are more likely to trade in derivative markets. It is because there is a fixed cost associated with initial participation on derivative usage. This

again highlights the cost-based incentives to use derivatives. Ownership is also found to be positively significant suggesting that public sector banks have greater derivative activity as compared to private sector banks.

Further, the question of the impact of derivative use on riskiness of banks is interesting to investigate. We need to assess whether the banks riskiness depends upon derivative use or not. In order to document the effect of extent of derivative activity on off balance sheet risk exposures we use an augmented market model to calculate the systematic risk exposures of banks for the year 2013 .The results point towards a significant decrease in exchange rate riskiness using derivatives as well as a significant decline in the long term interest risk using derivatives. It implies and motivates banks to indulge in derivative trading, as the systemic risks do not seem to be potentially aggravated by using them and derivative activity may be concentrated among well capitalised banks which can safely manage risks.

References

Ashraf, D., Altunbas, Y., & Goddard, J. (2007). Who transfers credit risk? Determinants of the use of credit derivatives by large US banks. *The European Journal of Finance*, *13*(5), 483-500.

Booth, J. R., Smith, R. L., & Stolz, R. W. (1984). Use of interest rate futures by financial institutions. *Journal of Bank Research*, *15*(1), 15-20.

Broccardo, E., Mazzuca, M., & Yaldiz, E. (2014). The use and determinants of credit derivatives in Italian banks. *The Journal of Risk Finance*, *15*(4), 417-436.

Carter, D. A., & Sinkey Jr, J. F. (1998). The use of interest rate derivatives by end-users: The case of large community banks. *Journal of Financial Services Research*, *14*(1), 17-34.

Chitale, R. P. (2003). Use of Derivatives by India's Institutional Investors: Issues and Impediments. *Derivatives Markets in India, Tata McGraw-Hill Publishing Company Limited, New Delhi, India*.

Colquitt, L., & Hoyt, R. (1997). Determinants of Corporate Hedging Behavior: Evidence from the Life Insurance Industry. *The Journal of Risk and Insurance, 64*(4), 649-671..

Committee, B. (2012). Basel Committee on Banking Supervision Consultative Document Core Principles for Effective Banking Supervision, (September, 2012)

Cummins, J., Phillips, R., & Smith, S. (2001). Derivatives and Corporate Risk Management: Participation and Volume Decisions in the Insurance Industry. *The Journal of Risk and Insurance,68*(1), 51-91.

De Ceuster, M., Flanagan, L., Hodgson, A., & Tahir, M. I. (2003). Determinants of derivative usage in the life and general insurance industry: the Australian evidence. *Review of Pacific Basin Financial Markets and Policies*, *6*(04), 405-431.

De Haas, R., & van Lelyveld, I. (2006). Foreign banks and credit stability in Central and Eastern Europe. A panel data analysis. *Journal of Banking and Finance*, *30*(7), 1927–1952

Demsetz, R. S., & Strahan, P. E. (1997). Diversification, Size, and Risk at Bank Holding Companies. *Journal of Money, Credit and Banking*, *29*(3), 300–313.

Demsetz, R., & Strahan, P. (1997). Diversification, Size, and Risk at Bank Holding Companies.*Journal of Money, Credit and Banking, 29*(3), 300-313

Dependent, L., Models, V., & Panel, U. (2013). Limited Dependent Variable Models Using Panel Data, *22*(3), 307–338.

Doidge, C., Griffin, J., & Williamson, R. (2006). Measuring the economic importance of exchange rate exposure. *Journal of Empirical Finance*, *13*(4), 550-576.

Géczy, C., Minton, B. A., & Schrand, C. (1997). Why firms use currency derivatives. *The Journal of Finance*, *52*(4), 1323-1354.

Gruber, M. J., & Warner, J. B. (1977). Bankruptcy costs: Some evidence.*The journal of Finance*, *32*(2), 337-347.

Hogan, A. M., & Malmquist, D. H. (1999). Barriers to depository uses of derivatives: an empirical analysis. *Journal of Multinational Financial Management*, *9*(3), 419-440.

Kim, S. H., & Koppenhaver, G. D. (1993). An empirical analysis of bank interest rate swaps. *Journal of Financial Services Research*, *7*(1), 57–72.

Maddala, G. (1987). Limited Dependent Variable Models Using Panel Data. *The Journal of Human Resources, 22*(3), 307-338.

Sinkey, J. F., & Carter, D. a. (2000). Evidence on the financial characteristics of banks that do and do not use derivatives. *The Quarterly Review of Economics and Finance*, *40*(4), 431–449.

Sinkey, J. F., & Carter, D. A. (2001). Evidence on the financial characteristics of banks that do and do not use derivatives. *The Quarterly Review of Economics and Finance*, *40*(4), 431-449.

Tufano, P. (1989). Financial innovation and first-mover advantages. *Journal of Financial Economics*, *25*(2), 213-240.

Whidbee, D. a, & Wohar, M. (1999). Derivative activities and managerial incentives in the banking industry. *Journal of Corporate Finance*, *5*(3), 251–276.

Yong, H., & Robert-Chalmers, K. (2007b). Determinants of the Extent of Asia-Pacific Banks' Derivative Activities. *European Financial Management, 13*(3), 1–37.

Yung-Ming, S., & Moles, P. (2010). What Motivates Banks to Use Derivatives: Evidence from Taiwan. *Journal of Derivatives*, *17*(4), 67–78.