Journal of Accounting, Finance and Economics
Vol. 6. No. 1. March 2016. Pp. 30 – 48

Is Corporate Hedging Consistent with Value-Maximization in Emerging Markets? An Empirical Analysis of Indian Firms

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In this paper, the relation between hedging and leverage is studied using Indian firm data in the period 2002-2013 as the growth of Indian derivative markets has been rapid during this period following the economic liberalization. The analysis is carried out using a two-stage instrumental variable regression framework. The results show that hedging with derivatives allows firms to increase their debt ratio which results in a higher level of leverage leading to higher firm value from tax shields and are consistent with prior literature.

JEL Codes: C31, G31 and G32

1. Introduction

The Miller and Modigliani (1958, 1961) irrelevance propositions suggest that financial risk management at the firm level destroys investor value as shares of corporations are held by diversified investors who can eliminate non-systematic risk through their portfolio choices. More recent literature, however, shows that market imperfections create motivations for value-maximizing corporate managers to alter the risk vs. return profile of the firm. Market imperfections such as corporate taxation, costs of financial distress, various types of agency costs and information asymmetries account for the widespread use of risk management measures by corporations.

According to previous studies (Smith & Stulz 1985; DeMarzo & Duffie 1995; Phillips 1995; Breeden & Viswanathan 2016), firms use derivatives for financial risk management, in order to obtain funding and for investment purposes. Leland (1998) argues that hedging with derivatives increases firm value through two different channels related to the debt ratio. The principal gain comes from "the fact that lower average volatility allows higher leverage with consequently greater tax benefits." A secondary hedging gain comes from "lower expected default rates" and distress costs, resulting from unused debt capacity. That is, the majority of the gain comes from increased leverage/tax deductions but a portion of the increased debt capacity goes unused, resulting in lower distress costs, which also increases firm value. Thus, hedging allows firms to increase their debt ratio which results in a higher level of leverage leading to higher firm value from tax shields (Allayannis & Weston 2001a; Graham & Rogers 2002; Purnanandam 2008; Campello, Lin et al. 2011).

The objective of this paper is to analyse how the introduction of foreign currency derivatives (hedging) has affected the value-maximizing behaviour of Indian firms (through leverage) using a comprehensive sample in the period between 2002 and 2013. Indian firms were

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traditionally not allowed to use derivatives; however, the economic liberalization of the early 1990s facilitated the rapid growth of foreign exchange in India. Major changes in Indian foreign exchange market were observed in the period 2002-2013. Since early 2000s persons resident in India were allowed to enter into forward contracts on the basis of underlying exposures. In this context, the Indian firm data in the period 2002-2013 is a unique dataset.

This study contributes to the empirical risk-management literature by analysing foreign currency risk-management activities of a comprehensive sample of nonfinancial firms. Existing empirical studies in this area investigate only well developed economies and the analysis is limited to a period of one or two years. In this study, foreign currency risk-management activities of a comprehensive sample of nonfinancial firms in an emerging economy are analysed for a period of twelve years. New empirical evidence is provided on the change in the value-maximizing behaviour of firms after the introduction of foreign currency derivatives. The results are broadly consistent with prior literature and show that a positive relationship exists between hedging and leverage for moderately leveraged firms which reverses for highly leveraged firms.

The rest of the paper is organized as follows; Section 2 provides a broad literature review, Section 3 explains the two-stage instrumental variable regression framework used for the analysis, Section 4 describes the criteria used for selecting the data, Section 5 discusses the regression results, Section 6 presents robustness checks and Section 7 concludes.

2. Literature Review

This Section briefly summarizes the literature relating hedging and risk management. The motivations for corporate hedging and prior empirical evidence that suggests that hedging improves firm value are discussed.

2.1 Motivations for Corporate Hedging

Smith and Stulz (1985) develop a positive theory of the hedging behaviour of value-maximizing corporations and show that a value-maximizing firm can hedge for three reasons:

- Taxes
- Costs of financial distress
- Managerial risk aversion

Geczy et al. (1997) examine firms' use of currency derivatives in order to differentiate among various theories of hedging behaviour. Their results are consistent with the hypothesis that hedging can reduce underinvestment costs associated with investment opportunities in the presence of financial constraints (see Froot et al. 1993; Dolde 1995; Gay & Nam 1998; Deshmukh & Vogt 2005). Phillips (1995) surveys the use of derivatives practices and instruments among treasury professionals. The study documents that 63.2% of the respondents use derivative contracts, derivative securities or both; 70.8% of the users report that their firms use derivatives for financial risk management; 66.7% of the users report that their firms use derivatives in conjunction with obtaining funding; and 21.4% of the users report that their firms use derivatives for investment purposes. Bodnar, Hayt and Marston (1998) survey 1928 US nonfinancial firms about the use of financial derivatives. The study finds that of the firms using derivatives foreign-exchange (FX) risk is the risk most commonly managed with derivatives, being done so by 83% of all derivatives users.

According to DeMarzo and Duffie (1995) financial hedging improves the informativeness of corporate earnings as a signal of managerial ability and project quality by eliminating extraneous noise. Petersen and Thiagarajan (2000) examine a setting in which the derivatives strategies of two firms are known, but completely different. One firm aggressively hedges its risk using derivatives. The other firm uses a combination of operating and financial decisions, but no derivatives, to manage its risk. It is shown that the different choice of methods is a result of different abilities to adjust operating costs and different needs for investment capital. Haushalter (2000) examines the hedging policies of 100 oil and gas producers between 1992 and 1994 to investigate whether hedging policies of a firm are related to its financial policy, tax status, compensation policy, ownership structure and operating characteristics. The evidence shows that companies with greater financial leverage manage price risks more extensively.

2.2 Firm Value Maximization

This section addresses the fundamental question whether hedging increases firm value. Nance, Smith et al. (1993) provide empirical evidence on the finance theory hypotheses that hedging increases firm value by reducing expected taxes, expected costs of financial distress or other agency costs. Their survey consists of data on firms' use of forwards, futures, swaps and options combined with COMPUSTAT data on firm characteristics. The accumulated evidence suggests that firms which hedge; face more convex tax returns, have less coverage of fixed claims, are larger, have more growth options in their investment opportunity set and employ fewer hedging substitutes. The results remain the same despite increasing the power of the tests and provide a basis for a consistent view of hedging as a component of corporate financial policy. Allayannis and Weston (2001a) shed light on this important issue by providing evidence on the existence of a hedging premium. Specifically they find that, on average, firms that face currency risk and use currency derivatives have a 4.87% higher value than firms that do not use currency derivatives. The analysis by Graham and Rogers (2002) indicates that hedging with derivatives allows firms to increase their debt ratio by 3.03%. The consequence is a higher level of leverage leading to 1.1% higher firm value from tax shields. It is clear that the most significant advantage of increased debt capacity is derived from increased level of leverage (Leland 1998).

Acharya, Almeida et al. (2007) show that firms can use different combinations of cash and debt to transfer resources across future states of the world. These transfers allow constrained firms to improve the match between financing capacity and investment opportunities, and therefore can be value-enhancing. Purnanandam (2008) models a firm's leverage and hedging in an endogenous framework using a comprehensive dataset. Consistent with the theory, the model predicts a positive relation between leverage and hedging for moderately leveraged firms, which reverses for highly leveraged firms. Campello, Lin et al. (2011) show that hedgers pay lower interest spreads and are less likely to have capital expenditure restrictions in their loan agreements. These favourable financing terms, in turn, allow hedgers to invest more. Using a natural experiment and data from energy utilities, Perez-Gonzalez and Yun (2013) find that derivatives lead to higher valuations, investments, and leverage.

3. Research Methodology

Hedging lowers the volatility of firm value, which in turn lowers the probability of bankruptcy and allows firms to borrow more for a given level of the tax benefit of debt. This leads to endogeneity[1] between leverage and hedging. Therefore, while modeling the relation between hedging and leverage it becomes important to account for endogeneity bias. In such circumstances, the method of instrumental variables is be used to eliminate the problem of

endogeneity of one or more explanatory variables. Further, the computational method of two stage least squares is used for estimating linear equations that link the leverage and hedging decisions of firms (see Graham and Rogers 2002; Purnanandam 2008).

In accordance with earlier research, the following model is estimated in a two-stage instrumental variable regression framework:

$$LEVERAGE = \alpha_0 + \alpha_1 * HEDGING + \sum \gamma * X_i + \varepsilon_i \quad \text{..... (Equation 1)}$$

$$HEDGING = \beta_0 + \beta_1 * LEVERAGE + \beta_2 * SQRLEVERAGE + \sum \delta * Y_i + \epsilon_i. \quad \text{(Equation 2)}$$

The first-stage equation is an Ordinary Least Squares (OLS) model for the leverage decision, whereas the second equation models a firm's hedging (foreign currency derivatives) decisions. The leverage of the firm is defined as the ratio of total liabilities to the book value of total assets. In the second stage, the risk-management equation is estimated using the predicted value of the leverage as the explanatory variable in the Tobit[2] or Logit[3] estimation. To investigate the effect of high levels of leverage on hedging, sqrleverage is included as an additional explanatory variable in the second equation. X and Y represent control variables (such as firm size, quick ratio, modified Z-score etc.) affecting firms' leverage and foreign currency hedging decisions, respectively.

4. Data Description

Major changes in Indian foreign exchange market were observed in the period 2002-2013. Figure 1 shows the growth of foreign exchange trading in India. The economic liberalization of the early 1990s facilitated the rapid growth of foreign exchange in India (refer Table 1 for the chronology of introduction of derivatives in India). Therefore, the Indian firm data in the period 2002-2013 is a unique dataset as it would provide useful insights on how the introduction of foreign currency derivatives (hedging) has affected the value-maximizing behaviour of Indian firms (through leverage).

The analysis in this paper is limited only to those nonfinancial firms that have well-defined exposures to foreign currency risks. Financial firms and Utilities are excluded from the sample because the risk-management incentives of these firms are not necessarily similar to other industrial firms. A pre-defined exposure to foreign currency risk and data on net sales, leverage and market capitalization is required to be available for a firm to be included in the sample. Commodity derivatives are not included in this study.

Figure 1: Growth of foreign exchange trading in India between 1996 and 2014[4]

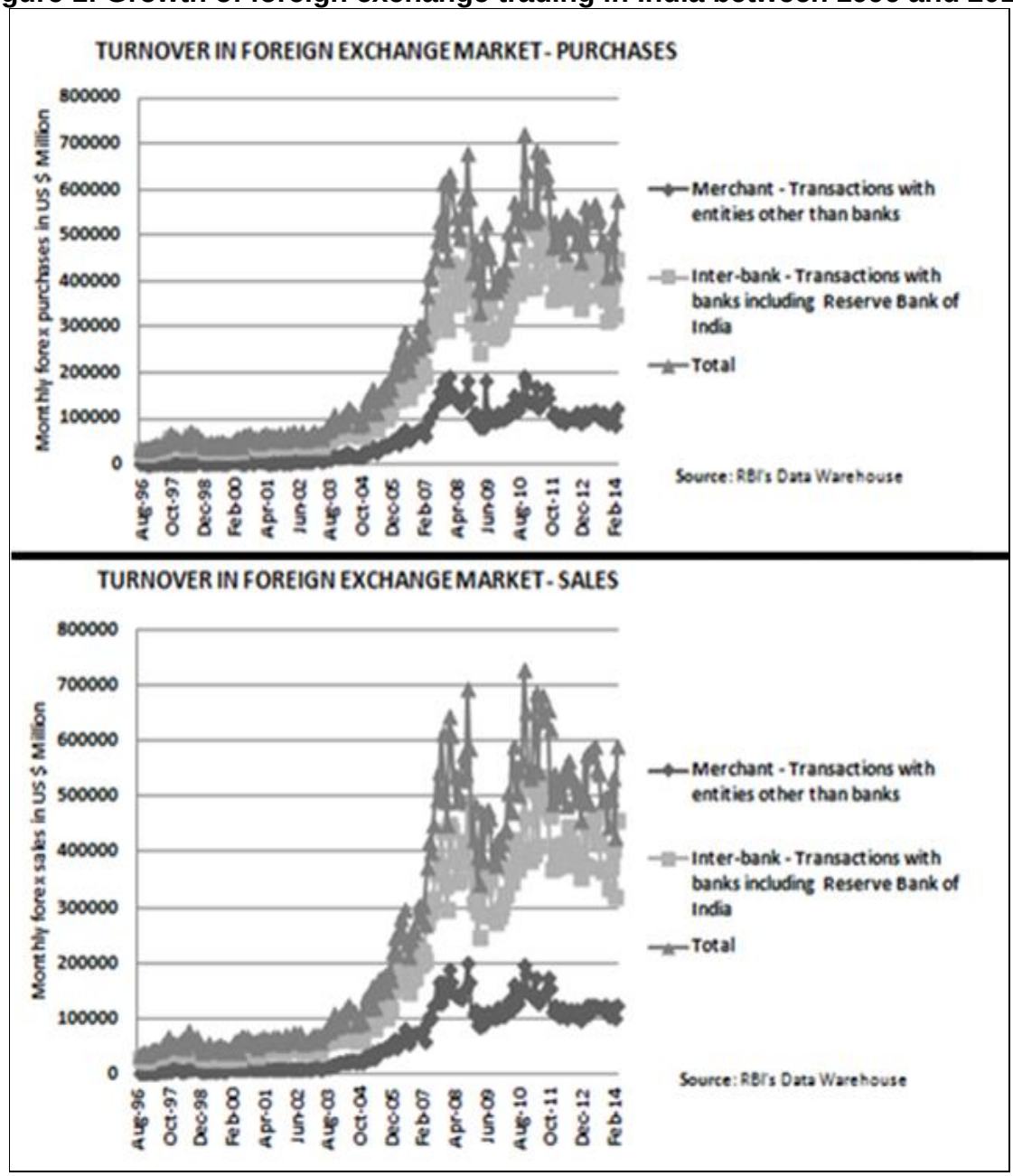


Table 1: Derivatives in India: A Chronology [5]

Date	Progress
1952	Enactment of the forward contracts (Regulation) Act
1953	Setting up of the forward market commission
1956	Enactment of Securities Contract Regulation Act 1956 (SCRA)
1969	Prohibition of all forms of forward trading under section 16 of SCRA
1980	Khuso Committee recommends reintroduction of futures in most commodities
1983	Government amends bye-laws of exchange of Bombay, Calcutta and Ahmedabad & introduced carry forward trading in specified shares
1991	**Liberalization process initiated**
1992	Enactment of the Securities and Exchange Board of India (SEBI) Act
1993	SEBI Prohibits carry forward transactions
1994	Kabra Committee recommends futures trading in 9 commodities
1995	G.S. Patel Committee recommends revised carry forward system
Dec 1995	NSE asked SEBI for permission to trade index futures
Nov 1996	SEBI setup LC Gupta Committee to draft framework for index futures
May 1998	LC Gupta committee submitted report
Jul 1999	**Interest rate swaps/Forward rate agreements allowed by RBI**
May 2000	SEBI gave permission to NSE & BSE for index futures trading
Jun 2000	Trading of Index futures commenced at BSE
Jun 2000	Commencement of Derivatives Trading (Index Futures) at NSE
Jun 2001	Index Options launched at BSE
Jun 2001	Commencement of trading in Index Options at NSE
Jul 2001	Commencement of trading in Options on Individual Securities at NSE
Jul 2001	Stock options launched at BSE
Nov 2001	Stock futures launched at BSE
Nov 2001	Commencement of trading in Futures on Individual Securities at NSE
Jul 2003	**Foreign currency – rupee options allowed by RBI**
Aug 2008	**Currency futures allowed by RBI**
Aug 2008	Launch of currency derivatives at NSE
Aug 2009	Launch of interest rate futures at NSE
Oct 2010	Introduction of Currency options on USD INR at NSE
Nov 2013	Launch of Currency Derivatives BSE CDX
Jan 2014	Launch of Interest Rate Futures BSE IRF

4.1 Control Variables & Instruments

The control variables/instruments used are motivated by prior literature. First, to capture the size effects in derivative usage, firm size (SIZE) as measured by log of sales is used (Dolde 1993). Market-to-book ratio (MTB) and the ratio of research and development (RND) expenses to total sales are used as a proxy for firm's growth opportunities. Froot et al. (1993) predict a positive relation between hedging and growth opportunities as hedging can minimize the underinvestment problem. Acharya, Almeida et al. (2007) argue that cash can serve as a hedge against future cash shortfalls for financially constrained firms, therefore quick ratio of the firm (QUICK) is included as a measure of the firm's liquid assets. Foreign sales as a percentage of a firm's total sales is included as an additional control variable (FSALE) as Jorion (1991) shows that foreign sales is a good proxy of a firm's exchange rate risk exposure. The natural foreign currency hedge effects are controlled by including the number of geographical segments (SEGNO) in which the firm operates in (Allayannis et al. 2001b). Due to limitations in the database the maximum number of segments a firm operates is counted as ten even if the firm operates in more than ten geographic segments.

Following earlier literature (Purnanandam 2008), depreciation and amortization scaled by the total assets of the firm (DA/TA) and firm's net income to net sales ratio (NI/SALES) are used as instruments. DA/TA is used as a measure of the firm's nondebt tax shield and NI/SALES is used to capture the effect of recent profitability on a firm's capital structure. Both these instruments are included in the first stage regression and possess good statistical properties. Additional control variables are included in the first stage regression to control for well-known drivers of cross-sectional dispersion in leverage ratios. Property, Plant and Equipment scaled by total assets (PPE) is included to control for the collateral available for borrowing. A firm's modified Z-score, MODZ (Equation 3) is included to control for the effect of firms that may currently be in financial distress. MODZ excludes the effect of leverage from the original Altman Z-score to avoid a mechanical relation between leverage and this variable (Graham et al. 1998). Following the similar method, the Altman Z-score excluding the effect of leverage for emerging markets[6] is EModz (Equation 4).

$$MODZ = \frac{3.3\ EBIT + Sales + 1.4\ Retianed\ Earnings + 1.2\ Working\ Capital}{Total\ Assets} \quad \text{(Equation 3)}$$

$$EMODZ = 3.25 + \frac{6.72\ EBIT + 3.26\ Retianed\ Earnings + 6.56\ Working\ Capital}{Total\ Assets} \quad \text{(Equation 4)}$$

Therefore, the following model is estimated by including the control variables & instruments in the two-stage instrumental variable regression framework (Equations 5 and 6 are extended versions of Equations 1 and 2):

$$LEVERAGE = \alpha_0 + \alpha_1 * HEDGING + \alpha_2 * SIZE + \alpha_3 * QUICK + \alpha_4 * FSALE + \alpha_5 * RND + \alpha_6 * DA/TA + \alpha_7 * NI/SALES + \alpha_8 * PPE + \alpha_9 * MODZ + \alpha_{11} * MTB + \alpha_{12} * SEGNO + \varepsilon_i \quad \text{(Equation 5)}$$

$$HEDGING = \beta_0 + \beta_1 * LEVERAGE + \beta_2 * SQRLEVERAGE + \beta_3 * SIZE + \beta_4 * QUICK + \beta_5 * FSALE + \beta_6 * RND + \beta_7 * MTB + \beta_8 * SEGNO + \epsilon_i \quad \text{(Equation 6)}$$

4.2 Logit Estimation

The Logit estimation is used to model a firm's binary decision of whether or not to use derivatives for hedging foreign currency risk. The firm data required is collected from the database DataStream for nonfinancial firms listed on S&P CNX 500 in the period from 2002 to 2013. A firm is classified as being exposed to foreign currency risk if it reports foreign currency sales (FSALE) or operates in multiple geographical locations (SEGNO) around the world (see Geczy, Minton & Schrand 1997). Table 2 provides summary statistics of all the nonfinancial firms that satisfy the data requirements.

Table 2: Summary Statistics of the firms exposed to FX Risk (S&P CNX 500)

Year	Firms	Size			Leverage			MTB		
		Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
2002	51	22.94	22.79	1.23	0.48	0.51	0.22	2.58	1.31	2.71
2003	64	22.97	22.82	1.23	0.50	0.54	0.21	2.33	1.46	3.05
2004	75	22.97	22.85	1.25	0.51	0.53	0.19	3.19	2.41	2.75
2005	85	23.27	23.16	1.28	0.53	0.58	0.19	4.21	3.11	3.45
2006	102	23.34	23.15	1.34	0.54	0.59	0.19	5.39	4.03	4.38
2007	118	23.64	23.45	1.33	0.55	0.58	0.19	5.57	4.05	5.49
2008	135	23.75	23.66	1.32	0.56	0.60	0.18	4.45	2.55	8.47
2009	141	23.94	23.80	1.31	0.57	0.62	0.19	2.73	1.36	5.51
2010	150	24.01	23.93	1.33	0.53	0.57	0.19	4.34	2.67	8.61
2011	166	24.15	24.06	1.30	0.55	0.57	0.19	3.76	2.24	5.58
2012	176	24.33	24.13	1.30	0.56	0.58	0.19	3.40	2.00	5.31
2013	184	24.45	24.25	1.28	0.55	0.56	0.21	2.97	1.64	4.42

The dependent variable (hedging) in the Logit estimation takes the value of one if a firm uses foreign currency derivatives and zero otherwise. A firm is classified as being a derivative user if it is exposed to foreign currency risk and amount of 'foreign exchange transactions' reported by the firm is not equal to zero. It is important to note that the foreign exchange transactions data (from the database Datastream) is used because a uniform measure was required for the period 2002-2013 and it was the closest available approximation for foreign currency derivatives use of a firm on the database Datastream. Table 3 provides the descriptive statistics of foreign currency derivatives users and non-users.

Table 3: Descriptive Statistics of FX Derivatives Usage (S&P CNX 100): Total firms exposed to FX Risk (T), Derivatives Users (U) and non-users (N)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
T	51	64	75	85	102	118	135	141	150	166	176	184
U	31	44	57	66	84	97	122	125	135	148	161	169
N	20	20	18	19	18	21	13	16	15	18	15	15

4.3 Tobit Estimation

In the Tobit model, the value of the dependent variable (hedging) is defined as the ratio of net notional amount of foreign currency derivatives to the book value of total assets (for hedgers) or zero (for non-hedgers). Data on foreign currency derivatives usage is obtained by searching for the words: "risk", "hedg"[7] and "derivative" in the annual reports of nonfinancial firms listed on S&P CNX 100[8] in the period from 2011 to 2013. When compared to the Logit model, a

smaller sample size/period is used for Tobit model due to limited availability of the annual report data. Table 4 provides the descriptive statistics of the sample. A firm is classified as being exposed to foreign currency risk (Panel A, Table 4) if it reports foreign currency sales or multiple geographical locations in the annual report. Panel B (Table 4) provides the statistics of the net notional amount of foreign currency derivatives scaled by the total assets of the firm.

Table 4: Descriptive Statistics (S&P CNX 100)

Firms\ Year	2011	2012	2013
PANEL A			
Total Number of Firms Exposed	63	63	63
Number of Derivative Users	47	49	48
Number of non-users	16	14	15
PANEL B			
Mean of Net Notional/Total Assets	0.088856	0.121085	0.10623
Median of Net Notional/Total Assets	0.033168	0.029142	0.029187
SD of Net Notional/Total Assets	0.160997	0.236173	0.207341

Other than the details on foreign currency derivatives, the firm data required is collected from the database DataStream. Table 5 provides summary statistics of all the nonfinancial firms that satisfy the data requirements in the sample period.

Table 5: Summary Statistics of the firms exposed to FX Risk (S&P CNX 100)

Year	Firms	Size			Leverage			MTB		
		Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
2011	63	25.56	25.33	1.20	0.51	0.54	0.19	5.34	4.14	4.93
2012	63	25.75	25.45	1.22	0.49	0.51	0.20	4.79	3.24	5.50
2013	63	25.84	25.48	1.24	0.49	0.49	0.21	4.85	2.91	6.39

5. Empirical Evidence

5.1 Foreign Currency Hedging – Binary Decision

In this section, a firm's hedging incentives to leverage is modeled using the data of nonfinancial firms listed on S&P CNX 500 in the period from 2002 to 2013 and the two-stage instrumental variable regression framework. The first-stage equation is an Ordinary Least Squares model (Equation 1) for the leverage decision, whereas the second equation (Equation 2) models a firm's binary decision of whether or not to use derivatives for hedging foreign currency risk using Logit estimation (refer section 4.2). As the aim of this study is to analyse how the introduction of foreign currency derivatives (hedging) has affected the value-maximizing behaviour of Indian firms (through leverage) therefore the cross-sectional regression analysis (using the two-stage regression framework) is conducted for every year in the period 2002-2013 in order to observe the change in trends, if any. In order to save space, only the cross-sectional regression results for a representative year (year 2012) are presented in Table 6. The first two columns of Table 6 present the results of OLS regression model for leverage and last two columns present the results of the Logit model. The Logit regression model is estimated with firm's foreign currency derivative usage as the dependent variable (one for hedgers and zero for non-hedgers). For easier interpretation, the values of marginal

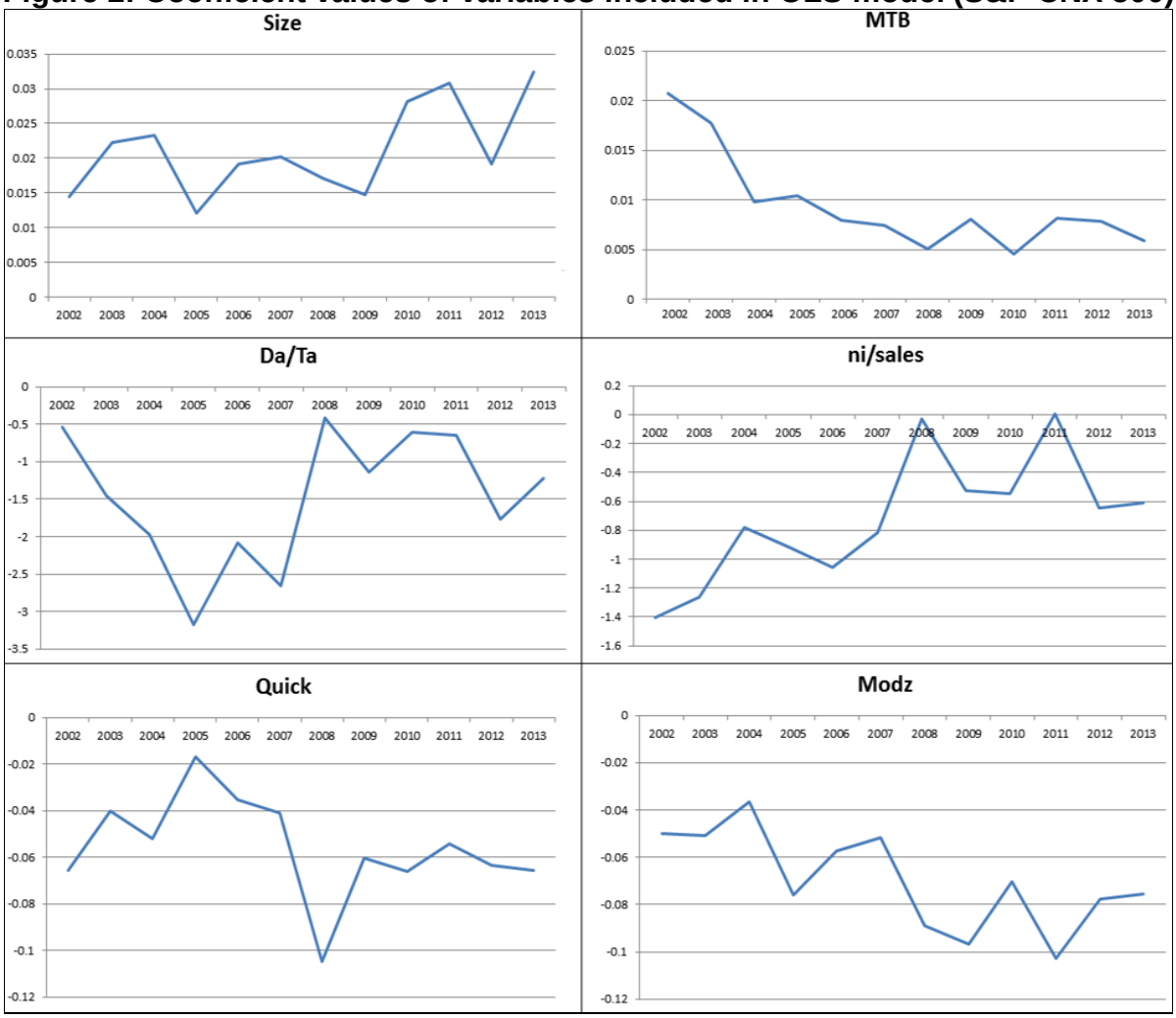
effect of the explanatory variable evaluated at mean rather than the raw estimated coefficient from the Logit model are presented.

Table 6: OLS and Logit Regression results for the year 2012 (S&P CNX 500)

Year 2012	LEVERAGE		HEDGING	
	Coefficients	t Stat	Coefficients	z
SIZE	0.019144	2.589011	-0.00869	-0.97
LEVERAGE			0.287686	0.27
SQRLEVERAGE			-0.51422	-0.56
QUICK	-0.06349	-6.40265	0.019174	0.52
FSALE	0.000196	0.566345	0.000403	0.92
RND	-1.57109	-2.85176	-0.84033	-1.27
DA/TA	-1.77193	-2.73295		
NI/SALES	-0.64651	-5.11882		
PPE	-0.0253	-0.40549		
MODZ	-0.07758	-4.99283		
MTB	0.007862	3.538347	-1.4E-05	-0.01
SEGNO	5.26E-06	0.000545	-0.00168	-0.16
R SQUARE	0.624911			
N	176		176	

The coefficient values of significant variables included in OLS model and Logit estimation for every year in the period 2002-2013 are plotted in Figures 2 & 3 respectively. Refer Table 6 for the coefficient values of the variables for year 2012.

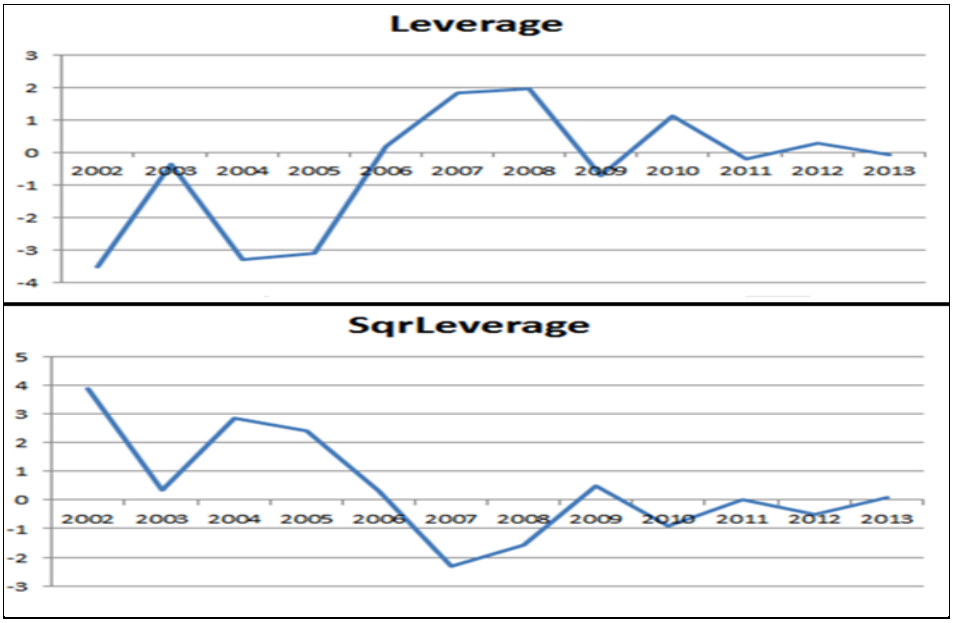
Figure 2: Coefficient values of variables included in OLS model (S&P CNX 500)



From Figure 2, it can be observed that the coefficients of the instrument variables DA/TA and NI/SALES are negative indicating that firms with higher DA/TA and NI/SALES have lower debt. While DA/TA measures the disincentive of debt rather than directly measuring the incentive to use debt based on tax considerations, NI/SALES captures the effect of recent profitability on a firm's capital structure (i.e., firms with higher profitability have lower leverage). The coefficient of MTB is positive showing that higher growth opportunities implies higher leverage whereas the coefficient of QUICK is negative showing that more liquid assets means less leverage. As expected the SIZE of a firm positively impacts leverage and a financially distressed firm gets lower debt (MODZ).

It should be noted that the values plotted in Figure 3 are the marginal effects and show the change in probability of hedging for one unit change in LEVERAGE and SQRLEVERAGE. From Figure 3, it can be observed that after year 2005 there is a change in the sign of coefficient value of LEVERAGE (from negative to positive) and SQRLEVERAGE (from positive to negative). This could be attributed to the fact that transactions in foreign exchange market had gained momentum only towards the end of the year 2005 (Figure 1) due to regulatory changes (Table 1). The coefficient values remain mostly positive for LEVRAGE and mostly negative for SQRLEVERAGE from the year 2006.

Figure 3: Coefficient values of variables included in Logit model (S&P CNX 500)



Consistent with the theory, it is empirically found that a non-monotonic relation exists between leverage and hedging. A positive relation exists between leverage and hedging for moderately leveraged firms, which reverses for highly leveraged firms. The results confirm that hedging allows firms to increase their debt ratio which results in a higher level of leverage. However, the marginal effects are almost zero as the number of Foreign Currency Derivatives Non-users included in the sample decreases rapidly over the years (Table 3).

5.2 Foreign Currency Hedging – Notional Amount

The regression results relating a firm's net notional amount of foreign currency derivatives usage to leverage and other control variables are discussed in this section. The results of the cross-sectional regression analysis conducted for the years 2013, 2012 and 2011 using the data of nonfinancial firms listed on S&P CNX 100 are presented in Tables 7, 8 and 9 respectively. The first two columns of Tables 7, 8 and 9 present the results of the Ordinary Least Squares model (Equation 1) using leverage of the firm as the dependent variable and last two columns present the results of the Tobit estimation (Equation 2) using the ratio of firm's net notional amount of foreign currency derivatives to the book value of total assets as the dependent variable (refer section 4.3).

It can be observed that the trend of the coefficient values of various instrument and control variables are similar when hedging is defined as a firm's binary decision of whether or not to use derivatives or as a firm's net notional amount of foreign currency derivatives for hedging foreign currency risk. In the first-stage or OLS model, the coefficients of the instrument variables DA/TA and NI/SALES are negative indicating that firms with higher DA/TA and NI/SALES have lower debt. The coefficient of MTB is positive showing that higher growth opportunities implies higher leverage whereas the coefficient of QUICK is negative showing that more liquid assets means less leverage. As expected the SIZE of a firm positively impacts leverage and a financially distressed firm gets lower debt (MODZ). In the second stage, the risk-management equation is estimated using the predicted value of the leverage as the explanatory variable in the Tobit estimation. For easier interpretation, the values of marginal effect of the explanatory variable evaluated at mean rather than the raw estimated coefficient

from the Tobit model are presented. As expected, the coefficient of LEVERAGE is positive whereas the coefficient of SQRLEVERAGE is negative. The two-stage instrumental variable regression analysis is repeated using EMODZ instead of MODZ for the sample size/period (S&P CNX 100 firm data for the years 2013, 2012 and 2011). No significant changes in results are observed.

Table 7: OLS and Tobit Regression results for the year 2013 (S&P CNX 100).

Year 2013	LEVERAGE		HEDGING	
	Coefficients	t Stat	Coefficients	z
SIZE	0.057586	3.725908	-0.00158	-0.06
LEVERAGE			0.49276	0.51
SQRLEVERAGE			-0.57129	-0.63
QUICK	-0.03931	-2.62361	0.028849	0.7
FSALE	-0.00079	-1.08414	0.003204	2.72
RND	-0.1414	-0.12775	-2.09214	-1.19
DA/TA	-0.55465	-0.48565		
NI/SALES	-0.48086	-3.67849		
PPE	-0.11971	-1.0787		
MODZ	-0.11703	-3.60537		
MTB	0.013079	3.345592	-9.9E-05	-0.02
SEGNO	0.001914	0.097236	0.017824	0.56
R SQUARE	0.712758			
N	63		63	

Table 8: OLS and Tobit Regression results for the year 2012 (S&P CNX 100)

Year 2012	LEVERAGE		HEDGING	
	Coefficients	t Stat	Coefficients	z
SIZE	0.056974	3.953649	-0.02634	-0.97
LEVERAGE			3.770798	3.09
SQRLEVERAGE			-3.13036	-2.85
QUICK	-0.05259	-3.3722	0.162119	3.19
FSALE	-0.00062	-0.83551	0.004784	4
RND	0.501568	0.460986	-2.78953	-1.6
DA/TA	-0.74153	-0.66852		
NI/SALES	-0.47399	-3.26162		
PPE	-0.09258	-0.84744		
MODZ	-0.13455	-4.05142		
MTB	0.017937	4.334274	0.00329	0.57
SEGNO	0.000714	0.040498	-0.004	-0.13
R SQUARE	0.722637			
N	63		63	

Table 9: OLS and Tobit Regression results for the year 2011 (S&P CNX 100)

Year 2011	LEVERAGE		HEDGING	
	Coefficients	t Stat	Coefficients	z
SIZE	0.060372	4.533078	-0.01731	-0.75
LEVERAGE			0.68971	0.67
SQRLEVERAGE			-0.42459	-0.43
QUICK	-0.05481	-3.36043	0.022543	0.5
FSALE	-0.00081	-1.13806	0.003699	3.35
RND	-0.32623	-0.34324	-0.75828	-0.51
DA/TA	-3.18928	-2.70312		
NI/SALES	-0.57813	-4.65894		
PPE	-0.05599	-0.58909		
MODZ	-0.13563	-4.38169		
MTB	0.021588	5.011212	-0.00305	-0.55
SEGNO	0.010582	0.613286	-0.01143	-0.43
R SQUARE	0.750014			
N	63		63	

6. Robustness Checks

As an alternative model specification the impact of the changes in leverage on the changes in derivatives holding are analysed using a Logit as well as OLS regressions. This change regression model would control for unobserved firm-specific factors since by construction it removes effects that could be correlated with both hedging and leverage at any given point in time (Purnanandam 2008). The following equation is estimated:

$$\Delta hedg_{x,t} = \beta_0 + \beta_1 * \Delta lev_{x,t} + \beta_2 * \Delta sqrlev_{x,t} + \sum \delta * Y_{x,t} + \epsilon_{x,t} \quad \text{..... (Equation 7)}$$

The dependent variable $\Delta hedg_{x,t}$ takes a value of one for an increase in hedging and zero for a decrease; $\Delta lev_{x,t}$ measures the change in leverage of firm x in year t; $\Delta sqrlev_{x,t}$ is the squared change in leverage for firms with an increase in leverage, zero otherwise and all other control variables in the model are also first differenced.

Tables 10 and 11 present the results of the Change regression for the years 2012-2013, 2011-2012 respectively. The Tables show the results of the Change regression framework where changes in foreign currency derivatives holding are regressed on changes in leverage and

other firm characteristics. The first two columns present the results of OLS regression model and last two columns present the results of the Logit model. For easier interpretation, the values of marginal effect of the explanatory variable evaluated at mean rather than the raw estimated coefficient from the Logit model are presented. In both OLS and Logit models, firms with a moderate increase in leverage are more likely to increase their hedging positions as evident by a positive coefficient on ΔLEV. In contrast, firms with a very high increase in leverage are more likely to decrease their hedging intensities as evident by a negative coefficient on ΔSQRLEV. Due to data limitations, the coefficients are not very significant.

Table 10: Change Regression results for the 2012-2013 (S&P CNX 100)

Year 2012-2013	OLS		LOGIT	
	Coefficients	t Stat	Coefficients	z
ΔSIZE	-0.39227	-0.45332	-0.84751	-0.89
ΔLEV	0.820872	0.262797	1.328062	0.4
ΔSQRLEV	-41.3234	-0.385	-57.2982	-0.42
ΔQUICK	-0.03293	-0.08831	-0.02622	-0.07
ΔFSALE	0.005095	0.638887	0.004345	0.37
ΔRND	8.413038	0.359187	18.48221	0.75
ΔDA/TA	-19.1804	-1.00455	-17.3628	-0.66
ΔNI/SALES	0.919548	0.513496	9.91594	1.56
ΔPPE	-2.38268	-0.86311	-4.19821	-1.39
ΔMODZ	0.331458	0.540782	-0.23724	-0.29
ΔMTB	-0.02763	-0.39031	-0.03279	-0.39
ΔSEGNO	0.014578	0.096441	0.010802	0.05
R SQUARE	0.17241			
N	49		49	

Table 11: Change Regression results for the 2011-2012 (S&P CNX 100)

Year 2011-2012	OLS		LOGIT	
	Coefficients	t Stat	Coefficients	z
ΔSIZE	0.168956	0.152006	0.168407	0.16
ΔLEV	0.175906	0.073595	0.232036	0.1
ΔSQRLEV	-1.90469	-0.14521	-5.1393	-0.28
ΔQUICK	0.128893	0.890335	0.135273	0.96
ΔFSALE	0.00683	0.475715	0.006975	0.53
ΔRND	5.378842	0.488821	6.003676	0.58
ΔDA/TA	5.1666	0.535486	7.120254	0.59
ΔNI/SALES	3.877581	1.143439	4.137031	1.24
ΔPPE	2.949665	1.101464	3.104058	1.15
ΔMODZ	-0.23659	-0.44774	-0.24285	-0.46
ΔMTB	-0.14015	-1.20951	-0.1599	-1.35
ΔSEGNO	-0.14261	-0.65462	-0.15352	-0.75
R SQUARE	0.11289			
N	49		49	

7. Conclusion

According to existing research, hedging with derivatives increases firm value through two different channels related to the debt ratio. The principal gain comes from the fact that lower average volatility allows higher leverage with consequently greater tax benefits. A secondary hedging gain comes from lower expected default rates and distress costs, resulting from unused debt capacity. By isolating a common risk factor among firms (exchange-rate risk), this study examines how the use of currency derivatives affects the value of Indian firms (leverage) that are exposed to exchange-rate movements. Indian firms were traditionally not allowed to use derivatives; however, the economic liberalization of the early 1990s facilitated the growth of derivatives market in India. In this context, Indian firm data in the period 2002-2013 is a unique dataset. Existing empirical studies in this area investigate only well developed economies and the analysis is limited to a period of one or two years. In this study, foreign currency risk-management activities of an emerging economy are analysed for a period of

twelve years. New empirical evidence is provided on the change in the value-maximizing behaviour of firms after the introduction of foreign currency derivatives. The analysis is limited to foreign currency derivatives only as surveys indicate that among the firms using derivatives foreign-exchange risk is the most commonly managed risk with derivatives.

Hedging incentives to leverage are modeled using a two-stage regression framework. A firm's binary decision of whether or not to use derivatives for managing foreign currency risk is analysed using data of nonfinancial firms listed on S&P CNX 500 in the period 2002-2013. To distinguish between firms with different hedging intensities, the analysis is repeated using net notional amount of currency derivatives data of nonfinancial firms listed on S&P CNX 100 in the period 2002-2013 (smaller sample size/period is used due to limited availability of the annual report data). The results show that a non-monotonic relation exists between hedging and leverage; there is positive relation between hedging and leverage for moderately leveraged firms and negative relation between hedging and leverage for highly leveraged firms. However, due to limited data availability and firms not capitalizing on their hedging potential the results are not very significant. Future studies could attempt to address these limitations.

Endnotes

[1] Endogeneity is defined as a loop of causality between the independent and dependent variables of a model (Woolridge 2009)
[2] Tobit regression is used to refer to the problem in which the dependent variable has values clustered at a limiting value, usually zero (Woolridge 2009)
[3] Logit regression is used to refer specifically to the problem in which the dependent variable is binary i.e. is the values of the dependent variable are between zero and one (Woolridge 2009)
[4] Source: RBI's Data Warehouse <http://dbie.rbi.org.in/DBIE/dbie.rbi?site=home>
[5] Source: Reserve Bank of India (RBI), National Stock Exchange of India Ltd. (NSE) & Bombay Stock Exchange (BSE Ltd.) websites
[6] Altman, E., 2005, *Emerging Market Credit Scoring System for Corporate Bonds*, Emerging Markets Review, vol. 6, pp. 311-323.
[7] The search on the word "hedg" is included in order to obtain results for the terms hedge and hedging
[8] Annual reports of firms listed on S&P CNX 100 are usually available on their respective websites.

References

Acharya, V, Almeida, H & Campello, M 2007, 'Is Cash Negative Debt? A Hedging Perspective on Corporate Financial Policies', *Journal of Financial Intermediation*, vol.16, no.4, pp. 515-554.

Allayannis, G & Weston, J 2001a, 'The Use of Foreign Currency Derivatives and Firm Market Value', *Review of Financial Studies*, vol.14, no.1, pp.243-276.

Allayannis, G, Ihrig, J & Weston, J 2001b, 'Exchange-rate Exposure: Financial vs. Operating Strategies', *American Economic Review*, vol.91, no.2, pp. 391-395.

Bodnar, GM, Hayt, GS & Marston, RC 1998, '1998 Wharton Survey of Financial Risk Management by US Non-Financial Firms', *Financial Management*, vol.27, no.4, pp.70-91.

Breeden, DT & Viswanathan, S 2016, 'Why Do Firms Hedge? An Asymmetric Information Model', *The Journal of Fixed Income*, vol.25, no.3, pp.7-25.

Campello, M, Lin, C, Ma, Y & Zou, H 2011, 'The Real and Financial Implications of Corporate Hedging', *Journal of Finance*, vol.66, no.5, pp.1615-1647.

DeMazo, PM & Duffie, D 1995, 'Corporate Incentives for Hedging and Hedge Accounting', *The Review of Financial Studies*, vol.8, no.3, pp.743-771.

Deshmukh, S & Vogt, SC 2005, 'Investment, Cash Flow and Corporate Hedging', *Journal of Corporate Finance*, vol.11, no.4, pp.628-644.
Dolde, W 1993, 'The Trajectory of Corporate Financial Risk Management', *Journal of Applied Corporate Finance*, vol.6, no.3, pp.33-41.
Dolde, W 1995, 'Hedging, Leverage and Primitive Risk', *Journal of Financial Engineering*, vol.4, no.2, pp.187-216.
Froot, KA, Scharfstein, DS & Stein, JC 1993, 'Risk Management: Coordinating Corporate Investment and Financing Policies', *Journal of Finance*, vol.48, no.5, pp.1629-1658.
Gay, GD & Nam, J 1998, 'The Underinvestment Problem and Corporate Derivatives Use', *Financial Management*, vol.27, no.4, pp.53-69.
Geczy, C, Minton, BA & Schrand, C 1997, 'Why Firms Use Currency Derivatives', *Journal of Finance*, vol.52, no.4, pp.1323-1354.
Graham, JR, Lemmon, ML & Schallheim, JS 1998, 'Debt, Leases, Taxes and the Endogeneity of Corporate Tax Status', *Journal of Finance*, vol.53, no.1, pp.131-162.
Graham, JR & Rogers, DA 2002, 'Do firms hedge in response to tax incentives?', *Journal of Finance,* vol.57, no.2, pp.815-839.
Haushalter, GD 2000, 'Financing Policy, Basis Risk and Corporate Hedging: Evidence from Oil and Gas Producers', *Journal of Finance*, vol.55, no.1, pp.107-152.
Jorion, P 1991, 'The Pricing of Exchange Rate Risk in the Stock Market', *The Journal of Financial and Quantitative Analysis*, vol.26, no.3, pp.363-376.
Leland, HE 1998, 'Agency Costs, Risk Management, and Capital Structure', *Journal of Finance*, vol.53, no.4, pp.1213-1243.
Miller, MH & Modigliani, F 1958, 'The Cost of Capital, Corporation Finance and the Theory of Investment', *American Economic Review*, vol.48, no.3, pp.261-297.
Miller, M.H. & Modigliani, F 1961, 'Dividend Policy, Growth, and the Valuation of Shares', *Journal of Business*, vol.34, no.4, pp.411-433.
Nance, DR, Smith, CW & Smithson, CW 1993, 'On the Determinants of Corporate Hedging', *Journal of Finance*, vol.48, no.1, pp.267-284.
Perez-Gonzalez, F & Yun, H 2013, 'Risk Management and Firm Value: Evidence from Weather Derivatives', *Journal of Finance*, vol.68, no.5, pp.2143-2176.
Petersen, MA & Thiagarajan, SR 2000, 'Risk measurement and hedging: With and without derivatives', *Financial Management*, vol.29, no.4, pp.5-30.
Phillips, AL 1995, '1995 Derivatives Practices and Instruments Survey', *Financial Management*, vol.24, no.2, pp.115-125.
Purnanandam, A 2008, 'Financial distress and corporate risk management: Theory and evidence', *Journal of Financial Economics*, vol.87, no.3, pp.706-739.
Smith, CW & Stulz, RM 1985, 'The determinants of firms' hedging policies', *The Journal of Financial and Quantitative Analysis*, vol.20, no.4, pp.391-405.
Woolridge, JM 2009, *Econometrics*, Cengage Learning, India.