



Measurement of Foreign Exchange Exposure for Selected Indian Firms

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Exchange rate fluctuation is the major concern for the firms globally, therefore it is essential for firms to know how much they are exposed to these fluctuations. The study aims to measure the foreign exchange exposure and its determinants for selected non-financial Indian firms. The period of analysis is concentrated from 2000-2015. This study has used a panel data methodology with fixed effects model to measure the firm's exposure by establishing the relationship with the exchange rate changes and the stock returns for the sample of 85 non-financial Indian firms. Furthermore, the firm-sensitive determinants like, export earning, import payments, net capital flows and size of the firm were used to estimate their effect on the foreign exchange exposure. The findings of the study showed that 55% variation in the stock returns was explained by the variation in the exchange rates. With respect to the determinants, it is found that market capitalization, which is a proxy for the size of the firm, is relatively most significant determinant for the exchange rate exposure. This is followed by net capital flows and trade.

Keywords: Foreign Exchange Exposure, Non-Financial Indian Firms, Econometric Modelling, Trade and Capital Flows

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Introduction

Foreign exchange fluctuation is the major source of macroeconomic uncertainty affecting firms in an open economy. Countries with floating exchange rate regime are more exposed to this fluctuation; which would in turn affect their firm's cash flows. The volatility of the firm's cash flow due to fluctuation in the foreign exchange is known as Foreign Exchange Exposure. These exposures are usually categorized into three types: first is the transaction exposure, which is defined as the likelihood of incurring exchange gains or losses on transactions already entered into and denominated in a foreign currency. Second, economic exposure, defined as the change in the present value of the firm resulting from any change in the future cash flow of the firm caused by the unexpected change in the exchange rate. The extent to which economic exposure affects

the company depends on the specific characteristics of the company and its industry. Third, translation exposure arises from converting the financial statements in foreign currency into home currency. These exposures are paper exchange gain/loss, retrospective in nature and short term in nature. All these exposures affect the present and the potential cash flows of the firms and thereby damaging the value of the firm. Thus in order to operationalize this theoretical relation, that the value of the firm is the present value of future cash flows; many empirical studies have used stock returns as the value of the firm.

The advantage of low cost-factor of production induces the firms to become multinational and thus become more and more competitive. In this process, they are exposed by the volatility of the foreign exchange. Volatility of foreign exchange refers to dispersal of returns, which expose firm to exchange rate related risks. Therefore, it is evident that the issues of measurement of foreign exchange have been the prime area of study for many researchers.

With the breakdown of Bretton Woods system and the beginning of the era of flexible exchange rate regime, foreign exchange market had seen sea change not only in the terms of turnover, but only in terms of its sporadic nature. Furthermore, the dawn of globalization and liberalization led to increased trade in the developing countries. The incentives for the firm to become more competitive and search for cheaper source of cost of production fueled the foreign exchange market and attached greater exchange exposure to the firm. Hence to grow competitively, firms need to understand their exposure level, thus measurement of exchange rate exposure and its determinants became all the more relevant and gained greater importance amongst researchers.

Most studies in the post liberalization era were concentrated to the developed countries. (Bartov, Gordon & KauV, 1994; Amihud, 1994; Glaum, Brunner & Himmel, 2000). The studies on the emerging market at firm level were few and concentrated around East Asian countries (Linda & Dominguez, 2006). This is because the aggregate data at business cycle frequency for these developing countries are limited in quality and quantity.

India being the second largest economy amongst Asian countries has seen the greater foreign exchange trades over the years. The trade flows amongst Indian firms have increased exponentially mainly due to integration of international financial markets, increasing cross border trades and huge capital flows. These changing dynamics have made foreign exchange market more volatile, which in turn, have detrimental effects. Thus, the need for proper determination of currency exposure at firm level is essential. Furthermore, the huge loss suffered during crises by the Indian firms makes it evident about the need to have appropriate measurement of the currency exposure and its management. The study has become pertinent mainly in the current context due to the present turmoil in the Indian financial markets. The fears of Fed interest rate tapering has grown more; in addition to this, in India, there is an added volatility as the market has become concerned about the policy rates and worried about oil marketing company demand for dollars.

Thus in the light of current significance, the paper conducts firm level study of foreign exchange exposure for non-financial Indian firms for the timeframe 2000-2015. For this analysis, firstly, the study has calculated the impact of changes in the exchange rate on the stock returns. Further on, the impact of firm specific determinant like export earning, import payments, net capital flows and the size of the firm were used to estimate their effect on the firm's foreign exchange exposure.

Literature Review

The seminal work done by Adler and Dumas (1980) and Hodder (1982) can be interpreted by defining exchange rate to currency risk using the regression coefficient concept of exposure. Later, the addition of value-weighted market index as proposed by Jorion (1990) was used to control for the market movements. Jorion (1990), showed that only 5 percent of the firms having substantial exchange rate exposure. Familiar research done (Bodnar & Gebhardt, 1999); Amihud, 1994; Bartov, Gordon & KauV, 1994) indicated that US firms are not significantly exposed to foreign exchange rate exposure. Study done by Loderer & Pichler (2000) showed that less than 40% of the Swiss firms are able to measure the operational cash flow sensibility to currency fluctuation, only 30% are protected against the vagaries in currency rates, and most of them only protect the direct risk and not the indirect risk. Amongst the various foreign exchange exposure experienced by firms, a study by Batten, Mellor and Wan (1993) revealed that 61.1% of the Australian firms are able to manage their transaction exposure, only 8.3% both transaction and translation and 16.6% manages all three exposure. Study done by Marshall (2000) indicated that transaction risk is perceived by U.S, U.K as the most important risk to manage. Froot, Scharfstein, & Stein (1993) argues that there is no general basis for managing the economic exposure, since measuring the economic exposure appears difficult and thus firms do not manage this risk. Srinivasulu (1983) recommends that translation exposure has no financial implication on the firm's future cash flow that is why; firms do not hedge their translation exposure. However, Rodriguez & Rita (1978) in empirical research confirm that US companies manages the translation exposure.

Studies done on the emerging markets are limited. The most conversant studies are Chue & Cook, (2008) who analyse exchange exposure at firm level for 15 emerging countries and concluded that 4.9% of the firms are significantly exposed to foreign exchange exposure for the time frame 1999-2002 at 5% level of significance. The study done by Lin (2011) examines the exchange rate exposure at market and firm level for six Asian countries including India and concluded that 1% depreciation of the Indian rupee would cause no change in Indian market return, whereas 1% appreciation of the currency would cause on an average, 0-6.99% decline in Indian market returns. Furthermore, the study reports that during the global financial crises of 2008, the firms that were exposed to foreign exchange were 8.61% only. Hence, these empirical studies suggest that few firms are exposed to foreign exchange exposure in the emerging market during their period of study.

The evidence against the foreign exchange determinants is conclusive. Research done by Jorion (1990) emphasized that exposure is positively correlated with the total sales made overseas and thus concluded that degree of foreign involvement increases the foreign exchange exposure. This is consistent by the works of (Jay & Prasad, 1995; Allayanis & Ofek, 2001; He. & L, 1998; Chue & Cook, 2008; Linda & Dominguez, 2006) who observed exchange rate exposure in eight countries, both developed and developing countries. The result showed the linkage amongst the exposure and other variable such as size of the firm, its position in the international market, foreign trade and transaction, global assets, and ability to contest as per industry. Some variables are used by Géczy, Minton, and Schrand (1997) to recognize the risks involved in foreign currency exposure, such as, research and development expenditure, firm's size, export and import ratio, amount of profit and firm's debt. According to the study done, the firms with high R&D expenses are prone to high exchange fluctuations, competition and financial distress and thus hedge more. Aggarwal and Harper (2010) conducted an important study that showed that firm with increased financial debt and financial risk face additional risk and indicated a positive connection to exposure of foreign exchange. Empirical studies done by Jay and Prasad (1995) and Allayanis and Ofek (2001) examined the marginal exchange-rate exposure of firms from eight countries, two of which are

emerging; Chile and Thailand. For the two countries, neither the firm size nor foreign sales is significant determinant of exchange rate exposure. Similar results were seen by Rossi (2002), who conducted the study on Brazilian companies. The paper gives the evidence that developing countries are less exposed to the exchange rate fluctuation than developed country. Thus, it is concluded that drivers for foreign exchange exposure differ from country to country and should be analyzed independently at firm level.

Research Gap and Contribution of the study

In light of above literature there are few existing studies done on the developing countries including India; the most familiar studies are Chue and Cook (2008) for 15 emerging markets; Muller and Verschoor (2007) for East Asian countries and Lin, (2011). But they do not cover the determinants of the exchange rate exposure in particular. Thus the above mentioned gaps in the literature make the present study unique. The purpose of the current study is to conduct the firm level analysis of the foreign exchange exposure; the study understands the impact of changes in the exchange rate on the stock returns of the Indian firms and analysis the impact of firm specific determinant. One novelty of this paper is the consideration of net-capital flows as a determinant for Indian firm in contrast to other studies.

Research Methodology

This study has been primarily focused on the non-financial companies as financial companies are more complex in their risk management techniques and foreign exchange exposure. This argument is consistent with the seminal work done by Adler and Dumas (1980), who reasoned "Exposure is not restricted to non-traded financial assets or liabilities with fixed, nominal, foreign-currency payoffs on the maturity date of the hedge. The exposure of such assets is easy to determine. They are 100% exposed from the sense that exposure is exactly equal to foreign currency face value as on that date."

Period of Study

The period of the study is concentrated from 2000-2015. This is so, because most of major reforms taken in 1990s were fructified from the year 2000. This is again clear from the fact that Indian GDP growth grew drastically after 2000. The contribution of external trade to the GDP over past 15 years (1985-200) has doubled. Furthermore, most of the macroeconomic variable started performing well from 2000 onwards.

Sample and Method of Data Collection

The sample of firms for the study are sourced from S&P BSE 200 for 40 industries based on the factors such as nature of industry, percentage of trade outside the domestic country and size of the company. The major focus of the study was on non-financial firms, 150 firms were initially identified from Capitaline database under this category, out of which 85 firms were selected. The reason for taking only the firms which are having significant exchange rate exposure could be justified from the argument given by Jay and Prasad (1995), that if the exposure is trivial, it cannot be used to derive any reliable conclusion.

The data was culled out and managed using tools such as SQL and Microsoft Office. Few firms were omitted due to non-availability of data for some variables across the time period. In order to calculate the stock returns opening and closing monthly stock prices were taken from BSE databases. Besides, nominal exchange rate (rupee per dollar) (NER) published in RBI database was

used for the purpose calculating the exchange returns. The data for the variables such as exports, imports, market capitalisation and net capital flows are sourced from Capitaline database. Both the stock return and exchange returns are taken in the log form.

In line with the previous studies (Bartov, Gordon, & KauV, 1994; and Amihud, 1994) a market index is added, to reduce noise in the model. For this purpose monthly index, returns of S&P BSE SENSEX from BSE database are used. Data for determinant factors i.e. trade (includes total export and total import), net capital flows, market capitalization has been collected from Capitaline database

The study has used nominal exchange rate rather than effective exchange rate. The nominal exchange rate variable is U.S. dollar, the number of units of domestic currency (INR) that can be purchase a unit of given foreign exchange (U.S. dollars). A decrease in this variable is termed as appreciation of the currency and vice versa of depreciation of the currency.

Most literatures measure exchange rate exposure using trade-weighted exchange rate. These trade-weighted baskets of currencies lack power if the nature of exchange rate does not correspond to the exchange rate included in the basket, which poses major problem. One way to overcome this is to use firm or industry specific exchange rate but hereto the difficulty is on what basis the exchange rates are considered. Usually firm may hedge their position to the most obvious currencies that is the countries where they export or import, but remained exposed to the currencies of countries with whom they compete on the world market. Since neither of the theory satisfies us we have used bilateral exchange rate, this is so because most of the trade done by Indian companies are exposed in US Dollars therefore, it makes sense to use bilateral exchange rate since exposure of the firm can explained more explicitly.

Variable Used: Determinants of Foreign Exchange Exposure

Exposure = f (Size (Market capitalization), Exports earnings, Imports payments, Net capital flows, Hedging)

Size (Ln SIZE). Market capitalisation is taken as the proxy for the size of the firm. Firm size is not a direct source of exchange rate exposure. Usually bigger firms are more internationally oriented thereby more exposed as compare to the smaller firm. A positive relation of market capitalisation with the exposure is seen in other words, as the stock price of the firm increases, the exposure also increases as the firm is able to benefit from the low cost of production from various countries. Many studies had taken the total assets as the proxy for size, but the study chose market capitalisation, since it defines the value of the firm and its size. Linda & Dominguez (2006); Allayanis and Ofek (2001); and (Jay & Prasad (1995), also found a significant positive effect of size on exposure.

Exports Earnings (Ln EXPO). They are an important source of exchange rate exposure formed by firm's foreign activities. The relation between the exports and the exposure is positive, which is a prior to the theory. This clearly means that as the exports rises firm's exposure to the foreign exchange fluctuation also increases.

Imports Payments (Ln IMPO). Many firms import the necessary equipment, raw material and other resources from abroad, for the production of their products. Thus in the process they are exposed to the sudden and sporadic fluctuations of the foreign exchange. Here to, a positive relationship of imports with the exposure is seen.

Net capital flows (Ln NCF). The reason for including the net capital flows is many firms prefer to raise cheaper source of funds in abroad as the rate of interest is low and more over studies on the emerging economies has stated that most developing countries firms have large capital outflows. This is one such reason why the firms are more exposed to the foreign exchange exposure. Previous literature (Allayanis & Ofek, 2001), states that firms can use foreign debt to protect themselves from exposure to exchange rate movements. Since a firm can issue foreign debt with revenues denominated in foreign currencies (cash inflows) as this would create a stream of cash outflows in a foreign currency. Thus it is appropriate to use the net capital flows. We see a positive relationship between the net capital flows and exposure to the firms.

Hedging Activity (HE). A negative relation of hedging with the exposure is predicted, that means, more the firm hedges, lesser the foreign exchange exposure. Firms hedge themselves from the uncertainty in the cash flows arise due to the foreign exchange fluctuation. This HEDGE is the dummy variable taken with the assumption that the firm is hedging to protect from uncertainty and not for the speculation purposes. If the firm is involved in hedging activity than the dummy variable have value 1, if it's otherwise than the value 0. In order to determine that the firm is involved in the hedging activities, the difference between Exports revenue and Import costs was calculated. If this difference is zero or negligible, it was assumed that export revenue and import cost are offsetting each other and hence exposure to exchange rate risk might be lower and firm is not involved in hedging activity. If this difference exists, then the firm would have hedged their positions. The inverse relation of the hedging with the exposure is consistent with the previous study by Allayanis & Ofek (2001).

Statistical Tools Used

This study has used a panel data methodology with fixed effects model to measure the firm's exposure by establishing the relationship with the exchange rate changes and the stock returns for the sample of 85 non-financial Indian firms. Panel data (also known as longitudinal or cross-sectional time-series data) is a dataset in which the behavior of the entities (companies) observed across time. This dataset allows to control for variables that cannot observe or measure like differences in the risk management techniques or business practices used across companies, or variables that changes overtime but not across entities. Thus, it accounts for the individual heterogeneity. With panel data, variables at different levels of analysis are suitable for multilevel or hierarchical modelling. The main advantages of the panel data is that they are more informative in terms more variability in the data, less co linearity, more degrees of freedom and therefore the estimates are more efficient. The panel data can be analyzed into two ways: fixed and random effects.

The present study uses the fixed effect method rather than random effect method, since this method works better under certain assumption. To see what this method involves, consider a model with single explanatory variable: for each of i

$$Y_{it} = \beta_1 X_{it} + a_i + u_{it}, \quad t=1,2,\dots,T \dots \text{Eq. 1}$$

Now average the equation over time,

$$\bar{y}_{it} = \beta_1 \bar{X}_{it} + a_i + \bar{u}_i \dots \text{Eq. 2}$$

Where $\bar{y}_{it} = T^{-1} \sum_{t=1}^T y_{it}$ and so on. Because a_i is fixed over time, it appears in both eq.1 and eq.2. If, both equations are subtracted,

$$Y_{it} - \bar{y}_i = \beta_1 (X_{it} - \bar{X}_{it}) + u_{it} - \bar{u}_i, \quad t = 1, 2 \dots T.$$

Thus it is that the fixed effect is appropriate for the present study as it takes the i period and the ai company for the analysis, which is fitting the objectives of the study.

Empirical Analysis

This section deals with the empirical results which have been measured for the foreign exchange rate exposure and also identifies the determinants for the selected non-financial Indian firm for the period of 2000-2015. Following are the list of variables used in the analysis. All the variables are taken in the log form in order to measure the coefficient of elasticity.

<i>LnNER</i>	-	<i>log Nominal Exchange Rate</i>
<i>LnSR</i>	-	<i>log Stock Returns</i>
<i>LnEXREXP</i>	-	<i>log Exchange rate exposure</i>
<i>LnSIZE</i>	-	<i>log Market capitalisation</i>
<i>LnEXPO</i>	-	<i>log Export Earnings</i>
<i>LnIMPO</i>	-	<i>log Import Payments</i>
<i>LnTRADE</i>	-	<i>log Trade</i>
<i>LnNCF</i>	-	<i>log Net Capital Flows</i>
<i>HE</i>	-	<i>Hedging Activity</i>

Measurement of the Foreign Exchange Exposure

The study has used the standard two-factor model to determine the foreign exchange exposure of firms, proposed by Adler & Dumas (1980) and Jorion (1990). In two factor model foreign exchange economic exposure can be determined by calculating the coefficient β_{xi} in time series regression of returns on a given asset, R_{it} , with respect to the market returns, R_{mt} , yearly fluctuation of foreign exchange rate, R_{xt}

In other words:

$$R_{it} = \beta_{oi} + \beta_{mi} R_{mt} + \beta_{xi} R_{xt} + \varepsilon_{it} \quad (1)$$

Where, $i=1, \dots, 85$, $t=1, \dots, 13$ where the coefficients β_{mi} and β_{xi} represent a measure of sensitivity of the stock returns, i to market risk and exchange risk, ε_{it} is a disturbance term. The introduction of market returns, R_{mt} as a second independent variable, explicitly control market movement, thereby reducing any correlation between disturbances. The total exposure of a firm comprises two effects. One effect is the average change in the present value of the cash flows caused by a unit exchange rate movement, which is explained by the stock returns of the firm. Another is the phenomena related to non-exchange rate qualitative factors explained in the stock return of the firm. Most empirical studies include a return to a market portfolio in the empirical model. This market portfolio not only controls for the macroeconomic factors but also dramatically reduces the residual variances of the regression. This improves accuracy of the exposure estimates as it takes into consideration both the macro and micro factors. The study has analysed the above regression and found that even though the R^2 is quite good, the coefficient of the nominal exchange rate, which defines the exposure is insignificant and positively related to the dependent variable, which is not consistent with the theory.

So the study estimated the equation only with the nominal exchange or explanatory variable and taken log form of nominal exchange rate, with one period lag. Such lags suggest that it takes

time before the impact of exchange rate effect the stock prices and suggest market inefficiency. (Bartov, Gordon, & KauV, 1994; Amihud, 1994). Following is the results of the first equation, where the stock price is depending upon the nominal exchange rate.

Table 1: Determinants of stock returns

Dependent Variable : LnSR			
Explanatory Variables:	Coefficient (C)	LnNER (-1)	DUM
	3.72	(11.78)	0.71
	- 0.22	(-2.90)	
R ² = 0.55	Adjusted R ² = 0.51	D-W stat = 1.95	F-stat = 14.48

The above Table 1 tells us that there is a significant relationship between the explanatory variable and explained variable. About 55% of variation in the dependent variable is explained by the explanatory variable. The relationship between the dependent variable and independent variable estimated in the equation is appropriate to the theory i.e. when currency depreciates, stock price would fall since, investor's returns would diminish and demand for such stock reduces. Durbin- Watson stat of 1.95 shows that there is no problem of autocorrelation and the F-stat of 14.49 shows that overall model is good. A dummy variable (DUM) is taken to control the abnormal movement of the stock returns. Dummy was used for the period 2008 since most of the firms had abnormal movements during this period. Capital market had performed well and FIIs had increased since, India was considered the safe place to invest compare to other countries.

Determinants of Exchange Rate Exposure

The goal of the previously estimated regression was to calculate the foreign exchange exposure but since the variation in the exposure varies from firm to firm. It is important to identify the determinants of the exchange rate exposure. This would allow us to understand, which factor would increase or decrease the exposure.

Effect of the Firm's Size. In the below equation, the study has taken market capitalization as the proxy for the size of the firm. Typically, larger firms are more internationally oriented and therefore have more exposed than smaller firm. Following is the estimated equation:

Table 2: Effect of size on the exposure

Dependent Variable : LnEXREXP			
Explanatory Variables:	Coefficient (C)	LnSIZE	DUMEXP
	2.85	0.0034	
	(140.62)	(1.36)	0.53
R ² = 0.65	Adjusted R ² = 0.62	D-W stat = 2.16	F-stat = 23.78

The result has shown a significant relationship between the firm's size and the exposure. Nearly 65% variation in the exchange rate exposure is explained by the size of the firm. From these result it is inferred that there is positive relation of the firm's size with the exposure, that explains the simple logic that large firm are more exposed to foreign exchange exposure compare to smaller firms. The result of the equation is in consistent with the other studies by (Allayanis & Ofek, 2001; Jay & Prasad, 1995), who also found a significant positive effect of size on exposure. The Durbin-Watson Stat is 2.16, which shows that there is no problem of auto correlation. F-statistic of 23.78 shows that the overall model is good.

Effect of Export earnings. Export's earning forms a crucial role in firms total earning. Therefore, firms must understand its foreign exchange exposure. To measure this significance, the study has regressed exports earning of the firm with the foreign exchange exposure.

Table 3: Effect of export earnings on the exposure

Dependent Variable : LnEXREXP			
Explanatory Variables:	Coefficient (C)	LnEXPO (-1)	DUMEXP
	2.85	0.006	
	(177.33)	(1.81)	0.5
R ² = 0.67	Adjusted R ² = 0.64	D-W stat = 2.19	F-stat = 24.10

It is clear from the above results that 67% of variation in the dependent variable is explained by the explanatory variables. The relationship between the export earnings and the firm's exposure is according to the theory i.e. when exports increase, firm's exposure to foreign exchange exposure also increases. The logic behind considering using a lag effect for exports (LNEXPOR) is that the payment of the receipts by the firm's customer is not done immediately for most of the firms, since a credit period is provided for say 6 months or less usually and so the effect of exposure is not immediate on the exports of the firms. The overall model is good as the F-stat is 24.10. The D-W statistic of 2.19 shows that there is no auto correlation problem.

Effect of Import payments. Many firms import the necessary equipment, raw material and other resources from abroad, for the production of their products. Thus, in the process they are exposed to the sudden and sporadic fluctuations of the foreign exchange. In the below regression, the study has regressed the imports payments and the exposure, this helped us to get a picture regarding the significance of this variable. Following results are depicted in table below.

Table 4: Effect of Import payment on the exposure

Dependent Variable: LnEXREXP			
Explanatory Variables:	Coefficient (C)	Ln IMPO(-1)	DUMEXP
	2.85	0.003	
	(189.36)	(1.70)	0.52
R ² = 0.66	Adjusted R ² = 0.64	D-W stat = 2.19	F-stat = 24.06

It is clear from the t-stat that the imports payments are significant factor for the firm's exposure. The study observes that 66% variation in the dependent variable, explained by the explanatory variables. The relationship between the import earning and exposure is according to the theory that is import positively related to the exposure. The study has taken the lag of imports (Ln IMPO) because the payment of the receipts by the firm is not done immediately and so the effect of exposure is not immediate on the imports of the firms. The Durbin-Watson statistic of 2.654, shows that there is no problem autocorrelation. The F-Stat of 24.06 explains that the model is good.

Effect of Trade. Trade is another variable, which is the combination of import and exports of the firms. The study has taken this variable to see the macro picture of the trade of the firm on the dependent variable.

Table 5: Effect of Trade on the exposure

Dependent Variable: LnEXREXP			
Explanatory Variables:	Coefficient (C)	Ln TRADE (-1)	DUMEXP
	2.84	0.005	
	(144.38)	(1.54)	0.54
R ² = 0.68	Adjusted R ² = 0.65	D-W stat = 2.19	F-stat = 24.09

The above results shows, there is significant relationship between the explanatory variable and explained variable. About 68% variations in the dependent variable is explained by the explanatory variable. The study observes the positive relationship between the firm's trade and the exposure, which is consistent with the theory and other studies. The rationality behind taking the lag of trade is that usually, firms buy or sell their products on the contract basis, the payment or the receipt of it would not be immediate and thus there is time gap between fluctuation of exchange rate and the exposures of exchange rate with the firm. The Durbin-Watson statistic of 2.19, shows that there is no problem of autocorrelation. F-stat also signifies that the model is good.

Effect of Net capital flows. Table 6 shows the relationship between the net capital flows and the exposure. The reason for including the net capital flows is many firms prefer to raise cheaper source of funds in abroad as the rate of interest is low, this is largely preferable amongst firm in the emerging economies. Following are the results:

Table 6: Effect of Net capital flows on the exposure

Dependent Variable: LnEXREXP			
Explanatory Variables:	Coefficient (C)	LnNCF	DUMEXP
	2.86	0.004	
	(370.48)	(1.36)	0.53
R ² = 0.65	Adjusted R ² = 0.62	D-W stat = 2.16	F-stat = 23.7742

It is clear from the results that net capital flows is significant and positively related to the exposure. About 65% variation in the dependent variable is explained by the independent variable, which is significant. The D-W statistic of 2.16, shows that there is no problem of autocorrelation. The F-stat of 23.77 shows that the overall model is good.

Effect of Hedging Activity. This equation takes into consideration the hedging factor of the firms. Firms hedge themselves from the uncertainty in the cash flows that arises due to the foreign exchange fluctuation. Before taking the variable we assume that the firm is hedging to protect from uncertainty and not for the speculation purposes. Following are the results of the equation:

Table 7: Effect of Hedging Activity on the exposure

Dependent Variable : LnEXREXP		
Explanatory Variables:	Coefficient (C)	HE (-1)
	2.86	- 0.009
	(398.25)	(-0.68)
R ² = 0.11	Adjusted R ² = 0.046	D-W stat = 2.65

The results shows, there is no significant relationship between the explanatory variable and explained variable. Only 12% variation in the dependent variable is explained by the explanatory variables. The relationship between the dependent variable and independent variable is according

to the theory i.e. more the firm hedge lesser the foreign exchange exposure. The inverse relation of the hedging with the exposure is consistent with the previous study by Allayanis & Ofek (2001). The rationale of taking the lag of hedging is that the effect of hedging is not immediate. Usually a firm which enters into forward contract, buys it on the anticipation of the fluctuation on the future date and so going by the logic the effect is not immediate for the firm. The Durbin-Watson statistic of 2.650, shows that there may be problem of mild negative autocorrelation.

After understanding the impact of each variable on the exchange rate exposure, the study now tries to appreciate how variables of a group affect foreign exchange exposure. In the first equation, the study has taken: Exports earnings Ln EXPOR (-1), Imports payments Ln IMPO (-1), Size Ln Size (-1), Net capital flows Ln NCF (-1) and Hedging activity HE (-1).

Table 8: Effect of export earning, imports payment, size, net capital flows and Hedging activity

Dependent Variable : LnEXREXP						
Explanatory Variables:	Coefficient (C)	Ln EXPOR (-1)	Ln IMPO (-1)	Ln Size (-1)	Ln NCF (-1)	HE (-1)
	2.78 (74.19)	0.007 (0.69)	- 0.015 (-0.18)	0.009 (0.90)	0.0032 (0.54)	-0.0078 (-0.36)
R2= 0.12	Adjusted R2 = 0.048		D-W stat =2.46			

In the above Table 8, the study has found that import is insignificant and negatively related to the exposure which is not consistent with the theory. Also, the study finds that the explanatory variable explains only 12% variation in the dependent variable. Furthermore, looking at various other statistics, which are not significant; the study is considering this equation for the analysis.

Hence, the study re-estimates the above equation with some changes. The study has now regressed another equation, which incorporates the trade factor that is the sum of the total exports and imports of the firm. The study found the following results for the regression:

Table 9: Effect of Trade, size of the firm, Net- capital flows and Hedging activities

Dependent Variable: LnEXREXP					
Explanatory Variables:	Coefficient (C)	Ln TRADE (-1)	Ln SIZE (-1)	Ln NCF (-1)	HE (-1)
	2.78 (70.73)	0.004 (0.63)	0.005 (0.81)	0.003 (0.54)	- 0.012 (-0.56)
R2= 0.18	Adjusted R2 = 0.04		D-W stat =2.56		

The above Table 9 showed that variable size of the firm has a lag effect, which is theoretically not congruent. Among variables mentioned the less significant is hedging, this argument is consistent with the previous equation. Previous study done by Jain, Yadav and Rastogi, (2009) points out that Indian firms does not want to actively participate in the derivative market due to the complexities involved. One reason why the firm's hedging is insignificant in India can be explained by the argument of Allayanis and Ofek (2001), that most of the firms use foreign debt as a hedging tool to protect themselves from the exposure.

Due to the above mentioned reason, the study has re-estimated another equation by not considering hedging activity as an explanatory variable. Furthermore, the study has taken a dummy term in order to explain the foreign exchange exposure of the firms, caused due to unexplained effects. These effects can be due to the macroeconomic problem, weak fundamentals of the company or abnormal movements in the stock price. Following is the final regressed equation:

Table 10: Effect of Trade, size of the firm, Net capital flows

Dependent Variable : LnEXREXP					
Explanatory Variables:	Coefficient (C)	Ln TRADE (-1)	Ln SIZE	Ln NCF (-1)	DUMEXP (-1)
	2.83 (119.0)	0.001 (0.32)	0.003 (0.98)	0.001 (0.36)	0.537
R2= 0.69	Adjusted R2 = 0.65		D-W stat =2.29		

From the above mentioned results, it is found that 67% variation in the exchange rate exposure variable is explained by the explanatory variables. The explanatory variables used in the model are trade, size of the firm, net capital flows. Among all the variables, the study found that relatively the size of the firm is an important determinant of exchange rate exposure. The results are in congruent with the previous equation. Next significant variable is net capital flows followed by the significant determinant that is trade activities of the firm. All the three explanatory variables are positively related to the exchange rate exposure, which is again as consistent by the previous equation. The results of 2.19 D-W static concludes that there is no problem of autocorrelation in the regression.

Summary and Conclusions

India has emerged as the second largest economy amongst Asian countries in terms of world trade, GDP growth, private consumption and private investment. In such an emerging economy where firms are expanding globally and the global players are making their foray to Indian markets for trade; stability of currency fluctuation is the most pertinent concern amongst firms. There is rising need among the firms to hedge their risks from this sporadic nature of the foreign exchange exposure. Thus, there is a need amongst firms for proper determination of this foreign exchange exposure before they think of how much to hedge. The objective of the study is to measure the foreign exchange exposure of selected non-financial firms and to identify the firm related variable, which determines the foreign exchange exposure. The period of the study is concentrated from 2000-2015. This is so, because most major reforms taken in 1990s were fructified from the year 2000 onwards.

The firm's cash flows are exposed to various exchange rate exposures, namely transaction exposure, economic exposure and translation exposure. These exposures are managed by the firm using internal or external hedging techniques. The internal techniques are prepayment, leading and lagging, netting. The external hedging techniques are forwards, future, options and swaps.

The focus of this empirical analysis was to obtain an estimate of firm-level exposure that can be interpreted as a measure of the sensitivity of the firm's cash flow to exchange rate changes. Such a measure is the primary in understanding the corporate decision of the firm. First the study demonstrated the importance of control for macroeconomic factors in the exposure regression. Exchange rate exposure derived from a simple model, where the firm returns are regressed against an exchange rate. Both the stock returns and exchange rate are taken in the log form in order to measure the coefficient of the elasticities. The study has taken one period lag for nominal exchange rate. Such lags suggest that it takes time before the impact of exchange rate effects the stock prices. The nominal exchange rate is negatively related to the stock returns that means, when the exchange rate increases (depreciates) the stock price reduces. From the analysis, it is found the exchange rate coefficient to be 0.22 that shows that 1 unit change in exchange rate would lead to 0.22% variation in the stock returns of the firms. Furthermore, the results showed the R2 of 55% signifying that 55% variation in the stock returns is caused by the variation in the exchange

rate. Further to check the robustness and the usefulness of model we have used the technique of in sample forecasting. The results exhibited the Root Mean Square Error (RMSE) of 0.156, which shows that the model has better forecast ability. Generally RMSE should be less than 3. The Theil inequality coefficient, which studies the predictive performance of the model is 0.027, generally this value should be less than 1.

To study the significant factors which lead to the firm exposure, the study has regressed the foreign exchange exposure of the firms with the firm specific variables. The determinants for the firms selected for the study were market capitalization which is a proxy for the size of the firm, others are exports earnings, and import payments, trade of the firm, net capital flows and the hedging activities. Usually large firms are more exposed to foreign exchange exposure than the smaller firms and so the study has taken size as one of the determinants for the foreign exchange exposure for the study. It is observable that more the foreign related activities of the firm, the more the exposure. Exports, imports and the net capital flows contribute to these foreign related activities. The study measured the exchange rate exposure of the firm with each of the determinants to examine their relationship and the significance level. After this, the group variables were taken and examined the relationship with the exchange rate exposure of the firms. The study found that the firm's size is a significant factor of the exposure. This is followed by other variables; net capital flows and trade activities. Hedging activity is insignificant for the Indian non-financial firms; this is in congruence with the study and the previous literatures. It is further concluded that the firm specific variable that is size of the firm, trading activities and net capital flows are positively related to the exposure, as consistent with the theory and the previous studies. Moreover, the final results too are in congruence with the previous study stating the fact that exposure is not significant amongst Indian firms.

It is also found that market capitalization which is a proxy for the size of the firm is the most significant factor for the exchange rate exposure for the Indian firms. Furthermore, the study examined the impact of net capital flows on the firm exposure and found that the net capital flows are significantly and positively affecting the exposure of the Indian firm.

The finding indicates that the foreign exchange exposure is highly firm specific and may differ from industries and firm's internal strategy. It suggests that there is further scope of improvement in the study by taking into consideration more specific characteristics of the firm. This can be done by grouping the homogeneous nature of firms. Size of the firm, which is the significant factor of foreign exchange exposure, must be taken into consideration, while categorizing the firms. Furthermore, inclusion of more specific proxy variable for hedging activities may be helpful to improve the findings, which could be the limitation of this study.

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