The Use and Determinants of Derivatives: Empirical Evidence from Banking Sector of Pakistan

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Abstract

The purpose of this research was to address three questions regarding the extent of the use of derivatives; difference between the users and non-users and; factors that influence the usage of derivatives for Pakistani banking industry for the period 2004-2016. Banks are dynamic users of derivative instruments and a wide range of derivative instruments are persuasively used for risk management, speculation and trading purposes. Paired sample t-test was applied to determine the difference between the users vs. non-users and it was observed that almost all of the differences between the variables were significant, with the exception being risky assets and NPL/TL. The results of the probit model reveal that risky assets and the ratio for non-performing loans were not found significant whereas net loans to total assets was significant with negative sign which shows that banks were using derivatives infrequently while, banks capital proxy by EQTA was found significant at 5 percent level with positive sign which means that capitalized banks are more likely to use derivatives. The trade and hedge variables were found significant. Banks use derivatives for the purpose of risk mitigation (hedging). Regulatory authorities need to devise new regulations regarding the derivative instruments usage to cope with the changing economic dynamics of Pakistan.

Keywords*:* Derivatives, Banking Sector of Pakistan, Probit model, Risk Management.

Introduction

Banks are dynamic users of derivative instruments and a wide range of derivative instruments are persuasively used for risk management, speculation and trading purposes. These instruments have an enormous effect on financial institutions, markets, organizations, and society at large as witnessed in the recent global financial crisis (Banerjee et al., 2017; Broccardo et.al. 2014; Thanassoulis, 2012). Derivative instruments

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are not simply the financial innovations to the bank but they have totally changed the traditional way of conducting business by the banks. They are complex and extremely volatile financial tools originated from the rapid changes in technology, rules and regulations, and innovation over the past three decades (Hentschel & Kothari, 2001). The consequences of this led to wide variety of financial instruments commonly used by the organizations. The derivative instruments are now being utilized as the fundamental way for organizations to mitigate and manage risk (Casamento, 2010).

Banks utilize derivative instruments either for trading purposes, income diversification or for hedging (as a risk mitigation technique). The purpose to conduct this study was to assess the extent of usage of derivative instruments, the difference between the user and non-user, and what factors influence derivatives usage in banking sector of Pakistan. Since, failure to manage the bank risks had substantial costs of financial distress to be borne by the shareholders and investors. In context of this we aim at answering the following questions.

i.   *To what extent Pakistani banks use derivative instruments.*
ii.   *What are the differences between the user and non-user banks?*
iii.   *What are the determinants of derivatives usage?*

Answering the first two research questions, requires the analysis of the annual reports of a sample of all commercial banks operating banks from the periods 2004-2016. Since, in 2004 the State Bank Pakistan (SBP) has granted formal approval to the banking sector to do transactions in derivatives market. And the third question was handled by estimating a probit regression model.

Literature Review
The early literature on the usage of derivative instruments was primarily focused on the hedging argument. Several incentives can be acquired by firms from the hedging process, such as managing risk, incentives from taxation and debt (Duffee, 1996; Smith & Stulz, 1985). Banks utilize financial derivative instruments for hedging purposes i.e. risk mitigation, speculation, market making and trading purposes. The decision of the bank to indulge in derivative activities propose that the decision is related positively with size and leverage (Gunther & Siems, 1995; Sinkey & Carter, 2000). Prior literature on one hand presents that derivatives are used for the hedging purposes (Smith & Stulz,1985; Duffee, 1996).While on the other argues that derivative instruments are used to restructure the risks in trading into manageable risks (Duffee & Zhou,2001). Rampini & Viswanathan (2010) study which illustrated that

larger and well-capitalized firms hedge more than the firms possessing lower-capital. Presently, the stream of literature includes limited studies and presents empirical literature on the usage of derivatives. Keffala and Peretti, (2013) put forward that derivative instruments are used by the banks as risk controlling measures. They found that swaps and forward are utilized by the banks to control risk, whereas speculation is the motive for options utilization. Li and Marinc, (2014) observed the "impact of financial derivatives on risk sensitivities" of U.S. bank holding companies that are publicly listed from the year 1997 to 2001. The empirical outcomes indicated that the use of derivative instruments impose significant impact on their risk i.e. systematic risk exposures. The study by Danila and Haung, (2016) indicate that only firm size is significantly related to hedging and other results are not consistent with those of developed countries. The results recommend that Indonesian hedging market is not yet mature.

Data, Variables and Methodology

Data
This study uses panel data for the period 2004-2016 to examine the extent of use of derivatives and their determinants for Pakistani banking sector. According to SBP the total scheduled banks operating in Pakistan were 38 till the end of 2016.The banks were categorized as Public, Private, Foreign and Specialized banks. Due to inaccessibility and impossibility to obtain the data from the websites of some banks the number of sample reduced 27 banks categorized as local, public/private and specialized banks. For each bank the data on derivatives extracted manually from annual reports. In order to test the determinants of derivatives, probit regression model on a binary dependent variable is utilized. Panel data methodology was applied to analyze the use and determinants of derivatives in banking sector of Pakistan. Since, panel data methodology presents important benefits.

Panel data methodology assumes that individual banks and their characteristics are heterogeneous. Time series and cross sectional data studies not control for this factor of heterogeneity and therefore, run the risk of obtaining biased results (Baltagi, 2001). It also assists in analyzing the data over large number of years and avoids the problem of multicollinearity among independent variables (Li &Marinc, 2014).

Variables
The dependent variable is binary variable (0, 1). Recording 1, when a certain bank is user of derivative financial instrument otherwise 0, when a bank is non-user of derivative instrument.
Independent variables include the following:
- Banks risk and capital
- Banks attitude/ expertise in hedging activity
- Portfolio Composition
- Financial distress cost
- Substitute for hedging
- Control Variable Size

Banks capital and risk
Derivatives provide effective ways to manage risk. These aspects can be captured by using various risk measures. ("Risk-weighted" assets/ Total assets) is presented by studies to denote the variable risky assets to capture a bank's behavior towards the risk (Ashraf et al.,2007; Broccardo et al., 2014).Furthermore, variables that are related to the "quality of portfolio" are utilized to proxy banks risk which includes ("Total loans"/"Total assets") and (Non-performing loans/Total assets). To capture the regulatory pressure influence, the variable included is (Total equity/Total assets).

Banks attitude or expertise in hedging activity
The banks utilize all the instruments that are available in order to manage the risk (Minton et al., 2009). Here expecting the positive relationship between the usage of Derivatives and a bank's hedging activity which is shown by the two variables:
- The dummy (user hedge) presented as: (if the bank employs financial derivatives the dummy is coded as 1).
- The (trade) dummy presented as: (if the bank employs financial derivatives the dummy is coded as 1). "This aims at capturing the specific purpose" of the banks trading activity when utilizing financial derivatives.

Portfolio Composition
Due to the inaccessibility of "public data on the loan portfolio composition, it is more challenging to test the application of the portfolio composition and also (Net loans/Total assets) with an expected positive sign because derivatives present the ability to permit for an enhanced flexible approach for managing the risks that are related with concentration (Batten & Hogan, 2002).

Financial Distress Costs

Hedging theories showed that, firms having larger probability of financial distress cost are more interested in hedging processes (Aretz et al., 2007). The "profitability measures ROA while (Net interest revenue/Total assets) is used" to capture financial distress cost by providing significant negative signs.

Substitute for Hedging

Alternatives and less costly risk management activities may act as substitutes for the use" of derivatives Following the different studies we make use of liquidity variable with expected negative sign (Gunther &Siems, 1995; Sinkey & Carter, 2000). Maintaining, higher liquidity could alleviate insolvency risk through lower dividend payouts or through having a higher current ratio and accordingly reduce the propensity of banks to hedge (Amihud &Murgia, 1997).

Control Variable.

The proxy for bank size will be LTA variable given by (natural log of Total Assets). This variable will be presenting the ability of the bank to attain scope and economies of scale. Here a positive significant coefficient is expected as indicated in the previous literature (Ashraf et al., 2007; Minton et al., 2009).

Econometric Model

$D_{i,t} = \beta_0 + \beta_1 Risk_{i,t} + \beta_2 CAP_{i,t} + \beta_3 HdgAct_{i,t} + \beta_4 Distresscost_{i,t} + \beta_5 Substitutes + \beta_6 Size_{i,t} + e_{i,t}$

This model is binary dependent model (probit regression model) used to capture the use and determinants of derivatives, the technique used by (Broccardo et al., 2014).The Research hypotheses are hereby stated to give more prominence to the purpose of the Study.

H_1: Banks riskiness increases the likelihood of using derivatives. The banks that are riskier will be utilizing derivatives due to their risk sharing ability.

H_2: Capitalized banks are more likely to use derivatives.

H_3: Attitude and expertise in hedging activities increases the likelihood of using derivatives.

H_4: Banks are likely to use derivatives when financial distress increases.

H_5: Substitutes for hedging do not decrease the likelihood of using derivatives.

Results and discussion

Descriptive analysis
Descriptive statistics shows the use of derivatives by banks of Pakistan. Results are summarized in Table 1.

Table 1: Descriptive Statistics

Variable	Observations	Mean	SD	Min.	Max.
Banks risk					
RWA/TA	216	0.6026	0.1494	0.1246	0.9995
NL/TA	216	0.5358	0.4841	0.0467	6.6999
NPL/TL	216	0.1348	0.1308	0.001	0.9119
Capital					
EQTA	216	0.134	0.1452	0.0023	1.0000
Attitude/expertise in hedging					
TRADE	216	0.3194	0.4673	0.000	1.0000
HEDGE	216	0.3241	0.4691	0.000	1.0000
Financial distress costs					
ROA	216	0.0023	0.0210	-0.0924	0.0372
Substitutes for hedging					
LIQ	216	0.4027	0.1979	0.0174	1.5981
Other variables					
SIZE	216	298977.80	379960.20	5300.00	2555545.00

The extent of Derivatives Use in Pakistan

Table 2: Derivatives Usage in Pakistan

	2007	2008	2009	2010	2011	2012	2013	2014
Number of users of financial derivatives	20	21	21	21	21	21	21	21
User total number of banks (%)	74	77	77	77	77	77	77	77
Number of banks that have trading purpose	9	9	9	9	9	9	9	9
Number of banks that have hedging purpose	7	8	8	8	8	8	8	8
Number of banks having other purposes	4	5	4	4	5	4	4	4

Table 2 summarizes the extent of derivatives usage in banks of Pakistan. The results show that from the year 2008 to 2014 there is consistency in

derivatives use. 21 banks in Pakistan were using derivatives, the overall results frame positive attitude towards derivatives utilization. The percentage of users also increases as compared to 2007. The results revealed that banks were using derivatives more for the purpose of trading rather than hedging purposes from 2008-2014. Behavior of the banks towards hedging also seems to increase during the respective years. In 2007 only 7 banks were using derivative instruments for the purpose of hedging whereas, from 2008-2014 the number of banks increased to 8. Other purposes for which the banks operating in Pakistan utilize derivative financial instruments include market making, speculation and arbitrage.

Users versus non-users: (sample t-test)
Moving on to the second objective of the research, the difference between derivatives user and non-user banks has been analyzed. Table 3 refers to the sample t-test depicting whether two variables are statistically different from each other.   There is significant difference observed between variables of (Panel A) non-user and (Panel B) user with respect to various characteristics.

Table 3: Non-users versus users

Variables	Panel A(non users)	Panel B (users)		
Banks risk	Mean Value	Mean Value	t value	P value
RWA/TA	0.590	0.640	-1.715	(0.091)
NL/TA	0.744	0.476	-4.14	(0.000)
NPL/TL	0.128	0.136	0.317	(0.752)
Capital				
EQ/TA	0.188	0.118	-3.148	(0.002)
Banks attitude/expertise in hedging activity				
Trade	0.000	0.416	10.921	(0.000)
Hedge	0.000	0.416	10.921	(0.000)
Financial distress costs				
ROA	-0.008	0.005	3.029	(0.004)
Substitute for hedging				
Liquidity	0.331	0.423	2.058	(0.044)
Other variables				
Size	4.577	5.268	7.29	(0.000)

Almost all of the differences between the variables are significant, with the exception being risky assets, NPL/TL and Intinc. In addition non–users appear to have portfolios with better and high concentration of loans, and are well capitalized. With reference to the banks attitude and expertise in hedging activity, significant differences are observed

between Panel (A) and Panel (B). The user banks are observed to be more oriented towards the use of risk transferring instruments because the means of the variables for both (trade and hedge) derivatives are higher than those of the non-users.

When focusing on the goals of capturing financial distress costs it appears that overall profitability of the user banks with respect to total assets is higher and statistically significant as compared to the non-user banks. It signals that banks involve in derivative activities attain elevated profits as compared to the non-users. Finally, derivatives user and non-user banks present significant differences when size (log of TA) is considered. The user banks relatively appear to be larger in size than the non-users.

Regression Analysis for the Determinants of Derivatives Use.
The results are according to the expectations and confirmed by applying the marginal effects.

Table 4: Probit Regression Analysis for Determinants of Derivatives Use

Variables	Coefficient	Std. Error	Prob.
Banks risk			
RWA/TA	0.1943	0.9285	0.8342
NL/TA	-0.4848	0.2516	0.0540
NPL/TL	1.3815	1.0450	0.1862
Capital			
EQ/TA	2.1994	0.7140	0.0021
Banks attitude/expertise in hedging activity			
Trade	2.3429	0.8239	0.0045
Hedge	1.0932	0.6607	0.0980
Financial distress costs			
ROA	-1.2812	6.1231	0.0068
Substitute for hedging			
Liquidity	2.5310	0.7984	0.0015
Other variables			
Size	1.5342	0.3300	0.0000

The variable risky assets captures banks attitude towards risk. According to the results the risky assets variable and the ratio for non-performing loans is non-significant whereas net loans to total assets is significant with negative sign which shows that banks are using derivatives infrequently the results are consistent with the study of (Broccardo et al., 2014). Riskier banks in Pakistan are not likely to use derivative instruments.

The relationship between risk and derivative instruments vary across the types of derivative financial instruments. The risky assets variable is not significant whereas, NL/TA is significant with negative sign at 10% level rejecting the hypothesis showing that riskier banks use derivatives infrequently. The results show consistency with the results of (Broccardo et al., 2014). The other variable relating to quality of portfolio NPL/TL is non-significant. With regard to the measure of banks capital the variable EQTA is significant at 5% level with positive sign, when there is increase in capital, banks are more likely to use derivatives here the hypothesis is accepted which shows that capitalized banks are more likely to use derivatives showing the same results as Broccardo et al., (2014).

The variable trade shows a significant positive relationship with the derivatives utilization. Attitude and increased involvement in trading activities show that banks are more likely to use derivatives. There is also strong backing for this argument that banks having increased size are more likely to trade in the derivative markets. The reason behind this could be that the primary participation on the use of derivative instruments requires fixed costs, highlighting the "cost based incentives" to use the derivative instruments. Attitude and expertise in hedging activities shows significant positive relationship with the derivatives use.

Banks use derivatives for the purpose of risk mitigation (hedging). Banks have more likelihood of using derivatives for the purpose of hedging because of the external monitoring (Whidbee & Wohar, 1999). Li and Marinc (2014) suggested that small bank holding companies may use derivatives to larger extent for hedging purposes. Rampini &Viswanathan (2010) presented the risk management theory predicting that well-capitalized firms are more likely to hedge than the firms with constrained capital.

The variable financial distress is significant with negative sign. The profitability measure ROA for this variable yields significant negative sign. Therefore, we accept the null hypothesis (Broccardo et al., 2014). Use of financial derivatives reduces the likelihood of financial distress thereby reducing the costs associated with it (Mayers & Smith, 1987). For the given debt ratio the use of derivatives by banks will be lowering the prospects of financial distress (Froot & Stein, 1998).

The variable (Liquidity) substitute for hedging is significantly positive at 5 percent level. Indicating that substitutes do not decreases the likelihood of using derivatives thus accepting the hypotheses. Nguyen &Faff (2002)   determined liquidity as significant factor for the use of derivatives. The results also suggest that higher liquid banks are more likely to use derivatives.

With reference to the variable size (log of Total assets) is significant at 1 per cent level with expected positive sign. In contrast to smaller banks, the larger banks might be more able to attain economies of scale in maintaining and implementing a derivative strategy.

Conclusion

The analysis shows that there exists preeminent use of derivatives in Pakistan. Since, the year 2007 the usage of derivative instruments rose from 74% to 77% in the year 2014. The banks are using the derivatives for the purpose of buying and selling and for hedging against risks.

The significant difference was observed between user and non-user banks with respect to various characteristics. User banks have more risky assets and portfolios with non-performing loans. Whereas, non-users appear to have portfolios with better and high concentration of loans and were well capitalized. User banks were observed to be more oriented towards the use of risk transferring instruments through which they are able to achieve higher returns

The third research objective reveals that riskier banks tend to use derivative instruments more infrequently here rejecting the risk hypothesis. Large capitalized banks are more likely to use derivative instruments. This could also be effective to meet regulatory pressure such as restrictive regulatory prescriptions for banks in Basel 3 and also this represents an effective substitute to manage portfolio risks. The banks attitude and expertise in hedging activities also prompt banks to use derivatives. Financial distress positions also allow the banks to use derivative instruments. Banks are more likely to use derivative instruments when financial distress increases

Increased returns could be achieved by implementing derivatives strategy. Different derivative instruments could be set in a portfolio that minimize risk and maximize returns. There is significant difference between user and non-user banks, user banks are more benefited than the non-user banks. Therefore it is recommended for these banks, to enhance technical and human resource technologies that would be assisting them to use advanced derivative instruments in commercial businesses and also aids them in aligning themselves with the globalized environment.

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