Full Length Research Paper

Determinants of extent of financial derivative usage

Talat Afza[1]* and Atia Alam[2]

[1]Department of Business Administration, COMSATS Institute of Information Technology, Lahore, Pakistan.
[2]Department of Management Sciences, COMSATS Institute of Information Technology, Lahore, Pakistan.

The adaptation of free market policies in the world economy has increased the employment of risk management practices in corporation's financial decisions in order to reduce the variability in firm's future cash flows, due to the highly volatile exchange rates and interest rates. It is generally argued that, extensive usage of derivative instruments can minimize the firm's cash flow unpredictability by reducing financial distress costs, underinvestment problem, tax convexity and managerial ownership. Current paper attempts to identify the factors affecting the corporation's extent of both foreign currency and interest rate derivative instruments by Tobit model using the sample data of 105 non-financial firms listed on Karachi Stock Exchange. Aligned with the Pakistan derivative market, firm's extent of derivative usage is found to be positively related with lower financial distress costs, higher debt, underinvestment problem and fewer managerial holdings.

Key words: Hedging, derivatives, Pakistan, non-financial firms, interest rate exposure, foreign currency hedge.

INTRODUCTION

In a competitive financial environment, along with free market policies, usage of derivatives for the risk management purpose increases over time in order to reduce the impact of volatile exchange and interest rates on firm's future cash flows. Asian crises in 1998 and US financial crunch in 2007 provided the incentives to many corporations, especially Asian countries, for using derivatives instruments to hedge their respective risk exposure as their highly volatile home currency and interest rates make their cash flows more vulnerable to financial risks. According to survey report of International Swaps and Derivative Association, over 94% of the world's largest corporations are using derivative instruments to hedge their risk. Furthermore, foreign exchange derivative instruments are more widely used that is, about 88% of total surveyed sample firms whereas 83% firms are using interest rate derivatives. This growing usage of derivatives for hedging purpose inclined financial theorist to determine the factors affecting firm's extent of derivative usage.

Contrary to perfect capital market, assumptions by

Modigliani and Miller (1958), hedging theorists argue that under certain capital market imperfections like higher financial distress costs, underinvestment problem, tax convexity and agency costs, optimal usage of derivative instruments to hedge financial risk result in enhancement of firm value (Smith and Stulz, 1985; Stulz, 1984). Existing hedging theories segregate determinants of hedging usage in two mainstreams: first one is shareholder's wealth maximization hypothesis that hedging instruments are employed by corporations to minimize cash flow variability by reducing financial distress cost, underinvestment problem, agency cost of debt and tax convexity (Smith and Stulz 1985; Froot et al., 1993) while managerial risk aversion hypothesis states that, in order to protect their equity value, managers use hedging instruments in their own best interests.

Most of the existing literature consists of determinants of the usage of derivative instruments, fewer researchers have focused on examining the factors affecting the extent of such hedging usage. It is generally hypothesized that factors affecting firm's decision to use derivative instruments to hedge risk may be different from the determinants of intensity of such hedging usage. In the context of Pakistan, recent study by Afza and Alam (2010) had examined the factors affecting the decision to use derivative instruments by using the sample data of 105 non-financial firms of Pakistan listed on Karachi stock exchange. Current study attempts to determine the

---

*Corresponding author. E-mail: talatafza@ciitlahore.edu.pk.

Abbreviations: OSL, Ordinary Least Squares; REITs, real estate investment trusts.

factors affecting the extent (intensity) of corporation's derivative usage to hedge their financial risk exposure by using the sample data of 105 non-financial firms of Pakistan. Moreover, study examines whether the determinants of corporations decision to use derivative instruments to hedge risk are like determinants of extent of such derivative usage or whether the factors affecting the corporation's extent of derivative usage accords with the risk management theory.

LITERATURE REVIEW

Contrary to seminal work by Modigliani and Miller (1958), modern hedging theorists argued that under frictional world, corporations with higher financial distress costs, tax convexity, underinvestment problem and managerial risk aversion are more likely to sue hedging instruments extensively. Employing different proxies for the extent of hedging, researchers have found mixed evidence regarding the factors affecting the corporation's decision to use hedging instruments extensively.

Employing unbalanced panel data of 35-38 firms per year for three years, by taking average delta as a dependent variable, Tufano (1996) explores the determinants of the degree of price risk management by Gold mining industries of North America. One-side Tobit model is used to test the degree to which the gold mining industry involved in price risk management through financial contracts. Empirical findings depict an insignificant positive effect of leverage, tax convexity and firm value on corporation's degree of managing risk whereas consistent with the managerial risk aversion hypothesis, managerial ownership and managerial options demonstrate significant positive and negative impact on firm's degree of price risk management respectively.

In order to test the determinants of firm's hedging polices for the year 1997, a random sample data of 297 firms were selected from fortune 500 by Foo and Yu (2005). 230 firms out of 297 declared their derivative usage, which is 77% of the total sample data. Two different models ordinary least squares (OSL) and Tobit were used to explore the determinants of the extent of hedging; taking both notional and fair value as a dependent variable. The study concluded that determinants of decision to use hedging techniques vary greatly by extent of such decision. Managerial options appeared to have a significantly positive effect on firms' hedging policies, whereas financial distress cost, growth opportunities and tax convexities did not play a significant role in identifying corporation's extent of derivative usage.

Random sample of 186 real estate investment trusts (REITs) industry firm were used by Horng and Wei (1999) to empirically test the factors effecting the REITs Industry's decision to hedge firms risk exposure. 76 out of 186 firms mentioned their derivative usage in 1996 COMPUSTAT. Having notional value as a dependent variable, Tobit model was used as a proxy for the extent

of hedging. Empirical findings showed that small size firms are more likely to use hedging instruments extensively supporting financial distress costs hypothesis. Moreover, growth options, debt and cash depict a positive effect on the corporation's level of hedging, though, only leverage showed a significant positive effect on firms' level of hedging.

Using 100 U.S oil and gas producer companies, Haushalter (2000) identified the determinants of decision to use derivatives and the extent of such decision. Probit model and truncated model were employed respectively to test the factors affecting the corporation's decision to use derivatives and extent of such hedging decision. Findings for the extent of derivative usage were compatible with the financial distress hypothesis, and tax convexity. Managerial risk aversion and underinvestment hypothesis did not seem to be an important factor in deriving firms hedging policies.

Nguyen and Faff (2002) with a sample size of Australian 469 firms/year for the period of 1999-2000, identified the factors affecting the firm's decision to use derivatives extensively. Findings showed that extensive users were highly debited firms facing liquidity constraints and controlled by block holdings, whereas, non-users were found to have larger growth options and managerial holdings. Taking notional value as a dependent variable, Tobit model was used to measure the extent of hedging. Results support financial distress hypothesis and substitutes of hedging. Growth options and managerial risk aversion depicted negative influence on firm's extent of hedging usage.

The existing literature on determining the factors influencing the corporation's extent of derivative usage mostly focused on developed countries, little or no work is done in developing or emerging countries especially in Pakistan. Therefore, current study attempts to fill this gap by exploring the factors affecting the firm's extent of hedging usage by using 105 non-financial firms of Pakistan listed on Karachi Stock Exchange for the period of 2004-2008. It is expected that the current study helps practitioners in identifying the factors that effect firm value positively while using hedging instruments extensively.

METHODOLGY

Following Nguyen and Faff (2002), the present study examines firm's hedging policies as a function of financial distress cost, economies of scale, underinvestment hypothesis, tax convexity, managerial risk aversion hypothesis, foreign risk exposure and substitutes of hedging by using sample data of 105 non-financial firms listed on Karachi Stock Exchange for the period of 2004-2008. Managerial options are excluded from the model as data regarding options are not available in Pakistan. Almost 60% of total sample firms declared their usage of foreign currency derivatives and 70% firms are identified as interest rate derivative users. Financial sector has been excluded from the sample data since their business activities required derivative instruments to be used for both hedging and speculative purpose.

In order to measure mean difference between non-users,

moderate users and extensive users, non-parametric univariate analysis is undertaken. Tobit model is used to identify the determinants of extent of derivative usage for hedging purpose. Dependent variable is sum of fair value of foreign exchange derivative instruments and interest rate sensitivity value disclosed in notes of the annual reports of the sample firms. Profit and loss recognized in fair value hedging is recorded immediately in profit and loss account with the name of exchange rate fluctuations gain or loss. Therefore, net amount under the head exchange rate gain/loss is considered as a proxy for fair value of foreign exchange derivative contracts. Interest rate sensitivity is used as a proxy for the extent of hedging through interest rate derivative instruments. It is assumed that if the firm decides to hedge then most probably net value under the head interest rate sensitivity, disclosed in the notes of the annual reports, measure by subtracting total value of financial assets from financial liabilities, is hedged.

Model 1 demonstrates that extent of derivative usage is the function of financial distress costs, underinvestment costs, tax convexity and substitutes of hedging.

$$EXTDERIV_{it} = \alpha + \beta_1\ FDC_{it} + \beta_2\ INC_{it} + \beta_3\ SIZE_{it} + \beta_4\ AGCF_{it} + \beta_5\ TAX_{it} + \beta_6\ MNGRL_{it} + \beta_7\ LFS_{it} + \varepsilon_{it} \quad \dots\dots\dots\dots\dots (1)$$

Where,
$EXTDER_{it}$ = Extent of derivative usage of firm i for time period t
FDC_{it} = Financial distress cost of firm of firm i for time period t
INC_{it} = Interest coverage ratio of firm i for time period t
$SIZE_{it}$ = Log (total assets) of firm i for time period t
$AGCF_{it}$ = Ability to convert growth options into assets in place of firm i for time period t
TAX_{it} = Tax convexity of firm i for time period t
$MNGRL_{it}$ = Percentage of managers, employees and supplies ownership of firm i for time period t
LFS_{it} = Foreign sales of firm i for time period t

Firm's investment and financing policies can be affected by firm value so they are identified as firm's endogenous policies (Lin et al., 2008). Therefore in order to measure endogenity effect, Corporation's investment and financing policies are regressed separately on firm's extent of derivative usage. Model 2 below depicts the extent of hedging usage as a function of leverage, growth options, dividend payout and liquidity.

$$EXTDERIV_{it} = \alpha + \beta_1\ LEV_{it} + \beta_2\ MKBK_{it} + \beta_3\ DP_{it} + \beta_4\ QR + \varepsilon_{it} \quad \dots\dots\dots\dots(2)$$

Where:
LEV_{it} = Leverage of firm for firm i for time period t
$MKBK_{it}$ = Tobin's Q of firm i for time period t
DP_{it} = Dividend payout of firm i for time period t
QR_{it} = Quick ratio for firm i for time period t

RESULTS

Aligned with the theoretical framework, firms' extent of hedging usage is primarily dependent on financial distress costs, leverage, interest coverage ratio, size, growth options, and ability of firm to convert firms' growth options into assets in place, dividend payout, quick ratio, tax convexity, managerial ownership and foreign sales. For a comprehensive analysis, firms' extent of hedging usage is classified into three main categories, non-users, moderate users and extensive users. Corporation's that disclosed their inability in using derivative instruments to

hedge firms' foreign exchange rate exposure and interest rate risk exposure is categorized under the type of non-users. Whereas firms having notional value less than 75th percentile are considered under the category of moderate hedgers and the firms having notional value greater than 75th percentile are listed under the class of extensive hedgers.

Table 1 demonstrates univariate analysis for the extent of derivative usage. First column contains list of independent variables and column 2, 3 and 4 portray mean and standard deviation values of non-hedgers (140), moderate hedgers (248) and extensive hedgers (137). Whereas, column 5 and 6 demonstrates Mann-Whitney U values for the mean difference between non-user and moderate users and moderate users and extensive users respectively. Non-hedgers are identified as moderately financially distressed medium sized firms having lower leverage and high interest coverage ratio. Though, non-hedgers are facing somewhat high growth opportunities and have reasonable funds to transfer these growth opportunities into assets in place, therefore possess average profitability level as compared to other firms.

Supporting financial distress hypothesis, non-hedgers have lower dividend payout ratio as they face a little bit of financial distress costs and thus maintains moderate liquidity level for precautionary measures. Furthermore, in consistency with the hedging theory, non-hedgers are found to be having fewer tax losses and foreign exchange exposure while controlled by average number of managerial owners. Moderate hedgers are reported as highly financially distressed whereas small size firms with higher leverage ratio and normal ability to pay interest costs are facing lower growth options and higher ability to transfer those growth options into assets in place; though, having lower profitability and liquidity level. As compared to other two groups, moderate hedgers pay average dividend in order to reduce high interest and foreign exchange risk perceived by shareholders; as they face reasonable amount of tax losses and foreign exchange exposure.

In consistency with the theory, extensive hedgers are higher growth oriented large size firms with less ability to pay its finance costs and to convert its growth options into assets in place. Moreover, contrary to non-users and moderate users, extensive hedgers face high tax losses and foreign exchange exposure. However, in Pakistani scenario, transaction costs increase due to illiquid and amateur derivative market, therefore, low financially distressed firms with higher profitability level and lower financially constraints are more likely to use hedging instruments extensively. Along with the hedging substitute theory, corporations having higher dividend payout ratio have fewer cash holdings, thus using hedging instruments extensively in order to ensure investors that sufficient funds are available in hand. Higher managerial ownership in firms using hedging instruments extensively as compared to moderate hedgers verifies the existence of agency costs of equity in Pakistani firms.

Table 1. Univariate analysis for extent of all hedging instruments.

Variable	Mean (non-hedger) (145)	Mean (moderate hedgers) 0%values<75% > (122)	Mean (extensive hedgers) 75%<values<100% (77 hedgers)	Mean difference of non-user and moderate user	Mean difference of users and extensive users
FDC	5276 (0.2031)	0.4946 (.2064)	0.5438 (0.2188)	0.485	0.211
LEV	5528 (0.2208)	0.6019 (.1871)	0.5881 (0.1930)	0.052**	0.924
INC	5.4269 (3.7602)	4.7153 (3.1635)	4.1122 (2.6992)	0.178	0.193
SIZE	6.2777 (.5382)	6.1390 (.4534)	6.9482 0(.5164)	0.003***	0.000***
MKBK	1.2233 (0.7111)	1.2057 (.5160)	1.2483 (.6064)	0.599	0.844
AGCF	2.3185 (2.5345)	2.0761 (1.9193)	2.7605 (2.5414)	0.779	0.259
ROA	0.06813(0.08956)	0.0492 (.0807)	0.0822 (0.1059)	0.084*	0.041**
DP	0.1889 (0.3685)	2077 (.3057)	0.2081 (0.4020)	0.077*	0.819
QR	3.1131 (1.5693)	2.4235 (1.4096)	3.1804 (1.8867)	0.000***	0.003***
MNGRL	3.6360 (1.3375)	0.3.5480 (1.5398)	4.2466 (1.1674)	0.176	0.000***
TAX	.3310 (.4722)	0.4463 (.4991)	0.5324 (.5022)	0.046**	0.263
LFS	1.8523 (2.5919)	3.5480 (1.5398)	3.6394 (30455)	0.001***	0.004***

Note: ***,** and * are 1, 5 and 10% respectively.

Table 2 presents correlation matrix for independent and dependent variable. Results for the extent of derivative usage are negatively correlated with the financial distress costs and managerial ownership. While corporation's inability to pay its liabilities, its ability to convert growth options into assets in place and foreign exchange expo-sure are positively correlated with corporation's extent of derivative usage. Highly financially distressed firms are found to be large sized with lower ability to pay its interest liabilities, less managerial ownership and higher ability to convert growth options into assets in place and foreign exchange exposure. Corporation's having higher ability to pay interest costs have more ability to convert their growth options into assets in place, possessed fewer growth options and have lower foreign exchange exposure.

Model 2 depicts that corporation's extent of derivative usage is positively related with leverage and negatively related to growth options, dividend payout and liquidity. Negative correlation of leverage with growth options, dividend payout and liquidity supports agency cost, free cash flow theory and pecking order theory respectively. Aligned with the pecking order theory, growth options are positively correlated with the corporation's liquidity level. Empirical findings are presented in Table 3. Model 1, excluding variables representing endogenous policies, depicts positive relationship between corporation's financial distress cost and extent of derivative usage. Moreover, consistent with the financial distress hypothe-sis, corporations having lower ability to pay their interest payments are more likely to use derivative instruments extensively to hedge heir exchange rate exposures. Sup-porting, economies of scale hypothesis, large size firms are documented as extensive derivative user. In align with underinvestment hypothesis, corporations having lower ability to convert their growth options into assets in place are more tempted to use derivative instruments extensively in order to ensure shareholder's and debt holders that sufficient funds are available with the firm for investment purposes.

Negative relationship between managerial ownership and extent of derivative usage explains that higher mana-gerial ownership firms like to employ selective hedging in situations where benefits acquired from hedging exceed costs of risk management in order to enhance their equity. Tax convexity reflects negative effect on corpo-ration's extent of hedging. This might be due to the usage of dummy variable for tax convexity, and secondly, hedging tax losses does not enhance firm value as the transaction costs incurred in using hedging instruments exceeds benefit acquired from hedging tax losses because of the amateur derivative market of

Pakistan. Supporting foreign exchange exposure, corporation's having higher foreign sales are more likely to employ hedging instruments extensively.

Model 2 consists of variables representing firm's endogenous policies. Unexpected negative coefficients for leverage and growth opportunities depict that corpo-ration's having higher leverage and growth opportunities are currently in a financial distress state and therefore tend less towards using derivative instruments exten-sively. Supporting hedging substitutes, corporation's having higher dividend payout ratio and lower liquidity level are using hedging instruments extensively in order to avoid financially constraints.

Conclusion

Current study attempts to identify the factors affecting

Table 2. Correlation Matrix.

Variable	Model 1							
	FV	FDC	INC	SIZE	AGCF	MNGRL	TAX	LFS
FV	1							
FDC	0.0224	1						
INC	-0.0912*	-0.2773***	1					
SIZE	0.0834	0.1117**	0.109**	1				
AGCF	0.2805***	0.167**	-0.1125**	0.1051*	1			
MNGRL	-0.0045	-0.0072	-0.0676	-.1657***	0.0205	1		
TAX	0.0472	0.3275***	-0.319***	0.1071**	0.1254**	-0.0402	1	
LFS	0.1583***	0.1032*	-0.2292***	0.1187**	0.1888***	-0.0865	0.1353**	1

	Model 2				
	FV	LEV	MKBK	DP	QR
FV	1				
LEV	0.0219	1			
MKBK	-0.053	-0.1228**	1		
DP	-0.0122	-0.1974***	0.1998***	1	
QR	-0.0529	-0.3907***	0.1017*	0.1126**	1

Note: ***,** and* are 1, 5 and 10% significance level respectively.

Table 3. Tobit regression for all hedging instrument.

var16	Model 1			Model 2		
	Coefficient	t	P>t	Coefficient	t	P>t
FDC	-25330.25	-2.95	0.003***			
LEV				-903741.1	-0.71	.298
INC	-1121.732	-1.94	0.053*			
SIZE	2660.943	9.79	.206			
MKBK				-2119442	-1.42	.312
AGCF	5519.995	4.90	0.000***			
DP				101354.2	0.06	0.58
QR				-524774.3	-2.71	.000***
MNGRL	-9082.478	-2.31	.000***			
TAX	-3025.407	0.80	0.101			
LFS	2469.936	3.81	0.000*			
_cons	-3.80E+07	-9.59	.000***	5332417	1.43	.000***

Tobit regression	No. of observation=390 LR chi^2(9) =109.28		Tobit regression	No. of observation= 390 LR chi^{i2}(4) = 47.38
Log likelihood = -2384.6774	Prob > chi^2 = 0 Pseudo R^2 = 0.0159		Log likelihood = -2332.8739	Prob > chi^2 = .0000 Pseudo R^2 = 0.0068

Note: ***,** and * are 1, 5 and 10% significance levels, respectively.

extent of corporation's derivative usage to hedge foreign exchange and interest rate risk by using sample data of 105 non-financial firms listed on Karachi Stock Exchange for the period of 2004-2008. By taking sum of exchange rate and gain and loss and interest rate sensitivity as a dependent variable, Tobit model is regressed on financial distress costs, tax losses, managerial ownership and foreign exchange exposure. In order to address endogenity problem, corporation's investment and financing policies are regressed separately. Results are consistent

with the mathematical model provided by Smith and Stulz (1985) and amateur, and underdeveloped Pakistani derivative market.

Empirical findings support financial distress hypothesis that corporations having higher financial distress costs and inability of firm to convert growth options into assets in place are more likely to employ derivative instruments extensively in order to reduce cash flow invariability. Positive relationship between corporation's inabilities to convert growth options into assets in place and extensive usage of hedging instruments confirms existence of underinvestment problem and agency cost of debt in Pakistan. Managerial ownership depicts indirect relationship with the firm's extent of hedging usage because outside directors are more likely to employ risk management instruments in order to signal their repute in the market. Consistent with the foreign exchange exposure, corporation's having higher foreign sales are more likely to use hedging instruments extensively. Unexpected negative effect of tax losses on firm's extent of derivative usage might be due to the higher transaction costs as compared to the benefits acquired form trading in the hedging instruments to hedge tax convexity.

Current study explores the determinants of extent of derivative usage for hedging both foreign currency and interest rate hedging instruments and provides some important implications for academicians, decision makers and policy makers. For academicians, study helps in identifying the main determinants of extent of usage of hedging instruments in under-developed countries having amateur derivative market. Moreover, future research could be undertaken in determining the factors affecting the extent of derivative usage for foreign exchange and interest rate derivative usage individually for in-depth analysis. For decision makers, corporations having higher financial distress costs, financial constraints and foreign exchange exposure can enhance their firm's value by hedging their foreign exchange and interest rate exposure through extensive derivative usage. For policy makers, this study explains that despite of illiquid and amateur Pakistani derivative market; Pakistani non-financial firms intend to use hedging techniques extensively in order to minimize financial distress costs, financial constraints and foreign exchange exposure. Therefore, policy makers should develop a well-organized exchange traded derivative market so that financially constrained firms with highly variable cash flows and foreign sales can get benefit by optimally utilizing hedging techniques. As a result, it will not only facilitate the firms to achieve their primary goal of shareholders' wealth maximization, but may also enhance economic growth.

REFERENCES

Afza T, Alam A (2010), "Is Hedging a Value Maximizing Activity?" presented in a 2nd International Conference of AGBA South Asia Chapter held at Peal Continental Hotel, Bourbon, Pakistan on 21-23 July.

Foo M, Wayne Y (2001). The Determinants of Corporate hedging decision: An Empirical Analysis. Presented at the Northern Finance Association (NFA) 2001 Annual Meeting. September 28-30 in Halifax, Nova Scotia.

Froot KA, Scharfstein DS, Stein JC (1993). Risk Management: Coordinating Corporate Investment and Financing Policies. J. Financ., 48(5): 1629-1658.

Haushalter GD (2000). Financing Policy, Basis Risk, and Corporate Hedging: Evidence from Oil and Gas Producers. J. Financ., 55(1): 107-152.

Horng YS, Wei P (1999). An empirical study of the derivative use in the REITs industry. Real Estate Econ., 27(3): 561-587.

Modigliani F, Miller MH (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. Am. Econ. Rev., 48(3): 261-297.

Nguyen H, Faff RJ (2002). On the Determinants of Derivative Usage by Australian Companies. Austr. J. Manage., 27(1): 1-24.

Smith CW, Stulz RM (1985). The Determinants of Firms' Hedging Policies. J. Financ. Q. Anal., 20(4): 391-405.

Stulz RM (1984). Optimal Hedging policies. J. Financ. Q. Pol., 19(2): 127-140.

Tufano P (1996). Who Manages Risk? An Empirical Examination of Risk Management Practices in the Gold Mining Industry. J. Financ., 51(4): 1097-1137.