# DETERMINANTS OF EXCHANGE RATE EXPOSURE: A STUDY OF INDIAN FIRMS

Thesis

Submitted in partial fulfilment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

by

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## DECLARATION

I hereby declare that the Research Thesis entitled **Determinants of Exchange Rate Exposure: A Study of Indian Firms** which is being submitted to the National Institute of Technology Karnataka, Surathkal in partial fulfillment of the requirements for the award of the Degree of Doctor of Philosophy in **Management** is a bonafide report of the research work carried out by me. The material contained in this Research Thesis has not been submitted to any University or Institution for the award of any degree.

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**CERTIFICATE**

This is to certify that the Research Thesis entitled **Determinants of Exchange Rate Exposure: A Study of Indian Firms** submitted by **Krishna Prasad**, (Register Number: HM13P01) as the record of the research work carried out by him, is accepted as the Research Thesis submission in partial fulfillment of the requirements for the award of degree of Doctor of Philosophy.

**Dr. Suprabha K R**
Research Guide

**Prof. K. B. Kiran**
Chairman - DRPC

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## Abstract

Exchange rate exposure is the uncertainty created by the unintuitive movement in the exchange rates between the currencies. The findings of the previous studies revealed that the changes in exchange rate affect the firm value. Hence, understanding exchange rate exposure is important for both managers and the investors. This thesis attempts to answer three research questions. First, does the movement in the exchange rate affect the value of the firm? Second, what are the factors determining the exchange exposure of a firm? Third, what are the strategies used by the Indian firms to manage the exchange rate exposure? The sample of 387 non-financial firms listed in the National Stock Exchange is studied for a period of five years from 2011-12 to 2015-16. The exchange rate exposure of the firms was estimated using capital market model and cash flow model. The empirical results of this study indicate that stock returns of over 68 percent of the firms were significantly exposed to the changes in the exchange rates. The study reveals that the exposure of net importing industries such as Energy, Chemicals and Fertilizers was greater compared to the other industries. While the net exporting industries such as Information Technology and Pharmaceuticals exhibited the least exposure to exchange rate changes. The study argued that the exchange rate movements have a higher effect on the value of the firms with higher level of financial distress. The results supported this argument. The study provides evidence that the firm size, depth of international presence and hedging are the significant determinants of the exchange rate exposure. The influence of factors such as breath of international presence, liquidity, profitability and foreign currency borrowing was found to be insignificant. The survey of the hedging techniques used by the sample firms reveals that currency forwards are the most preferred currency derivative for hedging. The exchange traded products such as currency futures and currency options were used less frequently. Cross currency interest rate swaps were used to hedge the long term liabilities.



**Keywords**: Exchange rate exposure, financial distress, currency futures, determinants of exposure.

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## Nomenclature

| | |
|---|---|
| DTD | Distance to Default |
| DM | German Mark |
| EPS | Earnings Per Share |
| EUR | Euro |
| FCB | Foreign Currency Borrowings |
| FCD | Foreign Currency Derivatives |
| FD | Financial Distress |
| FDI | Foreign Direct Investment |
| FPI | Foreign Portfolio Investment |
| GBP | Great Britain Pound |
| HEDGE | Hedging |
| IMF | International Monetary Fund |
| INR | Indian Rupees |
| JPY | Japanese Yen |
| LQDTY | Liquidity |
| MNC | Multinational Companies |
| MRPL | Mangalore Petrochemicals and Refineries Ltd. |
| MTBV | Market to Book Value |
| NI | Net Importers |
| NSE | National Stock Exchange |
| ONGC | Oil And Natural Gas Ltd. |
| PFT | Profitability |
| R&D | Research & Development |
| RBI | Reserve Bank Of India |

| | |
|---|---|
| SEBI | Securities And Exchange Board Of India |
| UK | United Kingdom |
| US | United States |
| USD | US Dollar |

## 1.1 INTRODUCTION

Financial exposures and risks faced by the firms influence the value in many direct and indirect ways. Typically, the exposures are created as a result of unexpected changes in exchange rates, interest rates, and commodity prices. The term risk and exposure are often interchangeably used, but there is a subtle difference between the two. Risk refers to the probability of a loss, whereas exposure is the possibility of a loss. The risk arises from the exposure or exposure precedes risk. When a firm has financial market exposure, there is a possibility of loss nevertheless an opportunity for gain or profit (Horcher 2005). Therefore it is not possible to eliminate the exposure or risk as there is a linear relationship between risk and returns. But the firms can manage these risks by deploying proper risk management techniques in other words firms can hedge these exposures.

The fact that a significant number of corporations are committing resources to risk management (financial hedging) activities indicates the role of risk management in increasing the firm value (Bartram 2000). Besides increasing the value of the firm, it also provides greater consistency to the firm's earnings and reduces the cost of capital (Cho 1988; Mango and Major 2007).

The present research intends to estimate the exchange rate exposure and the determinants of the exchange rate exposure of the firms in India. Exchange rate exposure is the uncertainty created by the unintuitive movement in the exchange rates between the currencies. Hekman (1983) defined exchange rate exposure as "the sensitivity of its economic value, or stock price, to exchange rate changes." According to Adler and Dumas (1984) the extent to which the value of a firm is affected by fluctuations in exchange rates is known as exchange rate exposure. The exchange rate exposure is created by firm's transactions such as import, export, borrowing, lending, subsidiaries in a foreign country, royalty income/expense and so on. This exposure so created brings in the probability of loss, which is called as foreign exchange rate risk. This is a unique risk attached with the international trade, i.e. when firms operate in more than one country.

The international trade has significantly grown following the Second World War. A Large number of corporations started exploring the opportunities in the foreign countries

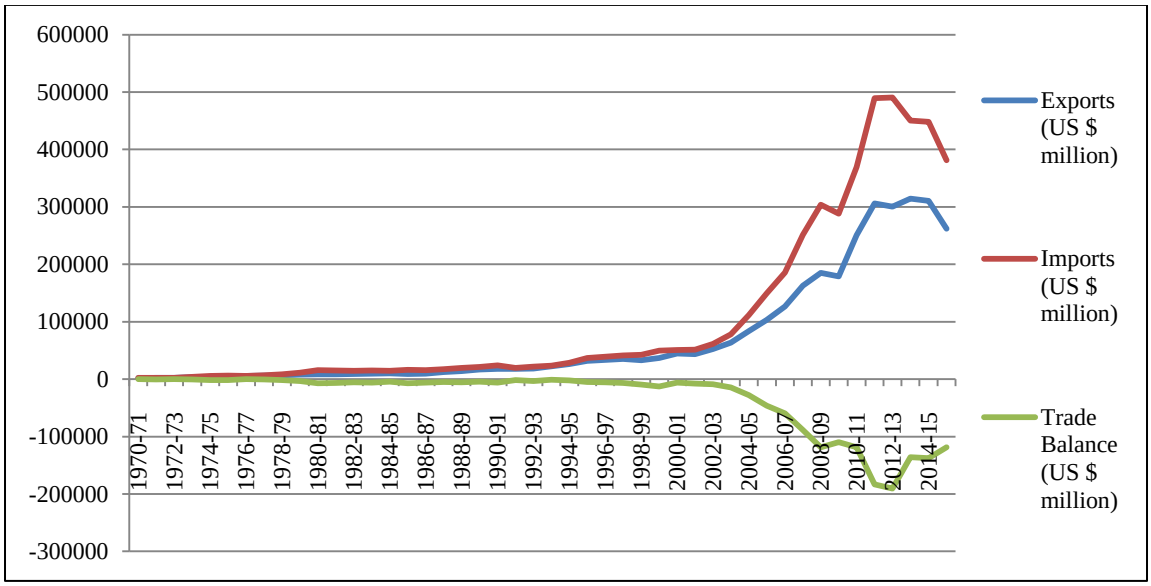
as a part of their expansion strategy. Indeed, the global trade was vital to the success of many businesses. The political environment post the Second World War was stable and conducive enough to do so and the more importantly creation of World Trade Organisation, World Bank, etc. made the international business much easier. During the era of Bretton Woods system (1945-1971) the where the exchange rates were stable perhaps the firms did not face a greater risk due to exchange rates. Since the collapse of Bretton Woods System during the 1970s, the flexible exchange rate regime increased the volatility in the exchange rates. The volatility was found to be the new source of risks faces by the MNCs.

In the Indian context, policies on international trade and investment around 1961 were quite liberal. Later, from 1962 to 1977, the trade and investment policies were primarily driven by the requirements of local industry and economy. Since 1978, the policies were heading towards liberalization of the economy, though they were implemented in incrementally (Nayak et al. 2005). The exchange rate in 1973 was Rs. 8.16 per USD over the period of two decades increased to Rs. 16.96 per USD in the year 1989. It can be observed from the Figure 2 that exchange rate was stable during this era during when forex exposure was not a matter of concern for the Indian MNCs.

The year 1991 was a major turning point in the liberalization and globalization process in India. In 1991 the foreign exchange reserves had nosedived to $1.2 billion which was barely enough to finance 13 days' worth of imports. The external help of IMF was accompanied by market-oriented conditionalities such as liberalization and globalization. At the face of crisis, the Government of India opened up the economy (Gaikwad and Scheve 2016). This important decision of Indian government opened windows for global business in India, many multi-national corporations (MNCs) entered Indian markets; similarly, many Indian companies cashed this opportunity to enter foreign countries. The growth of international trade details of India is shown in Figure 1. The total imports were $2162.3 million, and exports were $2031.3 million in the fiscal year 1970-71. During the fiscal year, 1980-81 imports and exports increased to $15172.9 million and $8703.9 million respectively widening the trade deficit of the country. Since the economy was liberalized in the year 1991 the international trade both in terms of

exports and imports increased. But the dramatic increase in the increase in India's foreign trade since 2003-04 could be attributed to Foreign Trade Policy (2004-09) ("India: Trade regulations" 2005). It can also be noted that trade deficit also increased during the same period as shown in Figure 1.

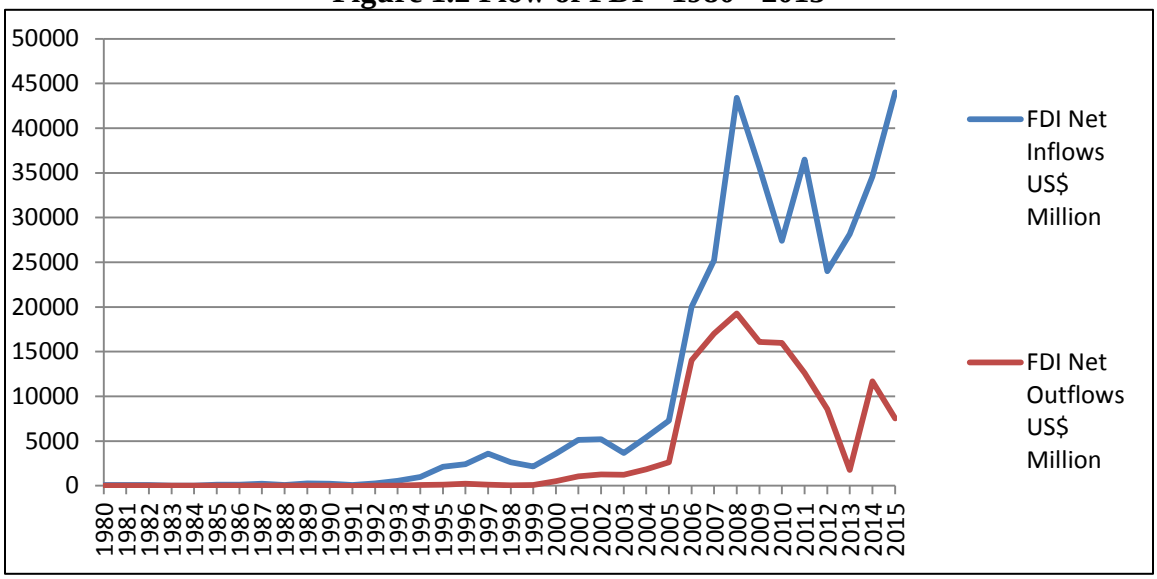
**Figure 1.1 India's Foreign Trade – US Dollars**




*Source: Handbook of Statistics on Indian Economy, RBI, Mumbai*

The increasing trade deficit also increased the exchange rate volatility. Besides the international trade, there was a spectacular increase inflow of Foreign Direct Investment (FDI) and Foreign Portfolio Investment (FPI) into the India post liberalization (Singhania and Gupta 2011). FDI and FPI initially were inbound and off late the number of Indian firms investing in foreign countries also increased as shown in Figure 2. It can observe from Figure 2 that the inflow of FDI started increasing from 1991 while only since 2004 there was a significant increase in the FDI outflows. It was during this period the Reserve Bank of India (RBI) permitted Indian firms to invest up to 100 percent of their net worth in foreign joint venture/wholly owned subsidiary under automatic route, and the limit was gradually raised up to 400 percent of net worth. The net FDI outflow reached the peak in 2007 and declined owing to the global financial crisis (Das and Banik 2015). The empirical evidence suggests that the FDI effects in India have become more favorable in the post-reform period (Chakraborty and Nunnenkamp 2006).

**Figure 1.2 Flow of FDI - 1980 - 2015**

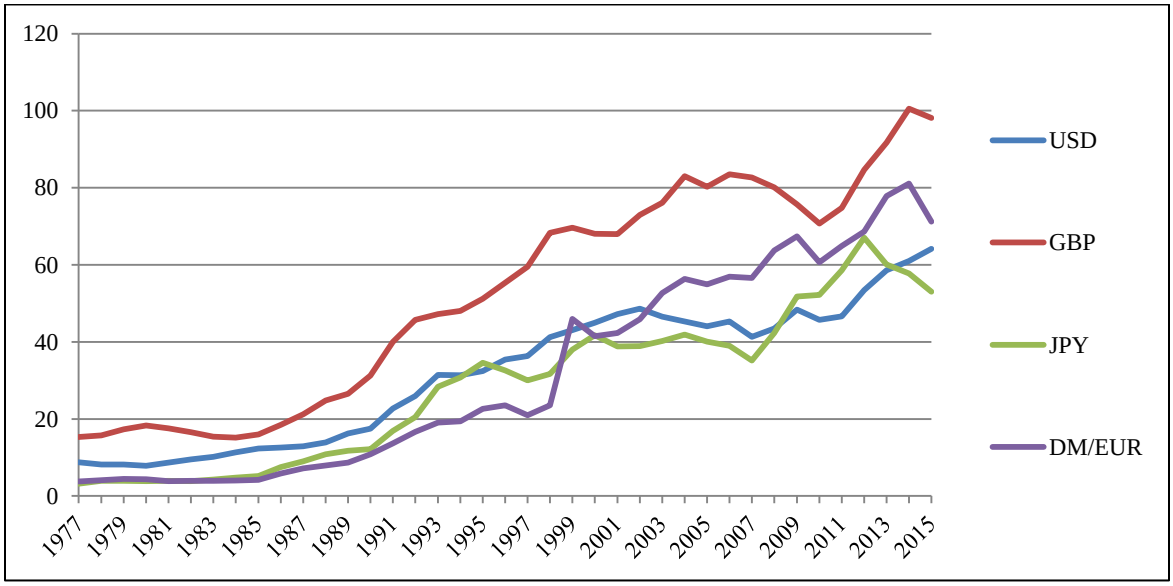



*Source: World Development Indicators, World Bank Group, Washington.*

The study on outward FDI by Pradhan (2008) listed the top Indian firms investing overseas and finding suggested that knowledge-based industries like software and pharmaceutical industry contributed the largest number of outward investing firms to this group of top 40 outward investors. Between 2003-2008 there were 1,257 foreign investments with the positive market response confirming that the market perceived the outward FDI as value maximizing strategy (Rani et al. 2015). Amidst all these developments, stability in the exchange rate is one of the important factors attracting FDI to a country (Cambazoglu and Günes 2016; Venkatachalam 2000).

Figure 3 shows the Exchange Rate of the Indian Rupee (INR) vis-a-vis the US Dollar, Pound Sterling, D. M./ Euro and Japanese Yen(₹ per 100 Yen). The exchange rate of major currencies against INR was relatively stable during 1977-1990. Even though it was flexible exchange rate regime during 1977-1990, the value of INR remained stable due to the anti-globalization policy of India. Since 1991 India shifting the policy to promote international trade the value of INR against all the major currencies started depreciating and the higher volatility. Both the Indian firms involved in international trade and investments and foreign MNCs with operations in India were exposed to the movements in the exchange rate.

**Figure 1.3 Exchange Rate of the Indian Rupee vis-a-vis USD, GBP, JPY, DM/EUR**




*Source: Handbook of Statistics on Indian Economy, RBI, Mumbai*

This development in the global economy, lead to the increased importance of exchange rate risk management. It should be noted that risk management is a costly activity and therefore the benefit of risk management should outweigh the cost. Hence, it is important to understand the determinants of the exchange rate exposure for effective management of the risk. The past researches conducted on exchange rate risk management and firm value indicates the managing the exchange rate risks will increase the value of the firm (Allayannis and Weston 2001; Chan et al. 2002; Magee 2009). Therefore, no firms involved in global trade could afford to demine the importance of managing exchange rate exposures.

Theoretically, all firms, domestic and international, are exposed to exchange rate risk. Yet empirical evidence finds mixed results. Large numbers of studies in the past reveal that the value of the only small number of firms is significantly affected by the exchange rate changes (Chue and Cook 2008; He and Ng 1998; Jorion 1990; M. and Lukose 2014; Muller and Verschoor 2006a). Bartram & Bodnar (2007) termed the inability of empirical evidence to support the theoretical phenomenon as ‘exchange rate exposure puzzle.' One of the important explanations for the exposure puzzle documented in the literature is that the firm level factors such as hedging or profit margins may reduce the exposure of the firms (Allayannis and Ofek 2001; Bartram and Bodnar 2007). Therefore, it is necessary

for corporate managers or to the investors to understand the factors determining the exposure. With the knowledge of the determinants which is sometimes country specific, the firms would be able to manage the economic exposure better.

This research attempts to study the level of exchange rate exposure of Indian firms using a sample of 387 firms for a time period of 2011-12 to 2015-16. There are three main research questions that the study attempts to answer. First, does the movement in the exchange rate affect the value of the firm? Second, what are the factors determining the exchange rate exposure of a firm? Third, what are the strategies used by the Indian firms to manage the exchange rate exposure?

## 1.2 RESEARCH QUESTIONS

The purpose of this study is to measure the exchange rate exposure of the firms and to explore the determinants the exposure. The research questions are listed below:

1. Is value of the firm affected by exchange rate fluctuations?
2. What are the factors influencing the exchange rate exposure of the firms?
3. Is there any difference in the exchange rate exposure of the firms in different industries?
4. What extent of usage of foreign currency debt as a hedging instrument?

## 1.3 OBJECTIVES OF THE STUDY

The objectives of this study are:

1. To study the impact of exchange rate exposure on the value of the firm.
2. To compare the industry wise exposure of the firms.
3. To investigate the factors influencing the exchange rate exposure.
4. To look at the usage of currency derivatives by the firms.

## 1.4 SCOPE OF THE STUDY

The scope of this study is limited to an examination of exchange rate exposure and its determinants of the companies listed on National Stock Exchange (NSE). The study is also limited to a time period from 2011-12 to 2015-16.

The organization of this thesis is as follows: Chapter 2 presents the extensive review of literature related to the effects of movements in the exchange rate on firm value and the various determinants. Chapter 3 discusses the research questions, objectives, hypotheses, methodology, empirical model and about the data and sample selection. Chapter 4 discusses the empirical results of the relation between exchange rate changes and the firm value. This chapter also presents the estimates of the factors determining the exchange rate exposure. The usage of derivatives and case studies on the exchange rate risk management strategies of the firms are presented in Chapter 5. The summary of the finding, conclusion and the scope for further study will be reported in Chapter 6.

## 2.1 DEFINITION OF THE EXCHANGE RATE EXPOSURE

The movements in the exchange rate will affect the cash flows of firms involved in the international business with receivables/payables in foreign currency. Adler and Dumas (1984) defines the exchange rate exposure as "the amount of foreign currencies which represent the sensitivity of the future real domestic currency value of any physical or financial asset to random change in the future domestic purchasing powers of these foreign currencies, at some specific future date." In other words, exchange rate exposure is the extent to which the change in the exchange rates affects the cash flows. However, the direction of the movement unfavorable to a firm is different for firms with foreign currency receivables and payables. What is an unfavorable change in the exchange rate for a firm with foreign currency receivable is favorable for firms with foreign currency receivable.

The fluctuations in the exchange rate affect the firms' immediate cash flows, it may influence the future cash flows and the consolidated financial statements. Hence the literature categorizes the exposure into three types (Redhaed 2001; Redhead 2001). .

First, transaction exposure, which is created by the transactions of the firm involving cash flows resulting from transactions such as, import, export, payment/receipt of interest, royalty, etc. If there is unfavorable change in the exchange rate consequent upon the transaction the revenue and the profit margin of the firm will be disturbed. Let us look at the example of an Indian company imported some goods invoiced in Euros. The Indian company has a future payment in Euros without knowing how much the Euros will cost in Indian Rupees. If Euro becomes more expensive in terms of Indian Rupee the Rupee cost of import will increase. Since the Euro exchange rate on the payment date is uncertain the cost of import also remains uncertain. The Indian company is said to have exposure to transaction exposure. The uncertainty about the Rupee cost of the imports will make it difficult for the importer to quote the price to the customers. The problem gets aggravated if the importer processes the material imported and sells it to customers in foreign country denominated in USD. For the exporters, with receivables in foreign currency depreciation of the foreign currency could narrow the profit margin from the sale or may even turn the sale into the loss-making transaction. Transaction exposure can

be related to any adverse effect exchange rate fluctuations on firms' known cash flows in the foreseeable future.

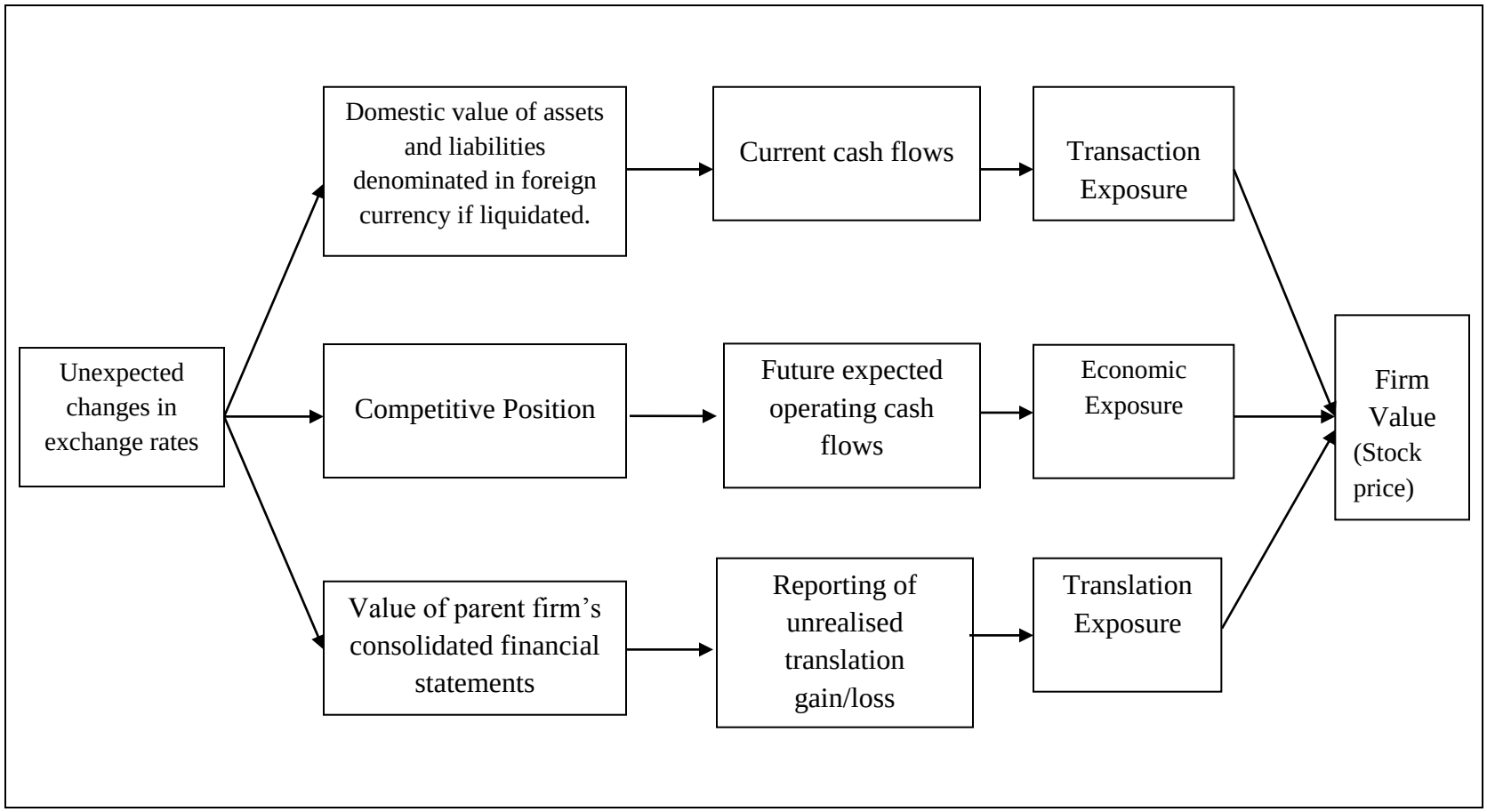
The second is economic exposure which is also known as operating exposure. The influence of unfavorable movements in the exchange rate on the future cash flows is economic exposure (Moffett and Karlsen 1994). It means that the unexpected change in the exchange rates may adversely affect the cash flows of the firm in the future. To illustrate, if the domestic currency appreciates, the value of an exporting firm would decrease as the domestic currency sales of the firm would decrease in the future due to the changes in exchange rate. While, the value of importing firm would increase as the cost of the future import would decrease due to the domestic currency appreciation. The value of even a purely local firm also would be effected due to the domestic currency appreciation as the firm may have to compete with the foreign firm in the domestic market or purchase inputs which are sensitive to the exchange rate changes (Kang et al. 2016; Marston 2001). The economic exposure can be further illustrated with an hypothetical example of Indian software firm which as operations and subsidiaries in a number of countries around the world. The firm's largest market is US and Europe which contributes about 60 percent of their total sales. The management factors in an annual depreciation of Rupees against US Dollar and Euro for next three years owing to the negative macroeconomic outlook. However, if the Indian economy improves, the Rupee would rally against both US dollar and Euro. The Indian software firm is now not only exposed to the transaction exposure (due to the large export sales) but the cash flows of next three years also may be affected.

Economic exposure compared to other two types is less precise. For instance, translation exposure is measured as the difference between the value for assets and liabilities measured in terms of foreign currency and domestic currency (Soenen 1979) while the transaction exposure is measured as difference between the cash inflow and cash outflow in foreign currency (Madhura 2010). The measurement of economic exposure is not as straight forward as the measurement of the other two types of exposure making the measurement relatively less precise. Therefore hedging the economic exposure also becomes challenging for the firms (Moffett and Karlsen 1994). The difference between

transaction exposure and economic exposure is that transaction exposure disturbs the present cash flows while the economic exposure is a long-term risk (Vij 2001).

The third is translation exposure also known as accounting exposure. When the financial statements of the subsidiaries are consolidated with that of the parent company, translation exposure measures the changes in the firms' book value due to the exchange rate fluctuations (Rodriguez 1979). Suppose, the book value liabilities owned by the subsidiaries are translated at current exchange rates rises faster than the book value of assets translated at current exchange rates, the net worth of the parent company will decrease resulting in a foreign exchange loss (translation loss). On the other hand, if translated book value of liability rises less rapidly than translated book value of assets, the net worth will increase resulting in a foreign exchange gain. Nevertheless, in both the cases will not affect the cash flows. In the case of translation of profit changes in the exchange rate will reduce the Earnings per Share (EPS) (Rodriguez 1981). The exchange rate movements may also affect the future conversions. Therefore, translation exposure may have a significant influence on the value of the firm. This research attempts to study the economic or operating exposure and the determinants of the operating exposure.

**Figure 2.1 Exchange Rate Exposure and Firm Value**




*Source: Sikarwar (2015)*

## 2.2 FIRM VALUE AND FOREIGN EXCHANGE EXPOSURE

The changes in the exchange rate according to standard economic analysis affect the value of the firm (Makin 1978). The profitability of the Indian firm with foreign sales or foreign subsidiaries should increase (decrease) with the unanticipated depreciation (appreciation) of Indian Rupees as expected foreign currency cash flows will increase (decrease) when converted to Indian Rupees. For example, analysts[1] rated the performance of MRPL Ltd. below average and the reason being loss due to exchange rate fluctuations which stood at was Rs. 1182.7 crores which were over 2.9 percent of the net sales for the year ended March 2016.

The studies by Jorion (1991); Bodnar and Gentry (1993) examined the exchange rate exposure of US firms i.e. changes in the stock returns in relation to the changes in the exchange rates. These studies were primarily on the assumption that stock markets fully react to changes in the exchange rates. But these studies had limited success in detecting the significant correlations between exchange rate fluctuations and the stock returns. Bartov and Bodnar (1994) identify two possible explanations to this. First, drawbacks in the research design and sample selection procedures i.e. study included firms with limited international presence. Second, is mispricing, i.e. the adjustment in the stock price for the changes in exchange rate changes may take time. They reexamined the relation between exchange rate changes and stock prices by overcoming the two problems mentioned above. Their findings suggested that the contemporaneous changes in the US Dollar did not explain the abnormal stock returns while lagged change in US Dollar had an influence on the stock returns as the authors fail to find the significant correlation between abnormal returns with the level of international activities and the exchange rate changes.

The relationship between the stock returns and the exchange rate changes are studied by many researchers. The country wise summaries of the studies are listed in Table 2.1 given below.

[1] Based on the fundamental research by analysts at Motilal Oswal Ltd. The report is available at: http://www.motilaloswal.com/site/rreports/636221411574920041.pdf

**Table 2.1 Country-wise Listing of Exchange Rate Exposure**

| Author/Year | Country | Period | Sample Size | Methodology | Findings |
|---|---|---|---|---|---|
| Choi and Prasad (1995) | US | 1978-89 | 409 | Two factor model | 14.91 per cent |
| He and Ng (1998) | Japan | 1979-93 | 171 | Two-factor model | 25.00 per cent |
| Chow and Chen (1998) | Japan | 1975-92 | 1110 | Multi-factor model | 69.81 per cent |
| Martin et al. (1999) | US | | 168 | Two-factor model | 51.19 per cent |
| Allayannis and Ofek (2001) | US | 1993 | 378 | Two-factor model | 44.7 per cent |
| Kiymaz (2003) | Turkey | 1991-98 | 109 | Two factor model | Pre-crisis period - 61.46 per cent<br>Crisis period - 98.16 per cent<br>Post-crisis period - 93.6 per cent |

| Author/Year | Country | Period | Sample Size | Methodology | Findings |
|---|---|---|---|---|---|
| Martin and Mauer (2003) | US | 1989-98 | 217 | Two-factor model and Cash flow model | 17.1 per cent |
| Muller and Verschoor (2006) | Europe | 1988-02 | 817 | Two factor model | USD - 14.33 per cent<br>JPY 14.5 per cent<br>GBP 19.70 per cent |
| Jong et al. (2006) | The Netherlands | 1994-98 | 117 | Two-factor model | 50 per cent |
| Dominguez and Tesar (2006) | 8 countries | 1980-99 | 2387 | Two-factor model | 20 per cent<br>Lowest of 14 per cent in Chile<br>Highest of 31 per cent in Japan |

| Author/Year | Country | Period | Sample Size | Methodology | Findings |
|---|---|---|---|---|---|
| Bartram (2007) | US | 1976-06 | 6917 | Two factor model and Cash flow model | Cash flow - 5.6 per cent<br>Stock Price - 13.2 per cent |
| Salifu et al. (2007) | Ghana | 1999-04 | 20 | Two-factor model | 55 per cent to USD<br>35 per cent to GBP |
| Chue and Cook (2008) | 15 Countries | 1999-02 | 931 | Two factor model | 38.99 per cent |
| Aggarwal and Harper (2010) | US | 1990-96 | 1047 | Two-factor model and FF model | 23.49 per cent |
| Huffman et al. (2010) | US | 1997-04 | 185 | Fama-Fench Three Factor Model | 38.1 per cent |
| Choi (2010) | Korea | 1996-08 | 66 | Two factor model | 50 per cent |

| Author/Year | Country | Period | Sample Size | Methodology | Findings |
|---|---|---|---|---|---|
| Kang and Lee (2011) | Korea | 1994-07 | 392 | Two-factor model | 40.8 per cent |
| Kangaraj and Sikarwar (2011) | India | 2006-11 | 361 | Two-factor model | 16.06 per cent |
| Lee and Suh (2012) | US | 1984-02 | 261 | Cash flow model | 27.27 per cent of industries |
| Agyei-Ampomah et al. (2013) | UK | 1991-10 | 269 | Two-factor model | 14.93 per cent |
| Chang et al. (2013) | US | 2000-11 | 2647 | Fama-Fench Three Factor Model | 1.39 per cent |
| Demirhan and Atyp (2013) | Turkey | 2005-11 | 17 | Two-factor model | 40 per cent |
| Miao et al. (2013) | China | 2002-12 | 16 Industries | Two factor model | 43.75 per cent |

| Author/Year | Country | Period | Sample Size | Methodology | Findings |
|---|---|---|---|---|---|
| Hutson and Laing (2014) | US | 1999-06 | 935 | Two-factor model | 5.2 per cent |
| Baur and Miyakawa (2014) | Australia | 1980-10 | 95 | Two-factor model | 49.47 per cent |
| Sikarwar (2014) | India | 2006-11 | 20 industries | Two-factor model | 60 per cent |
| M. and Lukose (2014) | India | 2006-11 | 332 | Two-factor model | 10.84 per cent |
| Dhasmana (2014) | India | 1995-11 | 500 | Cash flow model | |
| Mohapatra and Rath (2016) | India | 200-13 | 232 | Two-factor model | 64.22 per cent |

Choi and Prasad (1995) use the two-factor model and examined the exchange rate exposure of 409 US firms for a period of 1978-89 and concluded that the exchange rate fluctuations affect firm value. The two-factor model is based on the Ross's (1976) arbitrage pricing theory which implies a linear relationship between stock returns, market returns and the exchange rate movements. The study also evidenced that stock prices of 14.91 percent of the sample firms were exposed to exchange rate fluctuations. He and Ng (1998) studied the relationship between lagged exchange rate changes and stock returns for a sample of 171 Japanese multinational corporations (MNC) and found that only 25 percent of the sample firms were to be significantly exposed to exchange rate changes. Their findings were contrasting the earlier findings of Bartov and Bodnar (1994) in the US context which used the lagged changes in the dollar to measure the effect of exchange rate exposure. Another study on currency exposure of Japanese firms by Chow and Chen (1998) found that 68.91 percent of the sample firms were significantly exposed. This is because of two reasons. First, they characterized the exchange rate exposures for different return horizons and second, they used a multifactor arbitrage pricing model. When the importers and exporters were separately examined it was found that the firms are adversely affected by Yen depreciation were the industries with higher imports and in the non-traded industries and less affected for the firm's export-oriented industries.

A study focusing on 168 US multinationals with operations in Europe by Martin et al. (1999) found 51.19 percent of the sample firms had significant exposure to the changes in exchange rates while Allayannis and Ofek (2001) found 44.7 percent of the sample US firms being exposed to currency risk. Both the studies used capital market approach to detect the exposure.

To investigate the foreign exchange exposure of firms in a highly inflationary environment Kiymaz (2003) by selecting a sample 109 firms traded on the Istanbul Stock Exchange during 1991-1998 found that the stock returns of 61.46 per cent of the sample Turkish firms were highly sensitive to exchange rate changes. During the crisis, it was found 98.16 percent of the sample firms were significantly sensitive to the changes in the exchange rates. The percentage remained high even during the post-crisis period implying that firms would pay more attention to the currency risk following the crisis.

The degree of exposure was higher for more textile, machinery, chemical, and financial industries in the pre-crisis period. This is due to the higher exchange rate volatility in the pre-crisis period and firms started paying more attention towards exchange rate exposures and used some hedging instruments available to them.

The benefits of capital market approach and cash flow approach of estimating the foreign exchange exposure was compared by the frequency with which each method detects exposure by Martin and Mauer (2005). Their study found evidence that when the cash flows are significantly exposed, the capital market did not find the exposure to be significant. Hence, concluded that cash flow approach to estimate the exposure was better in comparison with the capital market approach.

A study of European 817 sample European multinational firms by Muller and Verschoor (2006) found about 13 percent of the sample firms experienced economically significant exposure to Japanese Yen, 14 percent to the US Dollar and 22 per cent to Great Britain Pound. The study used capital market approach by adding GARCH(1,1) specification to the basic model, and the results were robust across sub-sample periods, suggesting that a depreciation of Euro against the other foreign currencies had a negative impact on European stock returns.

The examination of the relationship between exchange rate fluctuations and stock returns of the sample of firms in the Netherlands during 1994–1998 by Jong et al. (2006) found that about 50 percent of the Dutch firms were significantly exposed to currency risk. All the firms with significant foreign exchange exposure benefited from a depreciation of the Dutch guilder relative to the trade-weighted currency index and concluded that the firms in open economies, such as the Netherlands, exhibited significant exchange-rate exposure.

In a research paper with 2,387 sample firms from Chile, France, Germany, Italy, Japan, the Netherlands, Thailand and the United Kingdom by Dominguez and Tesar (2006) found that changes in the about 20 percent of the firms significantly exposed to changes in exchange rates. Furthermore, their findings suggested that firms dynamically adjust their behavior in response to foreign exchange risk.

The results of Bartram (2007b) showed that several US multinational during 1976 to 2006 were significantly exposed at least to one of the foreign currencies i.e. Canadian Dollar, Japanese Yen and Euro. They also found that the significant exposures were frequent at longer horizons compared to shorter horizons. This study uses both the capital market model and cash flow model. The two-factor model was used to estimate the exposure along with the regressing corporate cash flow variables on changes in exchange rates. The cash flow model estimated 5.6 percent of the 6917 sample firms were significantly exposed while two-factor model predicted 13.2 percent of the sample firms being exposed to the currency risk.

Salifu et al. (2007) studied the sample 20 firms listed in Ghana Stock Exchange for a period of 1999-2004. The study revealed that stock prices of over 55 percent of sample firms were significantly exposed to the changes in the price of US dollar and over 35 per cent were exposed to the Great Britain Pound. Further, the industry-wise exposure results showed that the manufacturing and retail sectors are significantly exposed to the changes in the exchange rate if US dollar and concluded that the Cedi depreciation against the US Dollar adversely affected stock returns of the sample firms.

The study on the exchange rate exposure of the firms in emerging market such as Brazil, Chile, Colombia, India, Indonesia, Korea, Mexico, Morocco, Pakistan, the Philippines, South Africa, Taiwan, Thailand, Turkey, and Venezuela found 38.99 per cent of the sample 931 firms were significantly exposed to the exchange rate fluctuations. This study employed the two-factor model to estimate the currency risk with world financial variables such as the Yen-Dollar and the Euro-Dollar exchange rates to identify the emerging market exchange rate movements that are exogenous to their local economic conditions.

Unlike some of the previous studies on exchange rate exposure that have focused on multinational companies, Aggarwal and Harper (2010) documents that even the domestic firms are exposed to significant foreign exchange risk. They argued that even the firms operating in the domestic markets are likely to be exposed to foreign exchange risks due to the competition from foreign businesses operating in the domestic market. Their results indicated that the exchange rate exposure of a domestic firm is not significantly

different from that of multinational firms. Two-factor model and Fama and French (1993) three-factor model to estimate the exchange rate exposure coefficient. One more study in the context of US used Fama-French (1993) three-factor model to measure the exchange rate exposure of 185 sample US firms and found that the three-factor model detected a higher number of firms compared to the two-factor model (Huffman et al. 2010).

Kang and Lee (2011) conducted an empirical analysis of the foreign exchange exposure of sample 392 Korean firms by employing both, the changes in the exchange rate and the standard deviation of exchange rates. The study found more about 40.8 percent of the sample firms were significantly exposed to the currency risk. While, in a study estimating the exchange rate exposure of Korean oil refiners and petrochemicals, Choi (2010) found that over 50 percent of the sample 66 firms were significantly exposed to sizeable fluctuations in the exchange rate. In terms of the effectiveness of the exchange rate type in estimating the exposure, they found that bilateral rate between US Dollar and Korean Won was more effective for estimating significant exposure of the Korean oil refiners and petrochemicals compared to an industry-specific exchange rate index. Lee (2011) observed the firm value of 33 percent of the firms significantly influenced by the changes in the exchange rates. Further, Lee opined that there could be other factors which could reduce the firm's exposure to exchange rate changes.

The relationship between changes in the exchange rates and the profitability of foreign operations was studied by Lee and Suh (2012). Return on equity from foreign operations was used as a measure of profitability from foreign operations, and it was regressed against the changes in the exchange rates to measure the sensitivity of profitability to changes in the exchange rate. The study found that 3 out of 11 US industries were had significant currency exposures and the variance components analysis revealed that exchange rate changes explain about 2 percent of the variation of a firm’s profitability from foreign operations. They noted that that the exchange rate exposure of measured using capital market-based methods may be weak since the movements in the exchange rate may not have a significant impact on the profitability foreign operations.

Agyei-Ampomah et al. (2013) compared the estimations of the exchange rate exposure using different capital market-based methods on sample 269 British firms from 1991 to

2010. The two-factor model suggested by Jorion found that 14.93 percent of the firms in the sample were directly or indirectly exposed to fluctuations in the trade-weighted currency index. However, the exposure to currency risk increases remarkably to 85.13 percent when the authors used time-varying exposure regressions (to capture the variation on the exposure) along with orthogonalized market returns. They also suggested that firm's exposure to changes in the exchange rate should be estimated using orthogonalized, rather than actual market returns in all the capital market models.

In an attempt to explain the relatively weak evidence of priced currency risk by the prior studies on US firms, Chang et al. (2013) hypothesized the reduction in the exchange rate exposure is due to the usage of currency derivative usages and earnings management. The empirical evidence revealed that earnings management activities (especially for income smoothing) reduced the firm-specific exchange rate exposure. They also claim that the result complement prior attempts to explain the reasons of unpriced currency risk. Similarly, Hutson and Laing (2014) found only 5.2 percent of the sample US firms studied during 1999 to 2006 had significant exposure estimated using Jorion's two-factor model.

The paper on examining the sensitivity of stock returns to exchange rates fluctuations both at Chinese firm-level and industry level by Miao et al. (2013) found that 7 out of the 16 industries were significantly exposed to exchange rate risk. Similarly, Allayannis and Ihrig (2001) documented that between 1979-95 4 out of 18 industries were significantly exposed to currency risk. Baur and Miyakawa (2014) analyzed the constant and time-varying effect of exchange rate movements on the value of sample Australian firms for a period from 1980 to 2010. For examining the time-varying effect, they used daily, weekly, monthly and quarterly changes in the stock returns, market returns and changes in the exchange rate. Their result provided weak evidence for firms being significantly exposed to currency risk over the full sample period and the time-varying models to estimate the exposure found most firms being exposed to currency risk in some periods.

In a study covering the Indian firms by Kanagaraj and Sikarwar (2011) examined the effect of exchange rate changes on the stock returns using the standard two-factor model. The study reported that stock returns of about 16 percent of the sample 361 firms had

significant exposure to the exchange rate changes. Another study in the Indian context by M. and Lukose (2014) reported that 10.84 percent of the sample 342 firms had significant exposure. Mohapatra and Rath (2016) using a sample of 232 Indian non-financial firms for a period of 2000 to 2013 documented that about 64.22 percent of the firms were significantly exposed to currency risk. Dhasmana (2014) used the cash flow model to estimate the level of exchange rate exposure and found that the volatility in the foreign exchange rate had a significant influence on the currency risk level of sample Indian firms. Sikarwar (2014) investigated the currency exposure at the industry level with a sample of 342 Indian non-financial firms from 20 industry groups was studied over the period of 2006 to 2011. The study found that a large number of industries significantly exposed to changes in the real exchange than that of nominal changes implying changes in the real exchange rate is the matter of concern for firms the emerging markets such as India.

From the review of the literature covering 6 continents including both developed and emerging markets on the influence of exchange rate changes on the firm value, it can be concluded that there is no doubt currency risk affects the value of the firm. But some of the earlier studies found a weak correlation between the firm value and the exchange rate changes. This is being seen by the researchers as ‘exposure puzzle’ (Bartram and Bodnar 2007).

The subsequent studies largely concentrated on solving the exposure puzzle focusing on the estimation methods. The methodological improvisations in the sample selection, the econometric model specification, and country-specific factors were being made to arrive at a model to estimate the exchange rate exposure more precisely. The initial model proposed by Jorion (1991) which is also known as a two-factor model, however, was used in most frequently in the literature being surveyed with modifications to minimize the drawbacks. Some of the previous studies reviewed used the time lagged effect i.e. using the exchange rate changes of the previous period (day, week, month or quarter) in the two-factor model instead of the contemporaneous changes based on the argument that the current changes in the exchange rate may not affect the current stock returns but might will be reflected in the subsequent prices. However, this methodology is in direct

contrast with the efficient market hypothesis which argues in a semi-strong form of market efficiency; the stock price reflects all the publicly available information (Fama 1970). There are a number of studies have empirically proved that the markets are efficient near to semi-strong form (Firth 1975; Timmermann and Granger 2004). Under the assumption of efficient markets, it can be conjectured that the time-lagged effect may be of little use in the estimation of currency risk. A few studies studied the exposure to currency risk by clustering the time period based on some major economic events such as pre-crisis, crisis and post-crisis periods, pre-Euro and post-Euro, before and after the Asian crisis, etc. These studies found that effect of foreign exchange rate movements on firm value differed during the time periods. Further, Fama and French (1993) model was also used to estimate the exposure, and the findings suggested that Fama-French model was a better estimator than the standard two-factor model. Many such as Bartram (2007), Martin and Mauer (2003) and Lee and Suh (2012) examined the sensitivity of firm's cash flows and profits to the changes in exchange rate. However, this cash flow approach provided an estimation of the sensitivity but did not determine if the sensitivity was statistically significant.

The present study re-examines the effect of changes in the exchange rate on the firm value by using both capital market approach and cash flow approach. The study includes both firm level and industry analysis of the exposure to currency risk.

*H1: Exchange rate fluctuations do not have any significant impact on the value of the firm.*

## 2.3 MANAGEMENT OF EXCHANGE RATE EXPOSURE

The financial risks can be effectively managed by employing the risk management process. Therefore, firms should employ a rigorous risk management process to minimize the currency risk. The transaction exposure can be effectively minimized by hedging. There are various tools used for hedging transaction exposure they are, financial instruments such as currency options, currency futures, cross currency swaps or non-financial techniques such as natural hedging, parallel loans, and invoice currency can be deployed in management this exposure. The translation or balance sheet exposure is

hedged very infrequently and non-systematically as it has much to do with the regulators governing the firm's accounting policies (Papaioannou 2006).

Economic risk is often hedged as a residual risk. Firms may find it difficult to measure and hedge this exposure since it largely depends on the political and economic conditions prevailing which at times becomes unpredictable. Though, strategies for hedging economic exposure have been investigated widely in the previous finance literature. Srinivasulu (1981), Aggarwal & Soenen (1989) and Lessard & Lightstone (1986) argue that economic exposure should be managed strategically, by developing production plants or sourcing in countries whose currencies are undervalued. Further, Kanas (1996) demonstrated how a financial instrument such as currency option could be used to hedge economic exposure effectively. Some commentators have opined that transaction exposure is an element of economic exposure as both are cash flow exposures. Belk and Edelshain (1997) states that the today's economic exposure are tomorrows transaction exposure which would be reflected in the financial statements of the firm at each reporting date. Thus economic exposure is also linked to the translation exposure. It is also said that, by managing today's economic exposure, the shape of tomorrow's transaction and translation exposure can be changed and even much reduced (Belk and Edelshain 1997). From the aforesaid discussion, it can be concluded that transaction exposure and economic exposure can be managed, while, translation exposure is an accounting-related issue and do not affect the firm's current cash flow. Economic exposure is a long-term risk and impacts the firm's long-term cash flows.

The firm value will increase only when the exposure is managed systematically. The prior researchers list the steps to be followed in exchange rate exposure management. McGann & Shade (1997) identified three important steps in exchange rate exposure management. Firstly, awareness of what is happening in the global economy and how they might affect the exchange rates. Secondly, well-reasoned policy and procedures to guide foreign exchange activities and lastly, understanding the hedging methodologies. A survey conducted by Wallace (1998) in the US, identified the seven best exchange rate exposure management practices followed by the large successful companies. They are, written foreign exchange policies, centralize the foreign exchange management with

their parent treasury, sufficient systems to be able to track underlying business exposures being hedged, frequently mark-to-market their foreign exchange positions, separate back office operations from trading, uniform book exchange rates and foreign exchange accounting practices, independent risk oversight. Perhaps, this sums up the whole process involved in exchange rate exposure management. However, the management of the firm should decide the suitable technique considering the risk tolerance and cost of risk management (Edelshain, 1997).

The conceptual framework of the management of exchange rate exposure is depicted in Figure 5. The risk management process is generally supervised by a board-level committee. In the Indian context, Companies Act 2013 and Clause 49 of listing agreement require all the listed firms to constitute a Board level Risk Management Committee. The Board is expected to define the roles and responsibilities of this Committee and delegates the responsibility of monitoring and reviewing of the risk management. The majority members of the Committee should be the members of the Board. However, some senior executives of the company are permitted to be the members of the Committee to provide the expertise function.

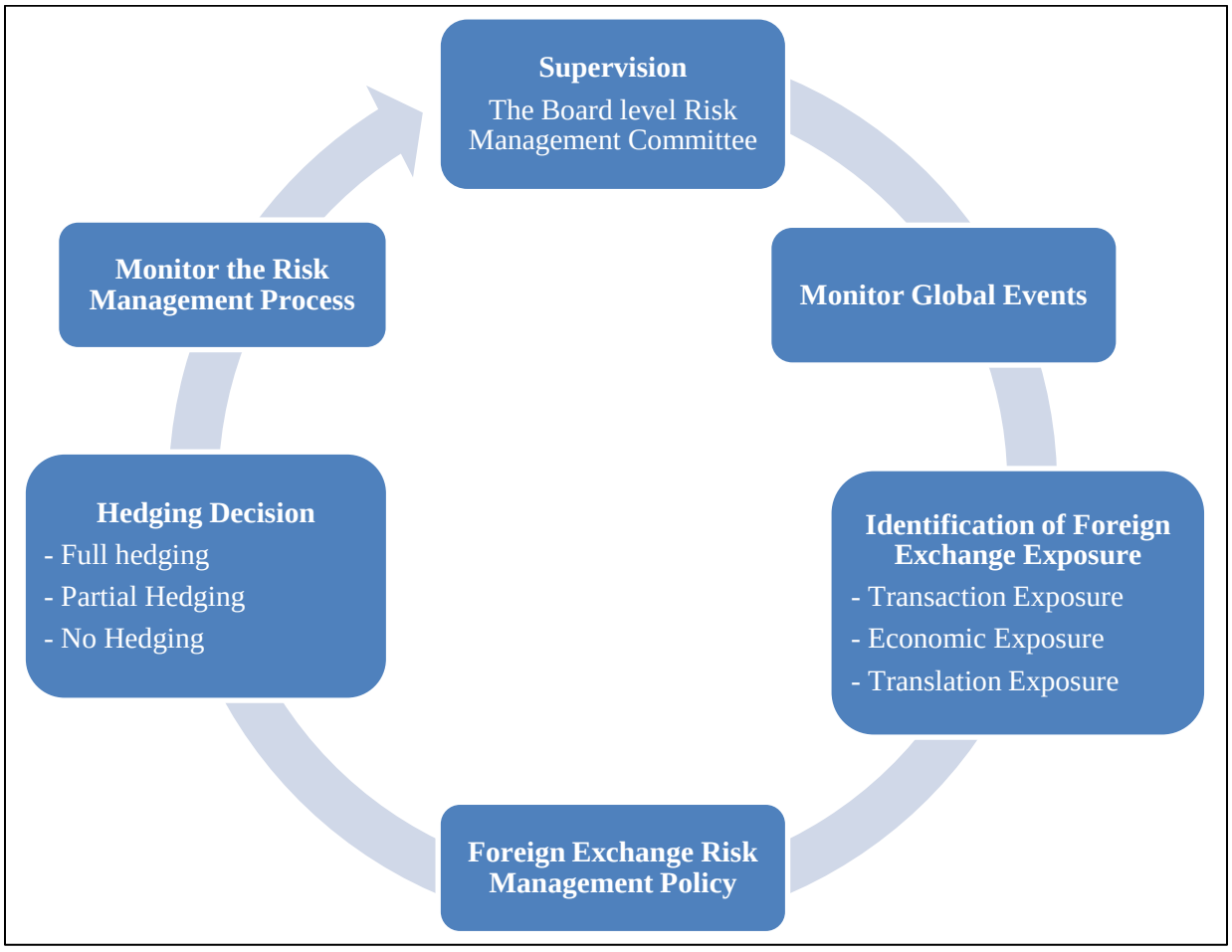
McGann and Shade (1997) opines that for a successful foreign currency risk management, awareness of the recent developments in the global economy and how it might move the foreign currency market is essential. The risk management process, therefore, should monitor the global event to take decisions. In the next step, firms should understand the nature of the exposure i.e. transaction and/or operating and/or translation exposure. Subsequently, a formal risk management policy document has to be developed. In India, the Companies Act 2013 requires its Board of Directors to develop and implement a risk management. Wallace (1998) considers a well-reasoned foreign exchange risk policy document was one of the best practices in the foreign exchange risk management process.

Once the currency risks are identified, it should be measured. There are various techniques developed over the last few years to measure the exposure which can be broadly categorized into capital market models and cash flow models. After measuring the exposure, proper risk management strategies should be employed by the firms to

manage which includes, using currency derivatives or implementing natural hedging techniques or no hedging.

Once the risk management systems are in place, the firms are required to monitor the effectiveness of the systems. The Risk Management Charter of Infosys Ltd., one of the top four IT firm in India, states that "The risk management committee shall annually review and approve the Risk Management Framework of the Company. The risk management committee shall periodically review the risk management processes and practices of the Company and ensure that the Company is taking the appropriate measures to achieve a prudent balance between risk and reward in both ongoing and new business activities"[2]. The monitoring activity is vital in completing the feedback loop.

**Figure 2.2 Conceptual Framework of Exchange Rate Risk Management**




[2] Risk Management Charter of Infosys Ltd. available at https://www.infosys.com/investors/corporate-governance/Documents/risk-management-committee-charter.pdf

The firms may manage the risks actively or passively. Passive management of risks works best if the firms are risk intolerant and firms with higher thresholds and stronger stomachs may choose to actively manage the currency risk (Kucemba 1996). In the situations where the parity conditions such as purchasing power parity and the international Fisher effect are not perfectly present, firms especially non-financial firms are to deal with the economic exposure due to the unexpected exchange rate changes affecting the value of the firm. Nevertheless, professional firm-wide risk management does not yet seem to be in place for all non-financial institutions. Consequently, the need for implementing or improving risk management systems appears especially strong for firms outside the financial sector (Bartram et al. 2005). Therefore the perception of the management of the risks becomes critical in the management of exchange rate exposure (Alssayah and Krishnamurti 2013; Ramlall 2009). The suitable strategies in managing foreign exchange rate exposure by the firm can be taken when the factors affecting the exposure is clearly understood.

## 2.3 DETERMINANTS OF EXCHANGE RATE EXPOSURE

The academic literature relating foreign exchange exposure management lists a wide range of theoretical determinants listed in Table 2.2. Broadly the determinants can be categorized as financial distress, firm size, hedging, breadth and depth of international presence, profitability and liquidity.

### 2.3.1 Financial Distress

There are a number of studies examining the relationship between currency exposure and financial distress. The results of these studies are mixed. Some studies argue that the firms with higher level of financial distress would hedge the exchange rate exposure which leads to lower level of exposure. Contrary to this theory, few studies have argued that due to the inability of firms with high level of financial distress to access the capital market and lower credit rating would increase the exchange rate exposure.

Smith & Stulz (1985) demonstrated that, for a value-maximizing firm, the cost of financial distress is one of the important reasons for risk management. He and Ng (1998)

argued that higher the debt equity ratio lower will be the exchange rate risk as firms with higher debt would have the higher expected cost of financial distress and hence would have greater desire to hedge. Hedging would lower the currency exposure. They empirically examined the relationship using a sample of 171 Japanese non-financial firms and employed long-term debt to equity ratio to measure the financial distress. Their results proved the theory that firms with higher debt to equity ratio exhibited lower exposure and the results were statistically significant in various time periods.

Similarly, Muller and Verschoor (2006a) argued that the firms with higher debt-equity ratios would have a higher cost of financial distress. Hence firms with higher financial distress level would have higher incentive to hedge. They hypothesized that hedging might reduce the exchange rate exposure. Their empirical results indicated that debt equity ratio was negatively related to the exposure indicating that highly leveraged firms had lower exposure, however, the coefficients were insignificant. In a survey of 117 non-financial publicly traded companies listed on the Copenhagen Stock Exchange by Aabo (2006) used the ratio between debt and total assets and found that the debt to total assets ratio was negatively related to the currency exposure.

Agyei-Ampomah et al. (2013) using a sample of 269 non-financial firms of United Kingdom studied the relationship between leverage and currency exposure. Debt to asset ratio was employed as a measure of financial distress. The results evidenced that debt to asset ratio was a significant determinant of the firms' exposure to movements in Japanese Yen indicating that high leveraged firms tend to have a higher exposure to Japanese Yen. A study of 935 firms of US by Hutson and Laing (2014) also used debt to asset ratio as a proxy of financial distress and found that currency exposure was negatively related to debt to asset ratio.

The study conducted in the Indian context by Mohapatra and Rath (2016) found that the influence of debt ratio on exposure was insignificant. This study used 269 non-financial firms both in manufacturing and services sector.

The argument that the high level of financial distress would increase the firm's currency exposure are discussed in this section. A firm with higher level of financial distress,

exchange rate movements will affect firm value because of three reasons. First, the firms with a lower level of financial distress will average out he effect of unfavorable movements in the exchange rate by accessing the external capital market, but a financially distressed firm will have limited ability to do this because of their higher cost of capital (Atanasova 2007). Subsequently, such firms will have to forgo the attractive investment opportunities affecting the future cash flows supporting this argument Garlappi & Yan (2011) shows that for firms with higher distress level, shocks to cash flows have a stronger impact on current stock prices.

Second, the increased volatility in the cash flows and stock prices may result in lower credit rating and higher bond yields (Douglas et al. 2016). Survey results of Loderer & Pichler (2000) found that money market hedge is the popular on-balance sheet hedging instrument and Bodnar et al. (1996); Sahoo (2016) reported over-the-counter derivatives such as currency forwards or currency swaps were most often used off-balance sheet hedging instruments. A firm with higher levels of financial distress would have limited ability, or even inability to hedge exchange rate exposure through financial markets as the cost of hedging depends on the firm's credit worthiness. Third, operational hedging is one of the widely used technique to minimize the exchange rate exposure (Treanor et al. 2014; Wong 2007). Therefore, firms would not be able to implement the operational hedging as well.

In this study, we examine the effect of level of financial distress on the exchange rate exposure. The past studies have employed debt to equity ratio, debt to total asset ratio, Ohlson O-score and KMV bond default model as a measure of financial distress. The present study employs Merton's (1974) distance-to-default to measure the firm's level of financial distress. The study hypothesizes that the exposure of the firms with higher financial distress would be higher than the firms with lower financial distress.

*H2: There is no relationship between financial distress and foreign exchange exposure*

### 2.3.2 Size of the Firm

The empirical literature point out that size of the firm is one of the important determinants of hedging decision. Large corporations have greater resources, expertise,

and economies of scale to hedge (Nance et al. 1993). However, the smaller firms know that they do not have the ability to face the consequences of major fluctuations in the exchange rates may therefore aggressively hedge their risks against the currency risk. Hence, the effect of the size of the firm is unclear.

He and Ng (1998) found that the firm size is positively related to exchange rate exposure. Smaller multinational firms were found to have less exposure to currency risk compared to larger firms. The reason being larger firms had a relatively lower level of financial distress and may have less desire to hedge against the exchange rate fluctuations compare to the smaller multinational firms. The study on determinants of exchange rate exposure by Chow and Chen (1998) found that the size of the firm is negatively related to exposure in the short term horizon and positively related in the long term horizon. This study used log of total debt plus market value and natural log of market value as the measure of firm size. The study concluded that small firms are apprehensive about the bankruptcy cost due to the changes in the exchange rate. But in the longer horizon, large firms have an advantage as it is difficult for small firms to hedge the economic exposure. Both the studies were in the context of Japanese firms.

Muller and Verschoor (2006a) using market value as the proxy for firm size found that firm size had a weak effect on the exposure for sample 817 European firms. Jong et al. (2006) opined that, compared to the smaller firms, the international presence of larger firms is relatively higher and therefore they may have higher exposure. They empirically tested the hypothesis using sample Dutch firms and found that the exposure of larger firms as hypothesized was higher than the smaller firms. The authors used log of the book value of assets as a measure of firm size. Similarly, the study conducted in the Danish context by Aabo (2006) found that the larger firms exhibited higher exposure and vice-versa.

Chue and Cook (2008) examined the effect of firm size on the exposure using the sample from 15 emerging markets. Log of market capitalization was the proxy for firm size. The results indicated that larger firms had less negative exposure to the exchange rate fluctuations. The findings of study covering non-financial firms of 18 countries by Doidge et al. (2006) evidenced that firm size was negatively related to the exposure of

firms in 11 countries, and the overall effect of the firm size was also negative. The effect of firm size on the exposure at the industry level was studied Doukas et al. (2003). Their study concluded that size of the firm is inversely related to the exposure. Consistent with this finding, Chang et al. (2013) using the sample US firms, El-Masry and Abdel-Salam (2007) using the sample UK firms, Solakoglu (2005) with the sample Turkish firms, Miao et al. (2013) in the Chinese context also reported that the firm size was negatively related to the exposure.

The studies in the Indian context by Cheung and Sengupta (2013) and Kanagaraj and Sikarwar (2011) documented the firm size measured by the log of total assets did not have a significant effect on the exposure. But, the results of M. and Lukose (2014) indicated that there is a significant positive association between the size of the firm and exposure. Contrarily, the study by Mohapatra and Rath (2016) found that the larger firms are less exposed to the currency risk and attributed this to the higher level of hedging by larger firms.

The influence of the firm size on the exchange rate exposure remains a puzzle as the findings of the previous studies provide different explanations. This study argues that the transaction exposure is normally deemed to be simple to evaluate and manage, while the economic exposure (long-term effects of exchange rate changes on future cash flows) are complex to determine and therefore may not be easily hedged. Consequently, it is expensive to hedge economic exposure than transaction exposure because the cost of financial hedging is comparatively less costly than hedging the economic exposure which usually necessitates rearranging sourcing, manufacturing and marketing operations.

Hence, it is natural to believe that the large firms' has the comparative advantage in hedging for economic exposure than for transaction exposure. Additionally, due to the comparative advantage for large firms in hedging the transaction exposure is found to be insignificant, they may focus on hedging economic exposure more than small firms. Whereas to reduce the cost associated with the financial distress the smaller firms may hedge transaction exposure even more than larger firms. Hence the study hypothesizes

that the exposure to currency risk of larger firms will be higher than that of the smaller firms.

*H3: Firm size does not have a significant influence on the exchange rate exposure*

The previous studies have used log of total assets, log of market capitalization, log of market capitalization plus book value of debt, total sales, log of a total number of employees as the proxy for firm size.

**Table 2.2 Summary of Studies on Determinants of Exchange Rate Exposure**

| Author/Year | Period | Sample Size | Determinants |
|---|---|---|---|
| Booth and Rotenberg (1990) | 1979-83 | 156 | Dummy for basic industry* (-)<br>Foreign listing* (-) |
| Jorion (1990) | 1971-87 | 287 | Foreign sales/total sales* (+)<br>Foreign assets/market value* (+) |
| Choi and Prasad (1995) | 1985-89 | 61 | Foreign sales* (+)<br>Foreign assets* (+)<br>Foreign operating profit* (+) |
| Miller and Reuer (1998) | 1988-92 | 404 | Foreign assets/total assets* (+) |
| He and Ng (1998) | 1979-93 | 171 | Size* (+)<br>Export Ratio* (+)<br>Dividend pay-out ratio* (-)<br>Quick ratio* (+)<br>Book to market value* (+)<br>Debt equity ratio* (-) |
| Chow and Chen (1998) | 1975-92 | 1110 | Leverage* (-) Size* (-)<br>Growth* (-) Import ratio (-)<br>Export ratio* (+) |
| Martin et al. (1999) | | 168 | Foreign sales to total sales* (-) |
| Allayannis and Ofek (2001) | 1993 | 378 | Foreign sales to total sales* (+)<br>FCD to total sales* (-) |
| Bartram (2004) | 1991-95 | 373 | Firm liquidity* (-)<br>Industry dummies* (+)<br>Foreign sales/total sales* (+) |
| Muller and Verschoor (2006a) | 1988-02 | 817 | Size* (+)<br>Dividend payout ratio (-)<br>Quick ratio (-)<br>Book value per share (-) Debt equity ratio (-) |

| Author/Year | Period | Sample Size | Determinants |
|---|---|---|---|
| Dominguez and Tesar (2006) | 1980-99 | 2387 | Multinational status* (+)<br>Foreign sales* (+)<br>International assets* (+)<br>Market share* (+)<br>Exports* (+)<br>Imports* (-) |
| Aabo (2006) | 2001 | 117 | Size* (+)<br>Foreign sales ratio (-)<br>Number of foreign countries to total assets* (+)<br>Debt equity ratio* (+)<br>Tobins Q* (-)<br>Marketcap* (+) |
| Chue and Cook (2008) | 1999-02 | 931 | Investability (-)<br>Turnover (-)<br>FCD to Cap* (-) |
| Choi and Jiang (2009) | 1983-06 | 243 | Multinationality* (-)<br>Financial hedging (+)<br>Operational hedging (-)<br>FH/OH interaction (+) Size* (-)<br>Debt* (+) |
| Aggarwal and Harper (2010) | 1990-96 | 1047 | Asset Turnover* (-)<br>Profit margin (+)<br>Industry Herf(+)<br>Market to book (+)<br>Asset tangibility* (-)<br>Size* (-)<br>R&D (+) |

| Author/Year | Period | Sample Size | Determinants |
|---|---|---|---|
| Huffman et al. (2010) | 1997-04 | 185 | Foreign sales ratio* (+)<br>Size* (+)<br>Hedging* (-) |
| Agyei-Ampomah et al. (2013) | 1991-10 | 269 | Debt to TA* (+)<br>Marcap*(-)<br>Market-book ratio* (-)<br>Quick ratio (-) |
| Chang et al. (2013) | 2000-11 | 2647 | Foreign sales* (+)<br>Size* (-)<br>Hedging* (-)<br>Earnings management (-) |
| Hutson and Laing (2014) | 1999-06 | 935 | Operational hedging* (-)<br>Financial hedging* (-)<br>R&D (+)<br>Debt to total assets (+)<br>MTBV (-)<br>Quick ratio (-)<br>Foreign sales (+) |
| Mohapatra and Rath (2016) | 2000-13 | 232 | Debt ratio (+)<br>Export ratio* (+)<br>Market to book ratio* (+)<br>Size* (-)<br>Asset turnover* (+) |

### 2.3.3 Depth of the International Presence

The economic exposure is often managed with the combination of operational and financial hedging strategies (Aggarwal and Soenen 1989; Soenen and Madura 1991; Srinivasulu 1981). Among the two broad strategies, financial hedging may not be able to avoid erosion of firm's competitive position due to appreciating domestic currency. Operational hedging involves decisions such as the location of the firm's production facilities, finding the location for sourcing the inputs, redesigning the nature of the products and choice of markets and market segments. The main objective of these strategic decisions is to match the input and output sensitivities in order decrease the level of firms exposure to foreign exchange risk (Bradley and Moles 2002). In this study, we divide the operational hedging into two parts i.e. depth of international presence and breadth of international presence.

The depth of international presence is defined as the contribution of the foreign currency income to the total income of the firm and/or contribution of the foreign currency expense to the total expense. A pure exporter firms may only have income denominated in foreign currency, and a pure importer firm would have expenses denominated in the foreign currency. Besides, a multinational company may have both foreign currency income and expense. The depth of the international presence is said to be higher when the proportion of foreign currency cash flows are higher. The appreciation in the domestic currency should impact the cash flows of a firm with higher foreign currency revenue and therefore should increase the exposure. However, economic theories suggest that the overall position of the firm with higher foreign currency revenue would not be affected as the cost of production may decrease offsetting the adverse impact of the exchange rate changes. It should be noted that the appreciation of the domestic currency may have an immediate effect on the firms' cash flows while the reduction the production cost may take time. Similarly, for a firm with higher foreign currency expenses, the depreciation of the domestic currency would increase the exposure. The short-term effects of the unfavorable changes in the exchange rate may be managed by hedging, but the long term effects have to manage by increasing the breadth of the international presence. The findings of Doidge et al. (2006) suggests that the firms with higher international sales

outperformed those with lower international sales during the large currency depreciations and underperformed during the large currency appreciations. Therefore, foreign exchange exposure is directly related to the depth of international presence.

Shapiro (1975) argued that the major factors that are influencing foreign exchange exposure of a firm are the proportion of export sales and the degree of substitutability between local and imported factors of production. El-Masry and Abdel-Salam (2007) found that the firms having significant exchange rate exposure were the firms with a higher proportion of overseas sales. According to Choi and Prasad (1995) due to the imperfect hedging the exchange rate exposure of firms increase with the firm's foreign currency revenue, profits and overseas assets. He and Ng (1998), Chow and Chen (1998) and Jong et al. (2006) also found the positive association between the export ratio and the exchange rate exposure.

According to traditional internationalization theory, it can be expected that the dominating causal effect between foreign currency cash flows and exposure, a pure exports firm may need/desire for imports and for some firms with imports may very well generate a need/desire for exports to create a natural hedge (Aabo et al. 2010). However, in reality, since the foreign currency inflows and outflows are not perfectly matched the operating hedge may only provide partial protection from exchange rate fluctuations (Chow et al. 1997).

Lee and Suh (2012) studied the impact of exchange rate fluctuations on profitability from foreign operations using a sample of 261 US multinational firms for a period of 1984-2002. The study concluded that the effect of changes in the exchange rate on profitability from foreign operations' was not statistically significant for the majority of the industries studied. In this study, the authors used the profitability from foreign operations as the measure of the depth of foreign operations. The empirical results of Pritamani et al. (2005) reveal that the sample of importing firms was positively related and exporting firms were negatively related to contemporaneous changes in exchange rates.

The previous studies have used foreign sales to total sales, foreign assets to total assets, foreign profit to total assets, export ratio, import ratio and foreign profit to total income

as the measure of the depth of international presence. The past studies have given more importance to the income generated in the foreign currency (inflow), and only some studies used import ratio (outflow). The foreign currency outflow could also affect the firms' exposure to currency risk. Imports, however, is a major part of outflow in foreign currency, but payment of royalty, interest, dividend, etc. may also explain the variations in firms currency exposure. According to Martin et al. (1999), the imbalances in imbalances in cash inflows and cash outflows are more sensitive to exchange rate changes. Therefore, in this study, foreign currency income to total income and foreign currency expense to total expense would be used as the measures of depth of international presence. It is hypothesized that the depth of international presence significantly influences the exchange rate exposure.

*H4a: There is no relationship between the depth of international presence and exchange rate exposure.*

The breadth of international presence is defined as the firms' foreign operation network. Exposure to currency risk can be minimized by diversifying the operations across several countries (currencies). When the inflows/outflows are in more numbers of currencies, the adverse movement in one currency will be offset by the other. Hence overall risk will be reduced. However, such hedges are expensive to construct, time-consuming and thus not easily lifted (Pantzalis et al. 2001). Nickerson and Sadanand (1991) developed a model in which they demonstrated that exchange rate uncertainty encourages the firms to pre-commit to overseas markets with the intention to lead the industry in relocating the production to low-cost countries. Such flexibility provides competitive enhancing the value of the firm. Therefore, increasing the breadth of the international presence along with decreasing the exposure it also increases firm value. However, it should be noted that the firm value may not increase if the cost of financial hedging is lower than the strategic option. The establishment of the foreign subsidiary is tantamount to purchasing strategic options with lower cost than financial markets hedging instruments (Miller and Reuer 1998).

There are some circumstances where a firm may have the flexibility to move production location from one country to another as a response to changes in the foreign exchange

rate. In such a case currency exposure and the financial hedging strategies would be affected (O'Brien 1998). Carter et al. (2001) argue that a firm's long-term operating policies adjustments to minimize the economic exposure are costly but are highly effective in reducing the economic exposure if the firm operates a network of multiple units/subsidiaries that are spread across geographic areas. According to Butler (1997), the cost of hedging is less when a firm chooses to hedge the exchange rate risk through currency diversification compared to the less diversified firm. Large diversified firm faces lower sunk costs when shifting production or sales between the countries because they are most likely to have established operations in those countries. The implication is that firms with the large diversified network are more successful in effectively managing the economic exposure.

Francis et al. (2007) utilized the MNC's foreign subsidiary network as a proxy for the breadth of international presence and found a stronger association between the subsidiary network and exchange rate exposure. The number of currencies that the firms have to deal with was used as the proxy for the breadth of international presence by Faff and Marshall (2005) with a sample 123 firms US, UK, and Asia Pacific regions. The authors provided evidence that the increase in the number of currencies decreased the level of firm's exposure to currency risk.

The breadth of the international presence is constructed with the Hirschman-Herfindahl index over all the countries in which firm operates.

*H4b: There is no relationship between breadth of international presence and exchange rate exposure.*

### 2.3.4 Liquidity

The optimal hedging theories state that a firm with generally a higher liquidity position and a lower financial distress is likely to hedge less against the exchange rate changes. Firms with highly liquid assets have a lower probability of default and liquidity offers an alternative to hedging. Hence, firms may not use hedging instruments as they may perceive liquidity as an alternative to hedging the currency risk (Geczy et al. 1997). Firms with higher liquidity may have higher flexibility in meeting short-term cash flows, thus

using the derivatives to smoothen the cash flow may only increase the hedging cost without the corresponding benefit. Therefore, one can expect that the firm with high liquidity to have an exchange rate exposure higher than the firms with low liquidity. The relationship between liquidity has been explored by the previous studies which are listed below.

The study by He and Ng (1998) used dividend payout ratio and quick ratio as proxies for liquidity and observed that Japanese firms with weak short-term liquidity which have more incentive to hedge had smaller exchange rate exposure. The findings of another study on the sample Japanese firms by Chow and Chen (1998) was contrary to the findings of He and Ng (1998). This study revealed that the firms with lower liquidity experienced higher exposures. Davies et al. (2006) used working capital ratio and quick assets ratio as proxies for liquidity on sample 107 Norwegian firms. The results indicated that firms with more growth opportunities, with larger size and with a lower level of liquidity hedged the currency risk and hence had the lower exchange rate exposure. The study of European firms by Muller and Verschoor (2006a) found that firms with weak liquidity had smaller exposure to currency risk. The liquidity measures used in the study were dividend payout ratio and quick ratio.

This study hypothesizes that the level of firms' liquidity is directly related to the exchange rate exposure. Current ratio and the quick ratio would be used as the proxy for firm liquidity.

*H5: There is no relationship between liquidity and exchange rate exposure.*

### 2.3.5 Profitability

Exchange rate movements can have a significant on the pricing behavior and profitability of exporting and importing firms. In the cases where firms are able to pass on the additional increase in the cost due to the changes in the exchange rates to the customers, which is called as "pass-through", the profitability of the firms may not be affected by fluctuations in the exchange rate. But, there is a difference among the firms in the extent to which they pass-through the effect of exchange rate changes on the price (Bodnar et al. 2002). Flodén et al. (2008) argued that increase in the convexity of cost reduces the pass

through. A firm with higher pass-through elasticity may not be affected due to unfavorable movements in exchange rates. However, this may not be possible for all the firms in which case the profitability of firms with lower pass-through may be affected. For instance, an exporting firm fixes the price in the foreign currency to its foreign customer by adding a profit margin to the total cost which is in the domestic currency. The unfavorable movement in the exchange rate subsequent to the commitment of the price may result in the decrease in the profit margin. Similarly, a firm with imports may compute the total cost based on the cost of import and adverse movement in exchange rates may increase the actual cost than that of budgeted cost. This will again result in a reduction of the profit margin of the importing firm.

The profitability of the firm is partially dependent on the pass-through, and therefore, the profit margin of the firm may affect the exposure. The profit margin also affects the hedging decision. If the profit margin is high, then the firms would take the exposure to save cost associated with the risk management. While if the profitability is low the firm could not afford to maintain high exchange rate exposure (Afza and Alam 2011). The empirical evidence of Elsawaf (2005) using a sample of 627 US non-financial firms suggested that the profit margin measured using EBIT, ROE, and ROA is significantly influences the firms hedging the currency exposure had lower profitability. Similarly, Muller and Verschoor (2007) using a sample of 3,634 Asian firms also concluded that firms with high dividend payout and high-profit margin have less incentive to hedge. While, Klapper et al. (2000) using the sample 327 East Asian firms found that the gross profit margin of hedgers was higher than the non-hedgers, as the profitable East Asian firms had easy access to the derivatives market.

From the above discussion, it is clear that the profit margin of the firm is one of the important determinants of the firms' exposure to currency risk. In a condition where pass through is possible profit margins may not be affected by the exchange rate changes. But the findings of the previous studies prove that pass-through differs from firm to firm and industry to industry. Dash and Narasimhan (2011) studied the level of pass-through using the sample Indian firms found that the bargaining power of Indian exporters compared to that of Indian importers. Moreover, it has been proved that firms with higher margins

have less incentive to hedge. The study hypothesizes that firms with higher profit margins would have less exchange rate exposure.

*H6: There is no relationship between profitability and exchange rate exposure.*

### 2.3.6 Hedging

Theoretically, unintuitive movements in the exchange rate should affect the value of the firm and its cash flows. The empirical findings in the past documented the relationship between stock returns and the changes in the exchange rate. The earlier studies measured the exchange rate exposure as the regression coefficients of the value of the firm on the changes in the exchange rates (Adler and Dumas 1984a; Hodder 1982). Jorion (1991) developed the two-factor arbitrage pricing model to measure the firm-specific exchange rate exposure after controlling for the market return. This model reported the weak correlation between the exchange rate changes and stock returns for the sample US firms. However, with the improvements in the measurement techniques, some of the recent studies reported that a large number of firms are significantly exposed to the exchange rate exposure (Agyei-Ampomah et al. 2013; Bartram 2007b; Fraser and Pantzalis 2004; Kang and Lee 2011; Salifu et al. 2007). As exchange rate exposure affects the firm value and cash flows, it becomes necessary for the firms to hedge the exchange rate exposure.

The hedging of financial risks is a costly activity, and therefore the benefit of hedging should outweigh the cost of hedging in order to increase the firm value. According to Modigliani & Miller (1958), it is useless for a firm to reduce risk by using derivatives under perfect capital market conditions as it would not increase the value of a firm and individual investors can manage hedging strategies themselves by investing in diversified portfolios. The subsequent studies by Stulz (1984) and Smith and Stulz (1985) revealed that, under certain market frictions, corporations having specific operating characteristics like higher financial distress costs, tax convexity, growth opportunities, managerial holdings and liquidity constraints, have an opportunity to enhance firm value by optimally utilizing hedging techniques. The implications of these findings are that benefits of hedging depend on various firm-level factors. In this situation, whether

hedging adds value for the firms is an important issue for both shareholders and managers.

There are a number of determinants influencing the hedging decisions. Minimizing the probability of business disruption defined as minimizing the variance of hedged operating cash flow is also the objective of hedging (Copeland and Copeland 1999). In addition to adding value to the firm, at the macro level, currency hedging is found to be effective in mitigating systemic spillovers (Chung et al. 2012). Judge (2006) studied the sample 366 large non-financial UK firms and provided strong evidence that expected the cost of financial distress was the important determinant for hedging the foreign exchange risk. Similarly, Nguyen and Faff (2003) reported that a firm is more likely to use currency derivatives if there is higher debt component in the capital structure. While the findings of the study by Hu and Wang (2005) on sample 419 non-financial firms in Hong Kong did not support the findings of Judge (2006) that cost of financial distress is the important determinant. Hu and Wang concluded that currency policy of the firms is the most important factor determining the hedging decision of the firms. The study by Charumathi and Kota (2012) examined the determinants of hedging and found that firm size was the significant determinant of the firms hedging decision. Operational hedging may not be a substitute to hedging currency risk using derivatives. Aabo and Ploeen (2014) found no indication of reduced use of financial hedging among the firms with a high degree of internationalization. Because of all the reasons cited above financial hedging still remains one of the important techniques for managing the foreign exchange exposure.

The use of currency derivatives is one of the important methods to managed the currency risk (McGann and Shade 1997). The survey results indicate the firms extensively use the currency derivatives to manage exchange rate exposure (Bodnar and Gebhardt 1999; Bodnár 2009; Loderer and Pichler 2000). In one of the article since the introduction of flexible exchange rate regime Frey (1977) demonstrated how foreign exchange risk could be managed using the currency forward contracts. According to Frey firms wishing to use to currency forward contracts should (1) analyze its exposed position, (2) centralize the control, (3) formulate the strategy and (4) evaluate the situation properly.

Jesswein et al. (1995) opine that the availability of a large variety of foreign exchange risk management products helped the managers to handle the risks effectively. Further, they categorized the development of derivatives market into three generations. The forward contract was considered as first generation product. In the second generation exchange traded instruments such as currency futures, options and warrants along with currency swaps flourished. The third generation witnessed the growth in innovative derivatives such as synthetic derivatives, compound options, foreign exchange agreements, hindsight options, and so on. The innovations in the products may be attributed to the demands of corporate and bank users for more sophisticated products at a lower cost over existing products. Marshall (2000) surveyed the large British, American and Asia-Pacific multinational firms and found that the forward contract was the popular method to hedge the transaction exposure and majority of these firms did not favor the exchange traded instruments such as currency futures and options. The usage pattern was found similar even in the American context (Jesswein et al. 1995).

The past research findings on the relationship between hedging and exchange rate exposure had given mixed results. Copeland and Joshi (1996) using a sample of 200 US firms found that measuring the outcomes of hedging may be difficult as many other macroeconomic factors change along with the changes in exchange rate. Further, they stated that given the scares resources and a substantial amount of capital allocated to hedging, it might diminish the value instead of creating. Therefore, hedging the currency exposure may become wasteful to the shareholders. The hedging may not have yielded the expected results due to the behavioral issues also. The survey results of Malindretos and Tsanacas (1995) reported that the managers had the clear understanding about the exchange rate exposures but were unsure about the appropriate techniques to address the exposure. Jong et al. (2006) examined the relationship between on-balance sheet, off-balance sheet hedging and exchange rate exposure using sample Dutch firms. The findings suggest that on-balance sheet hedging reduced the firms' exposure to fluctuations in the exchange rate. While usage of derivatives was found not have a significant impact on the exchange rate exposure. Jong et al. provided two reasons for the contrasting findings. First, on-balance sheet hedging had long-term orientation which was typically longer than the maturity of any derivative contracts and likely to be reducing

economic exposure whereas the off-balance sheet hedging was more related to the transaction exposure. Second, on-balance sheet hedging is reflected in the annual financial statements of the firms, and hence investors may be able to exercise better judgment about the exposure to currency risk. Yip and Nguyen (2012) investigated the relationship between exchange rate exposure and use of foreign currency derivatives with a sample 97 Australian resources firms during 2006-09. The evidence suggested that use of currency derivatives were not able to alleviate the exchange rate exposure of the sample firms during the study period. Information asymmetry could be one of the reason, for instance, according to Makar et al. (2011) the currency accounting practices in the US did not provide adequate and timely information to precisely estimate the future cash flows.

On the other hand, Zhou and Wang (2013) in their study of 500 UK-based firms evidenced that use derivatives to hedge against the risk of unfavorable exchange rate movements was effective in decreasing the exchange rate exposure. Allayannis and Ofek (2001) using a sample of S&P 500 non-financial firms finds that the usage of derivatives to hedge significantly reduces the exchange rate exposure of the firms. Hagelin and Pramborg (2004) examined the effect of hedging on exchange rate exposure on a sample 160 firms listed Stockholm Stock Exchange. The study revealed that the exposure of firms hedging was 0.25 times lower than the un-hedged firm. Further, use of foreign currency derivative was negatively related to the exposure implying that the hedging using the derivatives would reduce the firms' exposure to exchange rate risk. Nguyen et al. (2007) studied the relationship between the use of currency derivatives and exposure to currency with a sample of 99 French firms and found that the use of currency derivatives was found to be significantly related to lower exchange rate exposure. Another study on the sample French firms by Belghitar et al. (2013) also produced the similar results. In a study conducted by Rossi Júnior (2012) on sample 196 Brazilian non-financial concluded that the firms use financial hedging when the exchange rate exposure is nonlinear.

In the light of contradicting findings, it may be noted that partial or selective hedging could be more effective as it reduces the overall cost of hedging (Cvitanic 1999;

Savchenko and Makar 2010). The findings of a case study of HDG Inc. by Brown (2001) concluded that volatility in the exchange rates and exposure are found to be the important determinants of optimal hedging decisions. In the cases where the exposure is nonlinear Broll et al. (2001) developed a model where the firm with higher (lower) exports should adopt an over (under) hedging strategy in an efficient currency futures market where there is a convex (concave) relationship between spot and futures exchange rates rather than a linear relationship. A fairly priced currency options may be used by the firm as a combination with the currency futures in order to achieve better results against its nonlinear foreign exchange exposure. According to Belghitar et al. (2013), hedging the currency risk will create value to the firms in two ways. First, is by reducing the overall exposure that in turn reduces the external claims on the firm's cash flows. The second is via judicious implementation of a cost-effective hedging policy which reduces the exposure without interfering with the profitable exposures. Therefore, the derivative-based hedging program may be successful in creating shareholder value is contingent upon whether or not the gains outweigh the costs.

In the Indian context, the relationship between financial hedging and exchange rate exposure was studied by M. and Lukose (2014). They document that the sample firms were able to reduce the exchange rate exposure by using hedging through financial derivatives. This study gain importance in the light of Reserve Bank of India expressing concerns over the unhedged currency exposures of the Indian companies and exhorted them to hedge the exposures (Choudhury and Bhat 2015; Jayachandran 2014).

The objective of this research are in two folds. First, the current study surveys the foreign currency derivatives used by the sample Indian non-financial firms to understand the most frequently used and popular currency derivatives used by Indian firms. Second, the study examines the effect of using currency derivatives on the foreign exchange exposure.

*H7: Currency derivatives have no significant impact on exchange rate exposure.*

Financial hedging techniques also include the use of foreign currency debt. For instance, the firms with foreign currency receivables may borrow in foreign currencies with the

intention of creating a payable in the foreign currency. At least to some extent this would create a natural hedge by matching foreign currency inflows and outflows (Dhanani 2004). Moreover, foreign currency debt also reduces or eliminates the asset liability mismatches for the multinational firms with foreign subsidiaries (Hekman 1983). Therefore, foreign currency debt is expected to reduce the firms' exposure to exchange rate risk.

In the seminal study on the capital structure of multinational firms, Lee and Kwok (1988) develops a framework to examine the impact of foreign currency risk on the capital structure of firms. Based on this framework Burgman (1996) investigates the effect of exchange rate risk and political risk on capital structure decisions. He observes that negative relation between the degree of leverage and exchange rate risk is coherent with the traditional financial theories that exchange rate movement may increase the bankruptcy costs and hence decrease the optimal debt level. Contrary to this traditional argument, Burgman finds that total long-term debt was positively related to exchange rate risk; controlling for other capital structure determinants such as political risk, agency costs, size and industry membership. He attributes these results to firms' use of foreign currency debt as a hedge against the foreign exchange risk. Most of the previous studies on the use of currency derivatives to hedge have ignored the natural hedges and treated use of foreign currency debt as a predetermined capital structure decision (Berkman and Bradbury 1996; Mian 1996; Nance et al. 1993; Tufano 1996). In the review article by Leland (1998) observes that only hypothesis was consistently supported i.e. large firms are more likely to use currency derivatives due to the economies of scale. In contrast, smaller firms may prefer natural hedge (Arterian 1993). It was also noted that during the uncertain times firms might prefer natural hedging to financial hedging (Chowdhry and Howe 1999).

Few studies have attempted incorporating natural hedging while analyzing the use of currency derivatives, for instance, Fok et al. (1997) includes a variable proxy for natural hedge and finds natural hedge complements for financial hedging. Geczy et al. (1997) assumed that foreign currency debt is a natural hedge against the foreign operations and concluded that foreign currency borrowings and foreign currency derivatives might be

viewed as substitutes in hedging currency risk. Allayannis and Ofek (2001) incorporated Cragg model to analyze the decision of foreign currency borrowings. They found that exchange rate exposure and firm size were the significant determinants of the decision to borrow in foreign currency. However, they did not find evidence to multinational firms' preference of foreign currency debt to currency derivatives to manage the currency risk. Clark and Judge (2009) compared the financial hedging strategies and found that use of financial hedging instruments (debt or derivatives) depended on the type of exposure. Short-term exposures were hedged using the currency derivatives such as currency futures, forwards and options while the long-term exposures arising from assets located in foreign countries were hedged using foreign currency debt and currency swaps.

Based on the sample US and Canadian firms, Graham and Harvey (2001) found that use of foreign currency debt provided a natural hedge against exchange rate devaluation. Elliott et al. (2003) examined the relationship between foreign currency denominated debt and exchange rate exposure with a sample of 88 US firms during the 1994-97 period. Their results indicated that foreign currency debt was positively associated with the level of firms' exchange rate exposure. Further, they also found that US firms used both foreign currency debt and currency derivatives to hedge the exposure to exchange rate risk and foreign currency debt was a substitute for using of currency derivatives. However, combined use of currency derivatives and foreign currency debt may lead to some macro and micro-crises in the emerging markets as opposed to the findings in the developed markets (Gatopoulos and Loubergé 2013). Aabo (2006) studies the management of foreign exchange exposure of a sample listed non- financial Danish firms. The study concluded that compared to currency derivatives, the relative importance of borrowings in foreign currency to hedge currency risk was positively related to the firms' foreign subsidiaries. Clark and Judge (2009) investigated the management of foreign exchange exposure sample 500 non- financial listed firms in the United Kingdom and found that foreign currency borrowings are used to hedge economic exposure of firms due to their foreign operations. The results of Bartram et al. (2010) indicates that the exposure of firms with foreign currency debt was half of the firms without foreign currency debt.

The foreign currency debts are also used to hedge the accounting exposure, for instance, Aabo et al. (2015) studied the 368 Danish non-financial firms and found that foreign debt is largely used to hedge the foreign assets i.e. accounting exposure as opposed to the findings of previous studies. The evidence provided by M. and Lukose (2014) in the Indian context suggests that foreign currency derivatives were able to reduce the firm's exchange rate exposure and combined effect of currency derivatives and foreign currency debt was significant in reducing the firm's exposure to exchange rate risk.

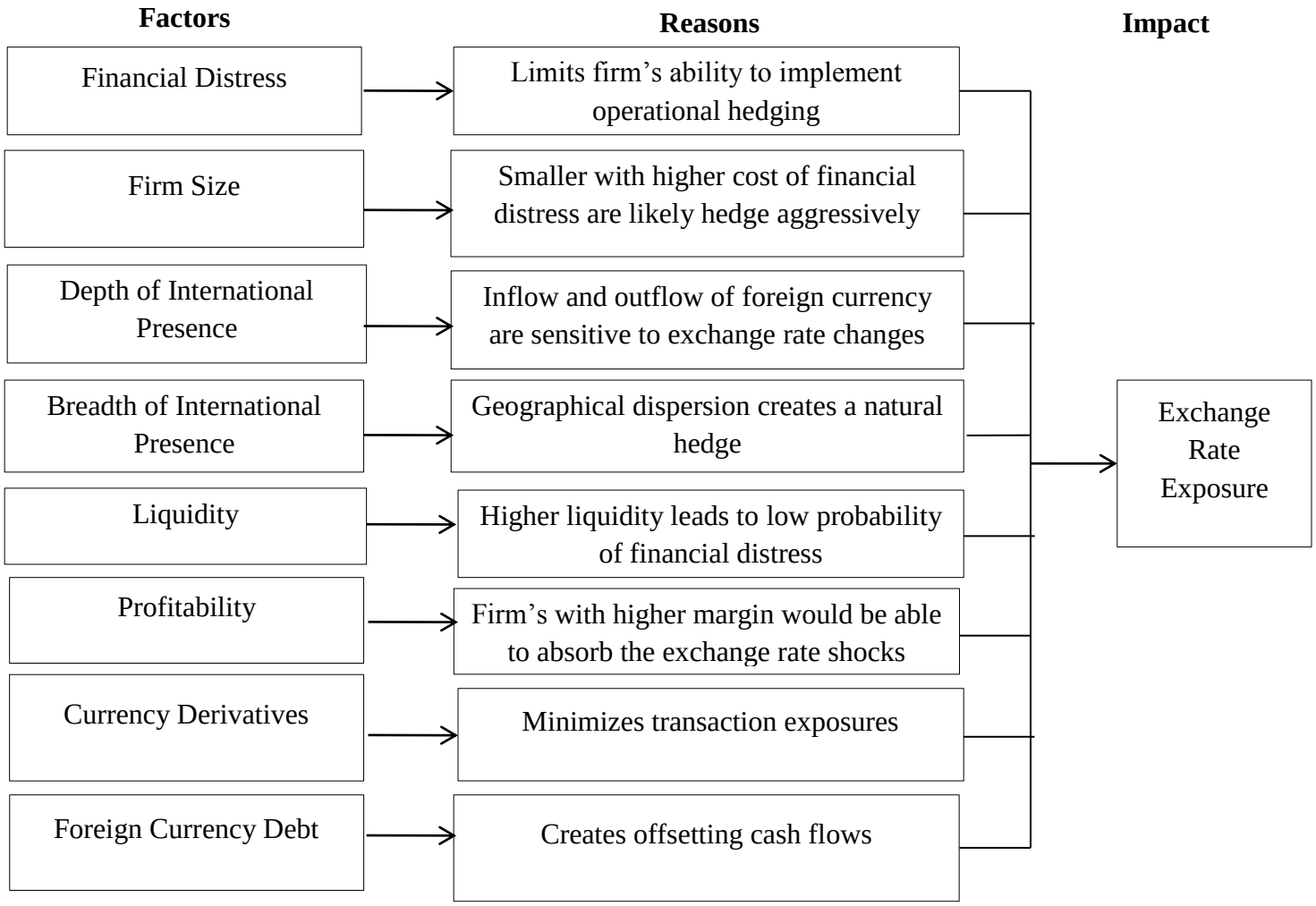
From the above discussion, it can be concluded that the use of foreign currency debt is one of the widely used technique to reduce the exposure to currency risk. The objective could be to hedge the cash flow or to hedge the foreign assets. Therefore, does the use of foreign currency debt reduce the firms' exchange rate exposure? would be the question this study attempts to answer. The effect of foreign currency debt would not the studied in isolation; the study also looks at the combined effect of the use of currency derivatives and foreign currency debt on exchange rate exposure.

*H8: Foreign currency debt does not reduce the exchange rate exposure.*

The previous studies in the past which studied the exposure to exchange rate risk of the firms from various developed and emerging markets documented that value of the very little percentage of firms being affected by the exchange rate changes. This is because there are many other factors determining the firms' level of exchange rate exposure. Hence, it becomes important to understand the determinants of the exchange rate exposure. With the knowledge of the determinants which is most of the times country specific, the firms would be able to manage the economic exposure better. In the Indian context, there is very little academic literature on the determinants of the exchange rate exposure. The previous studies in the Indian context by Kanagaraj and Sikarwar (2011) examined the effect of import ratio, export ratio, firm size and hedging on currency exposure, M and Lukose (2014) assessed the influence of foreign currency debt, foreign currency derivatives, export ratio and firm size on level of exposure, Dhasmana (2014) examined the effect of export ratio, sales growth, exchange rate volatility and firm size on exposure and Mohapatra and Rath (2016) examined the effect of debt, asset turnover, firm size, market to book value and export ratio on exposure.

However, the effect of some of the important factors such as level of financial distress, profitability, liquidity and breadth of international presence on foreign exchange exposure was not examined in the Indian context. This research intends to fill this gap by studying the effect of all the factors mentioned above using sample non-financial firms listed on National Stock Exchange.

**Figure 2.3 Conceptual Framework of the Study**



## 3.1 SAMPLE AND DATA

The non-financial firms constituted NIFTY 500 index of National Stock Exchange (NSE) is chosen as a sample of firms for the study. The firms included in NIFTY 500 index represented over 97 percent of the free float market capitalization of NSE as on 31st March 2016. The total traded value of the stock in this index represented over 87 percent of the overall traded value of NSE. The index includes the firms from over 73 industries. Hence, the firms constituted in this index would represent the population of Indian firms. Firms belonging to financial services industry were excluded from the study. The reason why financial firms were excluded is due to the complexity of exchange rate exposure and risk management practices of financial firms (El-Masry 2006). The total number of firms in CNX 500 index as on April 2016 was 500 out of which 76 were firms from the financial services sector. After elimination of 76 non-financial firms, the sample was reduced to 424 firms. The data for the companies was collected from Ace Equity database and Centre for Monitoring the Indian Economy (CMIE) database, Prowess for a period of five years starting from 2011-2016. Some of the sample firms followed calendar year, and most were following financial year, and the data was collected accordingly. Out of 424 sample firms, 37 firms data was not available for full five years as they were listed during the study period. Hence, they were eliminated from the final sample. The final sample consisted of 387 firms. The complete list of sample firms is available in Appendix I.

NSE categorized firms constituted in NIFTY 500 firms into 19 industries. After eliminating firms in Banking and Non-banking Financial Services industries the study included final sample firms from 17 industry portfolios namely Automobile, Cement & Cement Products, Chemicals, Construction, Consumer Goods, Energy, Fertilisers & Pesticides, Healthcare Services, Industrial Manufacturing, Information Technology (IT), Media and Entertainment, Metals, Paper, Pharma, Services, Telecom and Textiles. The majority of sample firms were from Consumer Goods industry with about 15.50 per cent, followed by Industrial Manufacturing (11.37 per cent). There were only 2 and 3 firms representing Healthcare Services and Paper industry respectively. Table 3.1 presents the industry wise break up of sample firms.

**Table 3.1 Industry-wise Representation of Sample Firms**

| Industry | No. of Firms | Percentage |
|---|---|---|
| Automobile | 29 | 7.49 |
| Cement & Cement Products | 15 | 3.88 |
| Chemicals | 11 | 2.84 |
| Construction | 38 | 9.82 |
| Consumer Goods | 60 | 15.50 |
| Energy | 35 | 9.04 |
| Fertilisers & Pesticides | 8 | 2.07 |
| Healthcare Services | 2 | 0.52 |
| Industrial Manufacturing | 44 | 11.37 |
| IT | 25 | 6.46 |
| Media and Entertainment | 17 | 4.39 |
| Metals | 17 | 4.39 |
| Paper | 3 | 0.78 |
| Pharma | 34 | 8.79 |
| Services | 28 | 7.24 |
| Telecom | 7 | 1.81 |
| Textiles | 14 | 3.62 |
| **Total** | **387** | **100.00** |

Estimating the firm's exposure to the exchange rate changes required stock returns, market returns and exchange rate changes. The stock returns were calculated based on the daily closing price of the firm collected from CMIE Prowess database. The closing index value was collected from NSE archives. The daily values of 36 countries' nominal effective exchange rate index (36 NEER; Base: 1985=100) published in European Central Bank statistical warehouse are used for the purpose of calculating daily exchange rate changes. The firm level data such as total assets, current ratio, net profit margin, foreign currency income, total income, foreign currency expense, total expense, the number of foreign subsidiaries and foreign currency borrowings was collected from Ace Equity Database. The data on derivatives usage was collected from the annual reports published by the sample companies.

## 3.2 MEASUREMENT OF EXCHANGE RATE EXPOSURE

There are two broad methods discussed in the literature to estimate the exchange rate exposure. First based on the capital market frameworks and second based on cash flow frameworks. However, both the methods are not comparable as they address somewhat different questions. In general, the capital market approach focuses on understanding the effect of foreign exchange risk on the firm value. This understanding would be helpful to decision-makers seeking to maximize the firm value. The nature of capital market models captures expectations formation and is forward looking. The cash flow approach would be important to those decision makers such as executives, employees or debt holders who are concerned about the firm-specific conditions. This approach is helpful in identifying cash flow patterns as a result of changes in exchange rates. Nevertheless, the cash flow approach, though less directly, may have implications for measuring the firm value, after all, the cash flow variability is one of the key components of assessing firm value. This study estimates the exchange rate exposure using both the models.

### 3.2.1 Capital Market Model

The capital market model is based on Ross's (1976) arbitrage pricing theory (APT) and extended by Solnik (1983) to international business environment. Much of the research estimated foreign exchange exposure employing variations of the capital market model, in which an individual stock return is regressed on changes in the foreign exchange rate. The resulting coefficient measures the sensitivity of stock returns to the changes in exchange rates, and it is interpreted as the firm's exposure to exchange rate fluctuations. This assumes exchange rate risk is a priced factor. Many studies have provided empirical evidence that exchange rate risk is priced (Doukas et al. 1999; Dumas and Solnik 1995; De Santis and Gérard 1998).

The capital market model, following Adler and Dumas (1984b), and Jorion (1990), estimates the exchange rate exposure from the following time series regression:

$$R_{it} = \beta_0 + \beta_1 e_{it} + \nu_{it} \quad (1)$$

Where, $R_{it}$ is the rate of return on the $i$th firm's stock and $e_{it}$ is the change in the exchange rates. In the seminal work by Jorion (1991) notes that the above model can be extended to

take market returns into account. Jorion included the market return in to the model to investigate the effect of exchange rate changes on stock returns of 287 US non-financial firms based on the capital market model with the multilateral exchange rate index, as suggested by Adler and Dumas (1984):

$$R_{it} = \beta_0 + \beta_1 e_{it} + \beta_2 R_{mt} + v_{it} \quad (2)$$

From the above regression model, coefficients $\beta_1$ and $\beta_2$ provide the measure of exchange rate exposure and market risk of the firm $i$, $v_{it}$ is the error term. The similar equation is employed by Adler & Dumas (1984) and Jorion (1990). This model is often used to examine the null hypothesis that the exchange rate fluctuations have no effect on stock returns i.e. $H_O: \beta_1 = 0$. The alternate hypothesis is $H_1: \beta_1 = 0$. The sign of exchange rate coefficient can be positive or negative depending on the foreign currency cash flows of the firm. For example, the firm with foreign currency payable will benefit from Rupee appreciation as the firm's cost in terms of Rupees would come down due to the appreciation of domestic currency. Conversely, firms with foreign currency receivables would benefit from the Rupees appreciation against foreign currency, as the cash inflow in terms of Rupees would increase because of the depreciating Rupees. A firm with positive beta coefficient would benefit from Rupee appreciation and a firm with negative beta coefficient would not benefit from the Rupee appreciation. It also means the firm with foreign currency payable is likely to have positive coefficient and vice versa.

This model exhibits the potential problem of multicollinearity. That is while estimating two-factor model there is a possibility that the market and exchange rate factors are correlated and influenced by similar macroeconomic factors. In order to control this problem, the exchange rate factor has been orthogonalized by using the approach of Kiymaz (2003). This was done in two steps:

In the first step the return of the market portfolio is regressed on the changes in the exchange rate as shown by Equation 3:

$$R_{\text{mt}} = \theta_0 + \theta_1 e_{it} + \varepsilon_{it} \quad (3)$$

The error term ($\varepsilon_{it}$) that is the difference between actual and predicted market return is used as the component of the market portfolio return that is orthogonal to the changes in the exchange rate ($F_{mt}$).

Finally, exchange rate exposure of firms was estimated by regressing firm's stock returns on orthogonalized market returns ($F_{mt}$) and on exchange rate $e_{it}$ as illustrated in Equation 4,

$$R_{it} = \lambda_0 + \lambda_1 e_{it} + \lambda_2 F_{mt} + \mu_{it} \quad (4)$$

Where $R_{it}$ is the weekly log-normal return of $i$ at time $t$, $F_{mt}$ is estimated the orthogonal component of market portfolio and $e_{it}$ is weekly log-normal change in the trade-weighted exchange rate index (NEER) over the same period.

The time series regression model in Equation 4 may have the econometric problems of multicollinearity, autocorrelation, and heteroscedasticity. The problem of multicollinearity was minimized by orthogonalization as explained above. To eliminate autocorrelation and heteroskedasticity, log-normal return of the variables are used in the model. Elton & Gruber (1974) argued that stocks follow log-normal distribution, therefore, log-normal returns should be used in the capital market models. Hence, we use daily log-normal firm's stock returns, market returns and changes in exchange rate index.

To analyze the industry-wise exposure to exchange rate changes this study uses the weighted average beta. Recent academic publications suggest that value weighted beta is better measure compared to the equal weighted (1/N) beta (Butler 1985; DeMiguel et al. 2009). Hence, the exchange rate exposure coefficient ($\lambda_1$) estimated using Equation 4 is multiplied by market value weight of the firm within the industry to arrive at the industry's exposure to exchange rate changes as explained in Equation 5.

$$WIE_i = w_{1a}\,\lambda_{1a} + w_{2b}\,\lambda_{1b} \ldots\ldots w_n\,\lambda_{1n} \quad (5)$$

where, WIE is the weighted average exposure to exchange rate of industry i, $w_{1a}$ is the market value weight of firms a and $\lambda_{1a}$ is the beta coefficient of the firm *a*.

### 3.2.2 Cash Flow Approach

The cash flow approach employs a simple model to measure a firm's exposure elasticity to the exchange rate changes without the need to use stock return data. The empirical studies on exchange rate exposure using capital market approach (for example Choi & Prasad 1995; Stulz 1984; Allayannis et al. 2001) typically found low or negligible levels of exposure for most firms, even when the firms examined have significant foreign operations. This has been considered somewhat of a puzzle. None of these studies are based explicitly on a model of firm behavior, so it is difficult to interpret their findings of low exposure in terms of economic behavior. Therefore Bodnar & Marston (2014) developed a new model to measure the economic exposure.

$$\delta = h1 + (h1 - h2)\,((1/r) - 1) \qquad (6)$$

where $\delta$ is exposure elasticity and is the function of only three variables, h1 (foreign currency-denominated revenue as a percent of total revenue), h2 (foreign currency-denominated costs as a percent of total costs) and r (profits as a percent of total revenues). The delta calculated using the model may be positive or negative. Profit of the firms with positive delta would increase with the domestic currency appreciation while the profits of firms with negative delta would lose from the domestic currency appreciation. The latter model is not very extensively used in the literature, but it is a very effective tool to measure the exchange rate exposure.

This study uses both capital market-based measure and accounting-based measure of FX exposure to study the factors influencing the exposure.

## 3.3 MEASUREMENT OF DETERMINANT FACTORS

The measurement of determinant variables in the model is presented below:

### 3.3.1 Financial Distress

To test our hypothesis that the effects of exchange rate movements on a firm’s stock price are increasing with the firm’s potential financial distress, we consider distance to default model based on Merton's (1974) bond pricing model with equity as a call option on firm

value whose strike price is equal to the value of debt (Bharath & Shumway, 2008). Hillegeist et al. (2004) proved that the Merton's distance to default measure outperformed both the Z-score and the O-score models in predicting bankruptcies during their 1980-2000 sample period. Based on Merton (1974) model, equity is considered to be a call option on the firm's assets. The market value of equity as follows:

$$V_E = VN(d1)\ w- Fe^{-rT}\ N(d2), \quad (7)$$

Where,

$$d1 = \frac{ln\left(\frac{V}{F}\right)+(r+0.5\sigma^2 v)T}{\sigma\sqrt{T}} \quad (8)$$

$$d2 = d1 - \sigma V\sqrt{T} \quad (9)$$

*F* is the face value of the firm's debt, *V* and $\sigma V$ are the total values of the firm and its volatility, respectively, *r* is the risk-free rate, and *T* is the time to maturity. *N*(.) is the cumulative density function of the standard normal distribution. Then distance-to-default is defined by the expression:

$$DD = \frac{ln\left(\frac{BVL}{MVE+BVL}\right)}{\frac{BVL}{MVE+BVL}-1\sigma E} \quad (10)$$

Where,

L is market-based leverage measure, BVL is a book value of liabilities, MVE is the market value of equity (number of shares outstanding times the closing price per share at the end of the last trading day of the month) and  is the annualized historical volatility of equity returns.

The higher the DD measure, the further away the firm is from the default point.

### 3.3.2 Measurement of other Determinants

The size of the firm is measured with natural log of total assets of the firm. The depth of international presence is measured as proportion of foreign sales to total sales and proportion of foreign currency expenditure to total expenditure.

Geographical dispersion is used as a proxy for the breadth of international presence. Geographical dispersion is constructed with Hirschman-Herfindahl concentration index over all the countries in which firm operates.

$$\text{Dispersion} = 1 - \sum_{j=1}^{k} \left[\frac{No.of\ Foreign\ Subsidiaries}{Total\ Number\ of\ Subsidiaries}\right]^2 \quad (11)$$

Liquidity of a firm is measured by current ratio which is computed by dividing current assets by current liability. A dummy variable of one if net profit margin (PFT) is positive and zero otherwise is used as a proxy for profitability. The usage of currency derivatives was collected from the annual reports of the sample firms for the study period. The dummy code of 1 is used if the firm used currency derivatives and zero otherwise. Similarly, a dummy variable is used if the firm had borrowed in foreign currency.

Table 3.2 presents the summary of measurement of dependent and independent variables.

**Table 3.2 Measurement of Determinants Factors and their Expected Relationship**

| Determinants | Measurement | Expected Sign |
|---|---|---|
| Financial Distress (FD) | Merton's Distance to Default | - |
| Firm Size (SIZE) | Log of Total Assets | + |
| Depth of International Presence (DEPTH) | Foreign Currency Revenue to Total Income Ratio | + |
| | Foreign Currency Expense to Total Expense Ratio | + |
| Breadth of International Presence (BREADTH) | Hirschman-Herfindahl Index | - |
| Liquidity (LQDTY) | Current Ratio | - |
| Profitability (PFT) | Dummy variable 1 if firm has positive net profit margin, 0 otherwise | - |
| Hedging (HDG) | Dummy variable 1 if firm uses currency derivative, 0 otherwise | - |
| | Dummy variable 1 if firm has borrowed in foreign currency, 0 otherwise | - |
| Net Importer (NI) | Dummy variable 1 if the foreign currency expense is more than foreign currency revenue, 0 otherwise | + |

### 3.4 MODEL

We employ two models to test the influence of aforesaid factors on exposure.

First model is cross section regression between the coefficients of exchange rate exposure (λi) estimated in the capital market model (equation 4) and The model is explained in equation 12:

$$\lambda_i = \alpha + \gamma 1FD + \gamma_2 SIZE + \gamma_3 DEPTH + \gamma_4 BREADTH + \gamma_5 LQDTY + \gamma_6 PFT + \gamma_7 FCD + \gamma_8 FCB + \gamma_9 NI + z_{it} \quad (12)$$

The second model is cross sectional regression between exchange rate exposure (δ) estimated using Bodnar & Marston (2014) and the explanatory variables in equation 13.

$$\delta = \lambda_i = \alpha + \gamma 1FD + \gamma_2 SIZE + \gamma_3 DEPTH + \gamma_4 BREADTH + \gamma_5 LQDTY + \gamma_6 PFT + \gamma_7 FCD + \gamma_8 FCB + \gamma_9 NI + z_{it} \quad (13)$$

where, FD is distance to default, SIZE is log of total assets, Depth is foreign currency revenue to total revenue and foreign currency expense to total expense, LQDTY is current ratio, PFT is the dummy variable 1 if firm has positive net profit margin 0 otherwise, FCD is dummy variable 1 if firm used currency derivative 0 otherwise, FCB is dummy variable 1 if firm has borrowed in foreign currency 0 otherwise, NI is the dummy variable 1 if the foreign currency expense of the firm is more than foreign currency revenue 0 otherwise.

There are different models which can be used to analyze panel data. The existence of the fixed or random effects is the basic difference between the panel data models (Greene 2012). Hausman test is relied on by the researchers (Clark and Linzer 2015; Fávero 2013) to assess if there are any significant difference between the estimates of the two models (random and fixed). In the case of no difference, it is advisable to use random effects, as they are more efficient than fixed effects. If there is a difference, it provided the evidence of bias in the random effects estimate and advised to employ fixed effects instead (Baltagi et al. 2003; Clark et al. 2010). Hausman test statistic is H = 133.641 which is significant at 1 percent level favoring the use of fixed effects (FE). Therefore, the current study tests the models specified in equation (12) and (13) using fixed effect

panel data model. To test the robustness of the results weighted least-squares (WLS) regressions are employed, and the reciprocal of the standard error of the exchange-rate exposure coefficient estimated from equation (4) is used to weight the variables.

To investigate the motives and the hedging practices, case study method is adopted. Two firms were chosen. First, a company which does not hedge in spite of large foreign currency cash flows and the second, a firm which hedges all its exposure using derivatives. MRPL Ltd. one of largest oil refinery in the country and Aspinwall & Co. Ltd. a trading firms with majority of its revenue denominated in foreign currency were chosen. Further, the person in charge of hedging was interviewed to understand the process and motives behind the usage of derivatives.

The empirical results of the empirical models discussed in the previous chapter are discussed in this chapter. The chapter begins by discussing the exchange rate exposure estimates of the sample firms in section 4.1. The exchange rate exposure is the beta coefficient obtained using the model specified in Equation 4. The section 4.2, the exchange rate exposure at the industry level is analyzed. In section 4.3 the descriptive statistics and the results of panel data regression models as specified in Equation 10 and 11 are presented.

## 4.1 EXCHANGE RATE EXPOSURE ESTIMATES

This section reports the exchange rate exposure coefficients of the sample Indian non-financial firms. Table 4.1 provides the summary of exchange rate exposure coefficient of the sample firms during the study period. From Table 4.1 it can be observed that over fifty percent of the sample firms were significantly exposed to exchange rate risk during four out five years studied. The stock returns of over 94 percent of the firms during the year 2015-16, over 66 per cent of the firms during 2014-15, over 70 per cent of the firms during 2013-14, over 42 per cent of the firms during 2012-13 and over 71 percent of the firms during 2011-12 were significantly sensitive to the changes in the exchange rates. In comparison with the previous studies on sample Indian firms by Kanagaraj and Sikarwar (2011) and M and Lukose (2014), the percent of Indian firms with significant exposure to exchange rate changes was higher. This is because the present study used the orthogonalized market return while the study by M and Lukose used the traditional capital market model. Besides, in this study, the log returns were used to estimate the coefficients.

**Table 4.1 Summary of Exchange Rate Exposure Coefficients**

| | 2015-16 | 2014-15 | 2013-14 | 2012-13 | 2011-12 |
|---|---|---|---|---|---|
| Number of firms significantly exposed | 365 | 256 | 271 | 163 | 277 |
| As a percentage of total sample | 94.315 | 66.150 | 70.026 | 42.119 | 71.576 |
| Number of firms with significant exposures at 10% | 14 | 50 | 30 | 23 | 47 |
| As a percentage of total sample | 3.618 | 12.920 | 7.752 | 5.943 | 12.145 |
| Number of firms with significant exposures at 5% | 27 | 73 | 64 | 45 | 67 |
| As a percentage of total sample | 6.977 | 18.863 | 16.537 | 11.628 | 17.313 |
| Number of firms with significant exposures at 1% | 324 | 133 | 177 | 95 | 163 |
| As a percentage of total sample | 83.721 | 34.367 | 45.736 | 24.548 | 42.119 |
| Mean | 1.704 | 1.056 | 0.544 | 0.404 | 0.852 |
| Median | 1.530 | 0.997 | 0.519 | 0.342 | 0.783 |
| 25th percentile | 1.066 | 0.611 | 0.286 | 0.115 | 0.462 |
| 75th Percentile | 2.311 | 1.430 | 0.778 | 0.621 | 1.181 |
| Min | -0.061 | -1.364 | -0.527 | -0.535 | -0.481 |
| Max | 4.506 | 3.419 | 1.454 | 1.959 | 2.549 |

*Note: The exchange rate exposure coefficients were estimated using time series model $R_{it} = \lambda_0 + \lambda_1 e_{it} + \lambda_2 F_{mt} + \mu_{it}$, where, $R_{it}$ is the weekly log-normal return of i at time t, $F_{mt}$ is estimated orthogonal component of market portfolio and $e_{it}$ is daily log-normal change in the trade-weighted exchange rate index (NEER) over the same period. The firm level exposure coefficients are reported in Appendix II.*

The mean of exposure coefficient of the sample firms for the year 2015-16 was 1.704, 1.056 during 2014-15, 0.544 during 2013-14, 0.404 during 2012-13 and 0.852 during 2011-12. There was an increasing trend in firms' exposure to exchange rate fluctuations over the five years. This trend can be attributed to the increased volatility of Indian Rupee during the study period (Gupta and Kashyap 2016). The highest exposure was 4.506, and the least was -0.061 during the study period. Table 4.2 provides the summary of a number of firms positively exposed and negatively exposed to the exchange rate changes.

**Table 4.2 Sign of the Exchange Rate Coefficients**

| | 2015-16 | 2014-15 | 2013-14 | 2012-13 | 2011-12 |
|---|---|---|---|---|---|
| Firms with negative exposure | 1 | 8 | 17 | 62 | 14 |
| Firms with positive exposure | 386 | 379 | 370 | 325 | 373 |

The average value of exchange rate exposure coefficients of the sample firms during the study period was 0.912 indicating that for one per cent appreciation in Indian Rupee the stocks gained by 0.912 per cent on an average. The number of firms with positive exposure was more than the firms with negative exposure. The firms with negative exposure were negligible. This suggests that, overall, the stock returns increased with the appreciation on Indian Rupees. The appreciation of domestic currency is expected to bring short term gains to the net importers. As the sample firms include both net importers and net exporters, the results are puzzling and may need further explanation. The studies in the other emerging markets such as Chue and Cook (2008); Dominguez and Tesar (2006); Muller and Verschoor (2006a); Tsai et al. (2014); Ye et al. (2014) also have found stock prices rising with the appreciation of domestic currency.

The literature provides various reasons for such unintuitive results. The study by Dominguez and Tesar (2006) found that depreciation of Thai Bhat generally decreased the share value of the Thai firms. They ascribed this to the large dollar denominated debt of Thai firms. Similarly, Chue and Cook (2008) reported that exchange rate depreciation had a negative impact on stock returns of firms from emerging market which included a sample from India. They observed a strong association between foreign currency debt and the exposure. The findings of the study concluded by Muller and Verschoor (2006a)

also suggest that due the reliance on imported raw materials for production and the exports the stock returns increased with the appreciation of domestic currency. Besides, the emerging markets would have a higher level of foreign currency debt and thus would be benefited by the domestic currency appreciation hence stocks react positively to this news. The study by Ye et al. (2014) on the sample firms from 12 emerging economies including India reported that stock prices increased with the appreciation in the domestic currency. Therefore, the unintuitive results could be due to other firm-specific factors.

Further, the overall foreign trade of the sample Indian firms was analyzed. During the study period, the total value exports of all the sample firms were ₹ 220.79 billion, and the total value of import was ₹ 320.10 billion for the year 2015-16. For all the study period the value of imports was higher than the value of exports. Hence, overall the sample firms were net importers this could possibly explain the positive exchange rate exposure. The foreign currency borrowings of the firms may also be a driving factor as 88 of the sample 387 firms had foreign currency borrowings of ₹ 21.55 billion. Priestley and Ødegaard (2007) argues that both net importers and net exporters are likely to gain from domestic currency depreciation. Typically, net exporter firms prefer to hedge the exports and not imports because these firms can influence the quantity and prices of exports but not prices of imports. It is this cases the exchange rate exposure of an exporter may contrary to the expectation. Moreover, this study is not particular about the direction of the impact of exchange rate changes on stock returns, but the study is concerned about the absolute exposure, following the literature (Aggarwal and Harper 2010; Aysun and Guldi 2011; Doukas et al. 2003; Nguyen et al. 2007). Therefore, to carry out the further analysis, the absolute value of exchange rate exposure coefficients is considered to study the relationship between firm-level determinants and exchange rate exposure.

The results indicate that the stock returns of over 66 percent of the sample firms during the study period are significantly exposed to exchange rate changes. However, the study could not provide evidence that all the firms have significant exposure as hypothesized. In contrast with the findings of previous studies, the methodological improvements used in this study was successful in detecting exchange rate exposure of a large number of

firms. Hence, it may be conjectured that changes in the exchange rate will affect the value of the firm and reject the null hypothesis that exchange rate exposure does not affect the value of the firm.

## 4.2 INDUSTRY-WISE EXCHANGE RATE EXPOSURE

Table 4.3 represents the number of firms in an industry with significant exchange rate exposure ($\lambda_1$) estimated using the capital market model as explained in Equation (4).

The Indian Automobile industry consists of automakers (assemblers) and three major suppliers. First, the third tier suppliers providing basic products like rubber, plastic, aluminum, steel, etc. Second-tier suppliers include designers of vehicle systems, providers of engineering resources, fabrication, welding, etc. The first tier suppliers provide major systems such as engine directly to the automakers (Gaddam 2016). The automobile industry contributed around 7 per cent to India's GDP and was able to generate export sales since the government allowed 100 per cent FDI in the automobile sector in the year 2002 (Tripathi and Rao 2016). The study observes that 89.66 percent of the sample firms from Automobile industry were significantly exposed to the exchange rate risk during the year 2015-16, while it was 62.07 percent during 2014-15, 75.86 percent during 2013-14, 31.03 percent during 2012-13 and 72.41 per cent during the year 2011-12. The grand mean of the firms exposed to exchange rate risk during all five study period was 66.21 percent.

The percentage of sample firms in the Cement and Cement Products industry with significant exposures were 100.00 per cent, 93.33 per cent, 86.67 per cent, 80.00 per cent, 73.33 per cent during the year 2015-16, 2014-15, 2013-14, 2012-13 and 2011-12 respectively. During the same period, the foreign currency revenue as a percent of total revenue increased from 2.42 in 2011-12 per cent to 4 per cent in 2015-16, and foreign currency expenses as a percent of total revenue increased to 10 per cent in 2015-16 from 8 percent in 2011-12. In the Construction industry, 100 percent of the firms in 2015-16, 65.79 percent in 2014-15, 78.95 in 2013-14, 63.16 in 2012-13 and 86.84 per cent in 2011-12 were had statistically significant coefficients. Overall, 78.95 percent of sample firms in the Construction industry had significant exposures.

**Table 4.3 Summary of Industry-wise Exposure to Exchange Rate Changes**

| Industry | No. of Firms | No. of Firms with significant exposure | | | | |
|---|---|---|---|---|---|---|
| | | 2015-16 | 2014-15 | 2013-14 | 2012-13 | 2011-12 |
| Automobile | 29 | 26 | 18 | 22 | 9 | 21 |
| | | (89.66) | (62.07) | (75.86) | (31.03) | (72.41) |
| Cement and Cement Products | 15 | 15 | 14 | 13 | 12 | 11 |
| | | (100) | (93.33) | (86.67) | (80) | (73.33) |
| Chemicals | 11 | 11 | 6 | 8 | 4 | 9 |
| | | (100) | (54.55) | (72.73) | (36.36) | (81.82) |
| Construction | 38 | 38 | 25 | 30 | 24 | 33 |
| | | (100) | (65.79) | (78.95) | (63.16) | (86.84) |
| Consumer Goods | 60 | 55 | 39 | 42 | 18 | 37 |
| | | (91.67) | (65) | (70) | (30) | (61.67) |
| Energy | 35 | 35 | 31 | 30 | 23 | 30 |
| | | (100) | (88.57) | (85.71) | (65.71) | (85.71) |
| Fertilisers and Pesticides | 8 | 7 | 7 | 5 | 2 | 8 |
| | | (87.5) | (87.5) | (62.5) | (25) | (100) |
| Healthcare Services | 2 | 2 | 1 | 2 | 1 | 2 |
| | | (100) | (50) | (100) | (50) | (100) |
| Industrial Manufacturing | 44 | 39 | 29 | 32 | 19 | 34 |
| | | (88.64) | (65.91) | (72.73) | (43.18) | (77.27) |
| IT | 25 | 22 | 9 | 8 | 7 | 18 |
| | | (88) | (36) | (32) | (28) | (72) |
| Media and Entertainment | 17 | 16 | 7 | 12 | 6 | 9 |
| | | (94.12) | (41.18) | (70.59) | (35.29) | (52.94) |
| Metals | 17 | 17 | 15 | 13 | 10 | 16 |
| | | (100) | (88.24) | (76.47) | (58.82) | (94.12) |
| Paper | 3 | 3 | 3 | 2 | 0 | 3 |
| | | (100) | (100) | (66.67) | (0) | (100) |
| Pharma | 34 | 32 | 15 | 21 | 6 | 14 |
| | | (94.12) | (44.12) | (61.76) | (17.65) | (41.18) |
| Services | 28 | 26 | 22 | 17 | 9 | 21 |
| | | (92.86) | (78.57) | (60.71) | (32.14) | (75) |
| Telecom | 7 | 7 | 6 | 5 | 7 | 6 |
| | | (100) | (85.71) | (71.43) | (100) | (85.71) |
| Textiles | 14 | 14 | 9 | 9 | 6 | 5 |
| | | (100) | (64.29) | (64.29) | (42.86) | (35.71) |

*Note: Percentage of firms exposed to exchange rate changes is reported in parasynthes.*

The percentage of firms significantly exposed to exchange rate risk in the Consumer Goods industry was 91.67 percent during the year 2015-16, 65.00 per cent during the year 2014-1, 70.00 per cent during the year 2013-14, 30.00 per cent during the year 2012-13 and 61.67 per cent during the year 2011-12. The overall percentage of firms exposed to exchange rate changes in all the five years was 63.67 percent. The Consumer Goods industry in India is the net importer. The share of foreign currency expense was 26 percent of total expenses as shown in Table 4.4.

The percentage of firms with significant exchange rate coefficients for the year 2015-16 was 100.00 per cent while it was 88.57 per cent, 85.71 per cent, 65.71 per cent, 85.71 per cent for the years 2014-15, 2013-14, 2012-13 and 2011-12 respectively. The overall percentage during the study period was 85.14 per cent. Energy industry exhibited the highest percentage of firms significantly exposed to exchange rate risk (with a minimum of 10 firms). The reason can be attributed to the import of raw materials such as crude oil, coal, and other products. In the year 2015-16, the cost of import constituted over 42 per cent of the total expenses. This was over 50 percent during the rest of the study period.

It was observed that 87.50 percent of the firms from Fertilisers and Pesticides industry during the year 2015-16, 87.50 per cent during 2014-15, 62.50 per cent during 2013-14, 25.00 per cent during 2012-13 and 100.00 per cent during 2011-12 had significant exchange rate exposure. The percentage of firms with significant exchange rate exposure coefficient overall during the study period was 72.50 per cent. The cost of imports constituted over 40 percent of the total cost of Fertilisers and Pesticides industry. Therefore, it was expected that the firms in this industry would be significantly exposed to currency risk. Out of 44 sample firms from Industrial Manufacturing sector, the stock return of 65.91 per cent of the firms was significantly exposed to changes in exchange rates. The percentage of sample firms for the years 2014-15, 2013-14, 2012-13 and 2011-12 was 72.73 per cent, 43.18 per cent and 77.27 per cent respectively with overall 69.55 percent of the firms with significant exposure to foreign exchange risk during the study period.

India is considered as one of the fastest growing economies in the world is mainly because of the remarkable performance of the services sector. The growth of Indian services sector is mainly driven by Information Technology (IT) industry (Joshi 2011). It

can also be observed that on an average 41.97 per cent of the total revenue was in terms of foreign currency for the year ended 2015-16. Hence the number of firms from IT industry with significant exchange rate exposure is expected to be high. The percentage of firms with significant exposure was 88.00 per cent during the year 2015-16, 36.00 per cent during the year 2014-15, 32.00 per cent during the year 2013-14, 28.00 per cent during the year 2012-13 and 72.00 per cent during the year 2011-12. On the whole, during the study period, 51.20 percent of the sample firms had significant exposure. In spite of dependency on higher export sales by IT industry number of firms exposed to exchange rate risk seemed to be lower. One of the important reasons is that the long-term trend of Indian Rupee is favorable for exporting firms. Besides, Walsh (2016) observes that maturing Indian industry has moved away from the dependency on the export sales. The share of export sales was 58.49 percent in 2013-14 which decreased to 41.97 percent in 2015-16.

Media and Entertainment industry has lower foreign currency revenue and expenses due to which only 52.94 percent of the firms studied had significant exposure during the study period. Metals industry includes firms operating in mining, iron, and steel, copper, aluminum, etc. According to World Steel Association, India is one among the top ten steel importers in the world (Anoyn 2016). India is a major exporter of aluminum products and bauxite (Satpathy and Mohan 2016). The percentage share of export revenue to total revenue was 16.65 percent, and share of import cost to total expenses was 35.87 per cent during the year 2015-16. This remained almost in a narrow range during the study period. Hence, during the study period, it was observed that 83.53 percent of the sample firms studied for five years exhibited significant exposure. highest being 100.00 per cent during the year 2015-16 and the least being 58.82 per cent during 2013-14. The sample included 2 firms from Healthcare Services and 3 firms from Paper industry. Healthcare Services had almost negligible foreign trade while the share of foreign currency revenue of Paper industry was over 13 percent of total revenue.

**Table 4.4 Industry-wise Percentage of Foreign Currency Income and Foreign Currency Expenses**

| | 2015-16 | | 2014-15 | | 2013-14 | | 2012-13 | | 2011-12 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Industry** | **FCI to TI** | **FCE to TE** | **FCI to TI** | **FCE to TE** | **FCI to TI** | **FCE to TE** | **FCI to TI** | **FCE to TE** | **FCI to TI** | **FCE to TE** |
| Automobile | 12.413 | 12.138 | 13.728 | 13.397 | 15.565 | 11.937 | 12.107 | 13.408 | 11.379 | 13.321 |
| Cement and Cement Products | 4.008 | 10.008 | 4.066 | 12.841 | 4.421 | 8.959 | 2.815 | 9.369 | 2.421 | 8.817 |
| Chemicals | 14.855 | 33.172 | 15.645 | 39.334 | 18.555 | 32.622 | 16.907 | 34.907 | 18.127 | 40.640 |
| Construction | 15.368 | 17.208 | 14.943 | 18.330 | 20.140 | 17.110 | 20.187 | 26.181 | 12.927 | 18.930 |
| Consumer Goods | 18.475 | 26.005 | 13.515 | 25.433 | 16.990 | 17.865 | 17.630 | 26.893 | 17.800 | 26.062 |
| Energy | 13.890 | 42.765 | 17.475 | 52.822 | 22.498 | 54.005 | 19.954 | 57.857 | 19.288 | 60.710 |
| Fertilisers and Pesticides | 13.033 | 40.292 | 11.201 | 40.172 | 12.071 | 32.859 | 9.964 | 38.556 | 9.227 | 46.159 |
| Healthcare Services | 2.531 | 1.043 | 2.773 | 1.724 | 2.766 | 1.656 | 1.527 | 1.724 | 1.395 | 1.278 |
| Industrial Manufacturing | 18.547 | 24.890 | 19.106 | 25.300 | 22.263 | 23.340 | 20.396 | 24.961 | 20.692 | 28.390 |
| IT | 41.972 | 24.777 | 42.411 | 24.865 | 58.495 | 18.047 | 38.187 | 20.278 | 38.140 | 20.542 |
| Media and Entertainment | 3.822 | 10.613 | 5.387 | 7.398 | 5.614 | 6.124 | 5.301 | 9.244 | 4.264 | 8.740 |
| Metals | 16.652 | 35.877 | 19.659 | 43.805 | 24.665 | 33.936 | 15.830 | 39.974 | 16.949 | 45.411 |
| Paper | 13.863 | 13.824 | 13.594 | 18.917 | 11.330 | 15.380 | 10.183 | 13.286 | 11.360 | 21.406 |
| Pharma | 57.006 | 17.549 | 56.869 | 27.207 | 78.910 | 21.749 | 56.919 | 26.001 | 51.858 | 25.914 |
| Services | 15.328 | 38.903 | 16.559 | 46.649 | 18.028 | 43.442 | 16.521 | 55.598 | 10.947 | 70.848 |
| Telecom | 6.184 | 8.064 | 6.127 | 7.745 | 8.705 | 5.680 | 6.180 | 6.711 | 5.082 | 6.174 |
| Textiles | 25.786 | 11.077 | 23.875 | 12.845 | 33.081 | 12.848 | 28.984 | 17.873 | 30.282 | 17.254 |

*Note: The figures are in percentage. FCI is foreign currency income, TI is total income, FCE is foreign currency expenses, TE is total expenditure.*

The Indian Pharmaceutical industry is the third largest in the world in terms of volume and is expected to grow at the rate of 15 per cent to 20 per cent CAGR (Shetty 2012). The share of export revenue increased to over 57 percent of the total revenue for the year 2015-16 from 51.85 per cent in the year 2011-12. The growth in the exports is expected to increase further (Pant 2016). The results show that 94.12 per cent, 44.12 per cent, 61.76 per cent, 17.65 per cent and 41.18 per cent of the sample firms from Pharma industry were significantly exposed to currency risk during 2015-16, 2014-15, 2013-14, 2012-13 and 2011-12 respectively. Throughout the study period, 51.76 percent of the firms had significant exposure. It is interesting to note that, the number of firms with significant exposure is less in net exporting industries such as IT and Pharma. This indicates that the net exporting industry is less exposed to currency risk compared to net importing industry.

Services industry includes businesses such as hospitality, logistics, trading, and transport (both road and aviation). The services industry (including IT industry) contributed around 66.10 percent to the total GDP of India. The foreign currency expense of Services industry was more than the foreign currency revenue mainly due to the import of traded goods and payment of interest on foreign currency borrowings. The study found that 67.86 percent of the firms in services industry exhibited significant exposure to fluctuations in foreign exchange rate, highest being 92.86 per cent of the firms during the year 2015-16 and lowest being 32.14 percent of the firms in 2012-13.

The exposure of 88 percent of the firms in Telecom industry was statistically significant. The major component of foreign currency revenue for telecom industry was the service fee received and interest paid on foreign debt was the major component of foreign currency expenses. The textile industry is one of India's oldest industries. The textile exports from India contributes over 11 per cent of the total exports (NITI Ayog 2016). The sample included 14 firms from Textile industry. The exposure coefficient of over 61 percent of the sample firms was statistically significant. Unlike net exporting industries such as IT and Pharma industry, the number of firms with significant exposure was high in the Textile industry. The study on Indian textile industry by Singh (2011) reports that the prices of the products are fixed based on the seasons and remains fixed for the season.

Further, Singh adds that only a few exporters in the textile industry hedge the transaction risk. The combination of low pass through and less hedging would have led to higher number of firms in the textile industry being exposed to currency risk.

The weighted average exchange rate exposures of the industries are given in Table 4.5.

**Table 4.5 Weighted Average Exchange Rate Exposure Coefficients**

| | Weighted Exchange Rate Exposure | | | | |
|---|---|---|---|---|---|
| **Industry** | **2015-16** | **2014-15** | **2013-14** | **2012-13** | **2011-12** |
| Automobile | 1.465 | 0.936 | 0.698 | 0.357 | 0.953 |
| Cement and Cement Products | 1.236 | 0.857 | 0.823 | 0.588 | 0.530 |
| Chemicals | 1.107 | 0.626 | 0.394 | 0.306 | 0.519 |
| Construction | 1.781 | 1.205 | 0.995 | 0.879 | 1.312 |
| Consumer Goods | 0.951 | 0.694 | 0.586 | 0.159 | 0.446 |
| Energy | 1.405 | 1.158 | 0.848 | 0.630 | 0.829 |
| Fertilisers and Pesticides | 1.294 | 1.273 | 0.304 | 0.314 | 0.994 |
| Healthcare Services | 1.573 | 0.911 | 0.530 | 0.243 | 0.959 |
| Industrial Manufacturing | 1.387 | 1.095 | 0.662 | 0.558 | 0.874 |
| IT | 0.791 | 0.332 | 0.097 | 0.021 | 0.465 |
| Media and Entertainment | 1.663 | 0.755 | 0.664 | 0.506 | 0.683 |
| Metals | 1.348 | 0.813 | 0.621 | 0.524 | 1.054 |
| Paper | 2.211 | 1.574 | 0.417 | -0.070 | 0.909 |
| Pharma | 0.996 | 0.466 | 0.465 | 0.140 | 0.357 |
| Services | 1.487 | 1.197 | 0.550 | 0.398 | 0.771 |
| Telecom | 1.072 | 0.831 | 1.169 | 0.934 | 0.762 |
| Textiles | 2.078 | 1.069 | 0.359 | 0.314 | 0.558 |

*Note: The exchange rate exposure coefficients were estimated using time series model* $R_{it} = \lambda_0 + \lambda_1 e_{it} + \lambda_2 F_{mt} + \mu_{it}$*, where,* $R_{it}$ *is the daily log-normal return of i at time t,* $F_{mt}$ *is estimated orthogonal component of market portfolio and* $e_{it}$ *is daily log-normal change in the trade-weighted exchange rate index (NEER) over the same period. The weighted average of the exposure coefficient was computed using* $WIE_i = w_{1a}\,\lambda_{1a} + w_{2b}\,\lambda_{1b} \ldots\ldots w_n\,\lambda_{1n.}$

The weighted average exposure of Construction industry during the study period was found to be higher. Even though the foreign trade activity (imports and exports) is considerably less in the construction industry, the high exposure could be because of the

foreign currency borrowings and other capital flows. The net importing industries such as Energy, Fertilizers, and Pesticides, Metals and Services were higher compared to firms with lower imports. In line with the previous finding, the exposure of net exporting industries such as IT and Pharma industries were considerably less i.e. 0.341 and 0.485 respectively.

From the above discussions, it is clear that not all the firms involved in international business are exposed to the exchange rate exposure. The empirical analysis suggests net importing firms and industries are exposed more the exchange rate movements than that of net exporting firms and industries both in terms of a number of firms exposed and magnitude of the exposure. The model used in this study predicted the exchange rate exposure of majority firms, the exchange rate exposure puzzle still remains. Therefore, the next section analyses the determinants of exchange rate exposure.

## 4.3 DETERMINANTS OF EXCHANGE RATE EXPOSURE

The analysis in this section explores the relationship between the level of financial distress, firm size, depth of international presence, breadth of international presence, liquidity, profitability, hedging, and exchange rate exposure. The exchange exposure coefficients estimated in the previous section from Equation (4) and (6) are used as a dependent variable for this analysis. Table 4.6 presents the descriptive statistics of the full sample.

The average exposure estimated using the capital market model of the sample firms during the study period was 0.912 which indicates that for every 1 unit change in the exchange rate index, the stock returns would increase by 0.912. The highest exposure during the study period was 4.506, and lowest was -1.364. The average exposure computed using the cash flow model was 1.736, for every 1 percent appreciation of the domestic currency, the firm's profitability would increase by 1.736 percent. However, for the firms incurring losses, the losses would increase by 1.736 percent. The average exposure estimated using both capital market model and cash flow model indicates the firms are gaining with the domestic currency appreciation.

**Table 4.6 Summary Statistics of the Dependent and Independent Variables**

| Variable | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| $\lambda_1$ | 0.912 | 0.747 | -1.364 | 4.506 |
| $\Delta$ | 1.736 | 12.857 | -95.146 | 98.755 |
| FD | 42.329 | 13.827 | 2.968 | 160.158 |
| SIZE | 3.384 | 0.626 | 1.621 | 5.505 |
| FCR/TR | 0.218 | 0.318 | 0.000 | 0.965 |
| FCE/TE | 0.199 | 0.208 | 0.000 | 0.974 |
| BREADTH | 0.704 | 0.368 | 0 | 1 |
| LQDTY | 1.788 | 2.025 | 0.057 | 55.113 |
| PFT | 0.904 | 0.295 | 0 | 1 |
| FCD | 0.717 | 0.450 | 0 | 1 |
| FCB | 0.483 | 0.500 | 0 | 1 |
| NI | 0.542 | 0.498 | 0 | 1 |

*Note: $\lambda_1$ is the exchange rate exposure estimated using the market model in equation (4), $\delta$ is the exchange rate exposure estimated using cash flow model equation (6). Distance to default is a measure of financial distress estimated using Merton's Bond Default Model, log of total assets is the proxy for firm size, FCR/TR is ratio of foreign currency revenue to total revenue, FCE/TE is ratio of foreign currency expense to total expense, BREADTH is Hirschman-Herfindahl index, LQDTY is current ratio, PFT is the dummy variable of 1 if firm is profitable, 0 otherwise, FCD is dummy variable of 1 if firm uses currency derivative 0 otherwise, FCB is dummy variable of 1 if firm has foreign currency borrowing 0 otherwise, NI is dummy variable 1 if firm is net importer 0 otherwise.*

The average Distance to Default was 42.329. Based on the calibration from previous crises, distance to default of 3 is considered as a minimal level of "safety" for banking and financial institutions (OECD 2016). Distance to default is extensively used by both researchers and practitioners due to the accuracy of prediction (Milne 2014). Even though the distance to default is widely used in measuring the financial distress of banking firms, there are many studies using distance default to predict the financial distress of non-financial firms (Chen and Chu 2014; Jessen and Lando 2015). However, the "safety" marks for non-financial firms are not being developed. The minimum distance to default was 2.968, and the maximum was 160.158. On an average, the financial condition of the sample firms looked good. The average of total assets was ₹ 162.15 billion during the

study period. The average, minimum and maximum values of the log of total assets are given the table above.

The foreign currency revenue of the sample firms constituted about 21.8 percent of the total revenue while on an average 19.95 per cent of the total expenses were in foreign currency. The mean Hirschman-Herfindahl (HH) index was 0.704 which points out that the lower level of operations in foreign markets by the sample firms. The lower HH index value of 0 denotes all the subsidiaries of the firms are in foreign countries, and higher HH index number of 1 means all the subsidiaries of the firm is in domestic country. The average current ratio of the sample firms during the study period was 1.788. The average profit after tax margin was 22.690 percent and over 90 percent of the firms were profitable. The survey of annual reports to find out the usage of currency derivatives, it was found over 71.7 percent of the firms used the currency derivatives for hedging transaction exposure, and over 48 percent of the firms had foreign currency borrowings.

Further, the study investigates the determinants of the net importer and net exporter firms. The sample firms were then categorized into a net importer and net exporter firms based on the foreign currency inflow and outflow. Out of 387 firms studied, 210 firms were net importers, and 177 firms were net exporters. Table 4.7 exhibits the summary statistics of the net importers and net exporters separately. The average exposure predicted with a capital market model of net importing firms was higher than that of the net exporting firms and is statistically significant. The average exposure estimated with cash flow model for net importing firms was -1.568 and for net exporting firms were 5.665. The sensitivity of the profit margins to the exchange rate changes was for net exporting firm was higher in comparison with net importing firms. The geographical dispersion was 0.797 and 0.593 for importing and exporting firms respectively indicating that exporters were more geographically diversified than the importer. It can also be inferred that the operational hedging of firms with higher foreign currency revenue was good.

**Table 4.7 Descriptive Statistics for Net Importer and Exporter Firms**

| | Net Importing Firms | | | | Net Exporting Firms | | | | Test for Differences |
|---|---|---|---|---|---|---|---|---|---|
| Variable | Mean | Std. Dev. | Min | Max | Mean | Std. Dev. | Min | Max | t-test p value |
| $\lambda_1$ | 0.954 | 0.715 | -0.527 | 4.323 | 0.862 | 0.781 | -1.364 | 4.506 | 0.003 |
| $\delta$ | -1.568 | 12.720 | -87.165 | 89.506 | 5.655 | 11.887 | -95.146 | 98.755 | 0.006 |
| FD | 43.305 | 14.450 | 10.418 | 160.158 | 41.170 | 12.962 | 2.968 | 84.832 | 0.001 |
| SIZE | 3.472 | 0.658 | 2.001 | 5.505 | 3.279 | 0.568 | 1.621 | 5.117 | 0.000 |
| FCR/TR | 0.074 | 0.234 | 0.000 | 6.207 | 0.388 | 0.321 | 0.000 | 2.142 | 0.000 |
| FCE/TE | 0.234 | 0.261 | 0.000 | 2.754 | 0.169 | 0.173 | 0.000 | 0.880 | 0.000 |
| Dispersion | 0.797 | 0.322 | 0 | 1 | 0.593 | 0.388 | 0 | 1 | 0.000 |
| LQDTY | 1.653 | 2.200 | 0.057 | 55.113 | 1.947 | 1.783 | 0.073 | 18.383 | 0.001 |
| PFT | 0.890 | 0.314 | 0 | 1 | 0.921 | 0.270 | 0 | 1 | 0.019 |
| FCD | 0.683 | 0.466 | 0 | 1 | 0.758 | 0.428 | 0 | 1 | 0.002 |
| FCB | 0.495 | 0.500 | 0 | 1 | 0.468 | 0.499 | 0 | 1 | 0.229 |

*Note: $\lambda_1$ is the exchange rate exposure estimated using the market model in equation (4), $\delta$ is the exchange rate exposure estimated using cash flow model equation (6). Distance to default is a measure of financial distress estimated using Merton's Bond Default Model, log of total assets is the proxy for firm size, FCR/TR is ratio of foreign currency revenue to total revenue, FCE/TE is ratio of foreign currency expense to total expense, BREADTH is Hirschman-Herfindahl index, LQDTY is current ratio, PFT is the dummy variable of 1 if firm is profitable, 0 otherwise, FCD is dummy variable of 1 if firm uses currency derivative 0 otherwise, FCB is dummy variable of 1 if firm has foreign currency borrowing 0 otherwise.*

The significant difference in the geographical diversification could have increased the average exposure of the net importing firms. The finding similar to that of the findings reported by the previous studies in the context of developed economies (Chod et al. 2010; Choi and Jiang 2009; Pantzalis et al. 2001; Treanor et al. 2014). It is observed that over 75 per cent of the net exporters used foreign currency derivatives on the other hand only 68 percent of the importers used the currency derivatives. It is evident that the exporting firms used both financial hedge and operational hedge to a greater extent. However, there was no significant difference between the foreign currency borrowing of the importing and exporting firms.

Table 4.8 provides the correlation matrix between the variables in the sample. The capital market-based exposure ($\lambda_1$) was negatively correlated with distance to default (FD), depth of internal presence (FCR/TR and FCE/TE), liquidity and profitability. The exposure was positively related to firm size, geographical dispersion (BREADTH), usage of currency derivatives (FCD), foreign currency borrowing (FCB) and the net importers (NI). With the exception of foreign currency expense to total expense ratio, current ratio, and usage of currency derivatives the relationship was significant. Interestingly, the exposure estimated using capital market model and cash flow models were inversely related. The delta ($\delta$) is negatively related the firm size, breadth of international presence, liquidity and with the net importers. The foreign currency revenue to total revenue ratio and net importer has a correlation coefficient of -0.577 and the correlation coefficient is less than 0.5 between all the other independent variables.

**Table 4.8 Pairwise Correlations**

| | $\lambda_1$ | $\Delta$ | FD | SIZE | FCR/TR | FCE/TE | BREADTH | LQDTY | PFT | FCD | FCB | NI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\lambda_1$ | 1 | | | | | | | | | | | |
| $\delta$ | -0.003 | 1 | | | | | | | | | | |
| FD | -0.429* | -0.097* | 1 | | | | | | | | | |
| SIZE | 0.155* | -0.106* | 0.181* | 1 | | | | | | | | |
| FCR/TR | -0.083* | 0.314* | -0.044* | -0.098* | 1 | | | | | | | |
| FCE/TE | -0.011 | -0.085* | 0.027 | 0.102* | 0.352* | 1 | | | | | | |
| BREADTH | 0.056* | -0.123* | -0.031 | -0.054* | -0.382* | -0.134* | 1 | | | | | |
| LQDTY | -0.040 | -0.004 | 0.087* | -0.006 | 0.061* | -0.067* | 0.034 | 1 | | | | |
| PFT | -0.166* | 0.043 | 0.198* | -0.080* | 0.036 | -0.011 | -0.062* | 0.133* | 1 | | | |
| FCD | 0.017 | 0.030 | 0.012 | 0.119* | 0.175* | 0.159* | -0.198* | -0.056* | 0.006 | 1 | | |
| FCB | 0.075* | 0.025 | -0.069* | 0.272* | 0.045* | 0.242* | -0.107* | -0.150* | -0.095* | 0.225* | 1 | |
| NI | 0.057* | -0.296* | 0.071* | 0.126* | -0.577* | 0.151* | 0.261* | -0.064* | -0.047* | -0.061* | 0.036 | 1 |

**Correlation is significant at the 0.05 level*

The univariate results suggest that there is a relation between financial distress, firm size, depth of international presence, breadth of international presence, liquidity, profitability, hedging, and exchange rate exposure. However, these results do not throw light on the combined effect of the factors mentioned above on exposure.

Table 4.9 summarizes the effect of the determinant factors on the exchange rate exposure of firms as specified in Model 1.

The results show that the distance to default (FD) which is a measure of the level of financial distress negatively impacts the exposure. It should be noted that higher the distance from default lower is the level of financial distress. Thus, increase in financial distress would increase the exchange rate exposure. For every unit increase in distance to default the exposure decreases by 0.021 units. The result is statistically significant. The relationship remains same with the results of WLS regression confirming the results. This result confirms the findings of the study by Wei and Starks (2013) in the American context. This study argues that firms with higher level of financial distress would have limited ability to manage exchange rate exposure and therefore their fundamental value would be sensitive to the cash flow volatility related to currency movements. Accordingly, this study hypothesized that the likelihood of financial distress explains cross-sectional variations in sensitivity of stock returns to the currency movements. The empirical evidence suggests that the firms with a greater financial distress exhibit greater exchange rate exposure. Based on the results, null hypothesis *there is no relationship between the level of financial distress and exchange rate exposure* is rejected.

**Table 4.9 Impact of Firms-level Factors on Exchange Rate Exposure ($\lambda_1$) – Model 1**

| | FE | WLS |
|---|---|---|
| FD | -0.021<br>(-9.61)*** | −0.023<br>(-30.69)*** |
| SIZE | 1.638<br>(8.91)*** | 0.249<br>(15.99)*** |
| FCR/TR | -0.258<br>(-3.04)*** | −0.175<br>(-3.51)*** |
| FCE/TE | -0.338<br>(-1.54) | −0.040<br>(-0.75) |
| BREADTH | -0.090<br>(-0.68) | 0.015<br>(0.52) |
| LQDTY | -0.011<br>(-1.69)* | 0.001<br>(0.17) |
| PFT | -0.109<br>(-1.08) | -0.117<br>(-2.62)*** |
| FCD | -0.684<br>(-3.22)*** | -0.028<br>(-1.96)** |
| FCB | -0.018<br>(0.19) | -0.016<br>(-0.77) |
| NI | 0.128<br>(1.73)* | 0.039<br>(1.65)* |
| _cons | -2.886<br>(3.95)*** | 1.131<br>(131.33)*** |
| F- statistics | 3.112*** | 131.3364*** |
| $R^2$ | 0.19 | 0.41 |
| *N* | 387 | 387 |

* p<0.10; ** p<0.05; *** p<0.01

*This table displays the results of Model 1 with $\lambda_1$ as the dependent variable. Fixed-effects (FE) model and WLS model results are displayed using 1935 observations which included 387 firms studied for 5 years. Robust (HAC) standard errors are used. Numbers in the parentheses under the coefficients are the respective t-statistics. $\lambda_1$ is the exchange rate exposure estimated using the market model in equation (4), $\delta$ is the exchange rate exposure estimated using cash flow model equation (6). Distance to default is a measure of financial distress estimated using Merton's Bond Default Model, log of total assets is the proxy for firm size, FCR/TR is ratio of foreign currency revenue to total revenue, FCE/TE is ratio of foreign currency expense to total expense, BREADTH is Hirschman-Herfindahl index, LQDTY is current ratio, PFT is the dummy variable of 1 if firm is profitable, 0 otherwise, FCD is dummy variable of 1 if firm uses currency derivative 0 otherwise, FCB is dummy variable of 1 if firm has foreign currency borrowing 0 otherwise.*

The natural log of total assets is used as the proxy for firm size. The results suggest that the firm size positively influences the exposure. The unit increase in the log of total assets will increase the exposure by 1.638 units. The magnitude of the influence decreases significantly in the results of WLS regression as shown in Table 4.9, yet the direction of the relationship remains same. The coefficients estimated under both the methods are statistically significant at 1 percent level. The findings of the previous studies on the relationship between firm size and exposure were inconclusive. This study argues that the international presence of larger firms is likely to be higher than the smaller firms and hence the larger firms would exhibit higher exposure. The empirical evidence supports the argument. This finding is similar to the findings of He and Ng (1998) in the Japanese context and Muller and Verschoor (2006a) in the context of US. The null hypothesis *firm size does not have a significant influence on the exchange rate exposure* is rejected.

Foreign currency revenue to total revenue ratio and foreign currency expense to total expense ratio are taken as proxies to measure the depth of international presence. As shown in Table 4.9, both, foreign currency revenue to total revenue ratio (FCR/TR) and foreign currency expense to total expense ratio (FCE/TE) negatively influence the exposure. The relationship between FCR/TR and exposure is statistically significant. One percent increase in the share of foreign currency revenue the exposure decreases by 0.258. The previous studies such by Dominguez and Tesar (2006), Jong et al. (2006) and Allayannis and Ofek (2001) using the sample firms from developed economies concluded that the foreign sales to total sales positively affects the exposure. The finding of this study is in contrast with the findings of previous studies. The possible reason for this could be the primary trend of the Indian Rupee. The average value of Nominal Effective Exchange Rate (NEER) index for the year 2011-12 was 94.74 which decreased to 76.45 in the year 2015-16. The compounded annual growth rate of NNER was -5.7 per cent per annum. The depreciation in domestic currency is favorable for firms with foreign currency receivables. It is shown in Table 4.7 that the average exposure of net exporting firms is lower than the net importing firms. Thus, the negative impact of foreign sales ratio is justifiable. The foreign expense to total expense ratio was also negatively related to the exposure, but it was not statistically significant. The results remain unchanged with the use of WLS regression. The null hypothesis was *there is no relationship between the*

*depth of international presence and exchange rate exposure* is rejected, and it can be concluded that the depth of international presence negatively influences the exposure of Indian firms.

The breadth of international presence measured as geographical diversification is negatively related to the exposure. The coefficient is -0.090 i.e. for every unit increase in Hirschman-Herfindhal index the exposure decreases by 0.090 units. But this relationship was not statistically significant. There is no evidence to conclude that the firms with the large diversified network are more successful in effectively managing the economic exposure. The null hypothesis *there is no relationship between breadth of international presence and exchange rate exposure* cannot be rejected.

The study argues that the firm with a higher liquidity position and a lower financial distress is likely to hedge less against the exchange rate changes. Firms with highly liquid assets have a lower probability of default and liquidity offers an alternative to hedging. Hence, firms may not use hedging instruments as they may perceive liquidity as an alternative to hedging the currency risk. The results indicate that the there is a significant relationship between current ratio and exposure. The beta coefficient was -0.011 significant at 10 per cent level. The increase in current ratio leads to decrease in the exposure by 0.011 units. The study also used quick ratio as a measure of liquidity, and the results were consistent. However, the results WLS regression did not confirm this relationship as the coefficient was 0.001 and was not statistically significant. Because of the contrasting results, we do not reject the null hypothesis; *there is no relationship between liquidity and FX exposure.*

The change in the exchange rates affects the firm's profit margins. Therefore, the study investigated the relationship between the firm's profit and exposure. A dummy variable was used as a proxy for profitability. The argument was the sensitivity of the exchange rate changes of the firms differed based on the profit margins. A firm with positive profit margin would be less sensitive to exchange rate changes compared to the firm with a negative profit margin. The empirical finding indicates that the exposure of firms with positive profit was 0.109 times less compared to that of the firm with a negative profit margin. The relationship was not significant in the fixed effects model while it was

significant at 10 per cent level when WLS model was used. The null hypothesis *there is no relationship between profitability and FX exposure* is not rejected.

A firm may choose to use currency derivatives to hedge the exposure or borrow in foreign currency. Both are categorized as financial hedging. The use of derivatives is expected to add value to the firms when the benefit of hedging offsets the cost of hedging. Thus not all the firms would use currency derivatives. As shown in descriptive statistics table, over 71 percent of the sample firms used the currency derivatives during the study period. The financial theories suggest that the use of currency derivatives would increase the firm value by weeding out the shocks of exchange rate changes and even out the cash flows. As displayed in Table 4.9, the exposure of firm using the derivatives was 0.684 times lower compared to the non-users. The coefficient was significant at 1 per cent level. The estimation of WLS regression confirms the relationship. The null hypothesis *currency derivatives have no significant impact on FX exposure* is rejected, and the study concludes that the use of currency derivatives reduces the exchange rate exposure and thus increases the firm value.

Foreign currency borrowing is often used as a substitute to currency derivatives in hedging the exchange rate exposure. The foreign debt reduces exposure by eliminating the asset liability mismatches for the multinational firms (Hekman 1983). The findings of Fok et al. (1997) and Geczy et al. (1997) concluded that the foreign debt complements currency derivatives in reducing the exposure. As shown in Table 4.9, there was an inverse relationship between foreign currency borrowing and exposure. The exposure of the firms with foreign currency borrowings was 0.018 times lower than the firms without foreign debt. However, the results were not statistically significant. It should be noted that the India is a net importing country and therefore the on an average foreign currency expense of Indian firms would be higher than the foreign currency revenue. The sample used in this study proves the same. Foreign currency borrowing is useful for the firms with foreign assets. As a result, foreign currency borrowing may not be perceived as a hedge against the exchange rate movements. The foreign currency borrowings also increases the likelihood of financial distress and so may not reduce the exposure. Thus,

the null hypothesis *foreign currency debt does not reduce the exchange rate exposure* is not rejected.

The Model 2 tests relationship between the firm level determinant factors and exposure estimated using cash flow model. The Table 4.10 displays the results of Model 2 specified in equation (13). Financial distress measured by distance to default is negatively related to the cash flow exposure to exchange rate changes. This is consistent with results of Model 1. The increase in distance to default will decrease the exposure (δ) by 0.699 times. Even though there is a difference in the magnitude of the impact, the WLS results confirm the relationship. The size of the firm is negatively related to the exchange rate exposure (δ) measured using the cash flow model. This association was only significant under WLS regression model. The current ratio was negatively related. However, it was not significant. The profitability of the firm was positively related to the exposure (δ) and was significant.

The cash flow exposure to exchange rate changes of the firms using the currency derivatives was 9.506 times higher than the non-users however the result was not significant. But, WLS method estimated a significant negative relation at 10 per cent level. The foreign currency borrowing thigh reduced the exposure, but the result was insignificant.

**Table 4.10 Impact of Firms-level Factors on Exchange Rate Exposure (δ) – Model 2**

| | FE | WLS |
|---|---|---|
| FD | -0.699 | -0.075 |
| | (-2.23)** | (-6.73)*** |
| SIZE | -11.582 | -1.854 |
| | (-0.59) | (-8.67)*** |
| BREADTH | 1.206 | -1.650 |
| | (0.06) | (-4.976)*** |
| LQDTY | -0.929 | -0.007 |
| | (-1.19) | (-0.87) |
| PFT | 57.305 | 5.633 |
| | (2.113)** | (4.71)*** |
| FCD | 9.506 | -0.497 |
| | (1.32) | (1.65)* |
| FCB | -2.786 | -0.435 |
| | (-0.684) | (1.836)* |
| NI | 5.389 | 5.549 |
| | (1.89)* | (21.80)*** |
| _cons | 9.378 | 9.337 |
| | (68.70)*** | (6.138)*** |
| F- statistics | 0.934 | 84.851*** |
| $R^2$ | 0.19 | 0.26 |
| *N* | 387 | 387 |

* p<0.10; ** p<0.05; *** p<0.01

*This table displays the results of Model 2 with δ as the dependent variable. Fixed-effects (FE) model and WLS model results are displayed using 1935 observations which included 387 firms studied for 5 years. Robust (HAC) standard errors are used. Numbers in the parentheses under the coefficients are the respective t-statistics. δ is the exchange rate exposure estimated using cash flow model in equation (6), FD is distance to default estimated using Merton's Bond Default Model, SIZE is log of total assets is the proxy for firm size, BREADTH is Hirschman-Herfindahl index, LQDTY is current ratio, PFT is the dummy variable of 1 if firm is profitable, 0 otherwise, FCD is dummy variable of 1 if firm uses currency derivative 0 otherwise, FCB is dummy variable of 1 if firm has foreign currency borrowing 0 otherwise.*

## 4.4 DETERMINANTS OF NET IMPORTING AND NET EXPORTING FIRMS

Further, this study investigates the relationship between determinant factors and exposure of net importing and net exporting firms separately. The firms with foreign currency revenue more than foreign currency expense were categorized as net exporting firms and the firms with foreign currency expense more than foreign currency revenue as net importing firms. The sample included 177 net exporting firms and 210 net importing firms.

Table 4.11 presents the impact of the financial distress, firm size, depth and breadth of international presence, liquidity, profitability, and hedging on the exchange rate exposure. There is no difference in the influence of financial distress on the exposure of net exporting and net importing firms. The coefficients are similar and not different from the one predicted for the full sample. Hence it can be concluded that the level of financial distress will affect the both net importing and net exporting firms with the same magnitude.

The effect of firm size on exposure differs among the net importing and exporting firms. The exposure of smaller exporting firms is likely to be lower than the smaller importing firms. The capital markets prices the exchange rate exposure of the large firms higher than the small firms. The possible reasons could be that the unfavorable exchange rate changes will have a huge impact on the cash flows of large firms compared to the smaller firms. Geographical diversion did not significantly influence the exposure levels of either net importing firms or exporting firms.

The level of firm's liquidity measured in terms of current ratio was inversely related to the exporting firms. Even though liquidity was negatively related to the exposure of importing firms the relationship was not statistically significant. The result implies that the 1 unit increase in current ratio would bring down the exposure by 0.046 for exporting firms. Thus the liquidity of exporting firms is a significant determinant of the exposure.

**Table 4.11 Impact of Firms-level Factors on Exchange Rate Exposure of Net Exporting and Importing Firms**

| | Net Exporters (177 firms) | Net Importers (210 firms) |
|---|---|---|
| FD | 0.021 | -0.021 |
| | (-5.99)*** | (-7.68)*** |
| SIZE | 1.998 | 1.242 |
| | (6.69)*** | (5.92)*** |
| BREADTH | -0.108 | -0.077 |
| | (-0.57) | (-0.43) |
| LQDTY | -0.046 | -0.006 |
| | (-2.08)** | (1.13) |
| PFT | -0.144 | -0.084 |
| | (-0.785) | (-0.71) |
| FCD | -0.628 | -0.738 |
| | (-1.72)* | (-3.107)*** |
| FCB | -0.071 | 0.022 |
| | (-0.47) | (0.218) |
| _cons | -4.047 | -1.843 |
| | (-3.441)*** | (-2.306)** |
| F- statistics | 3.01*** | 3.097*** |
| $R^2$ | 0.22 | 0.16 |
| *N* | 177 | 210 |

* p<0.10; ** p<0.05; *** p<0.01

*This table displays the results of with $\lambda_1$as the dependent variable. Fixed-effects (FE) model results are displayed using 1935 observations which included 387 firms studied for 5 years. Robust (HAC) standard errors are used. Numbers in the parentheses under the coefficients are the respective t-statistics. $\lambda_1$ is the exchange rate exposure estimated using capital market model in equation (4), FD is distance to default estimated using Merton's Bond Default Model, SIZE is log of total assets is the proxy for firm size, BREADTH is Hirschman-Herfindahl index, LQDTY is current ratio, PFT is the dummy variable of 1 if firm is profitable, 0 otherwise, FCD is dummy variable of 1 if firm uses currency derivative 0 otherwise, FCB is dummy variable of 1 if firm has foreign currency borrowing 0 otherwise.*

The usage of currency derivatives significantly reduced the exposure of both net importers and net exporters. The exposure of net exporter who used currency derivatives was 0.628 times lower than the non-user, and the exposure of net importer who used currency derivatives was 0.738 times lower than the non-user. Compared to the exporting firms the sensitivity of exposure to the derivative usage was higher for the importing firms. As pointed out earlier, the primary trend in Indian Rupees is unfavorable to the importers making the derivative usage critical. However, only 68.3 percent of the importing firms used the currency derivatives while 75.8 per cent of the exporters were the users of derivatives. The foreign currency debt though negatively related to the exposure the study does not provide evidence that the use of foreign debt is a significant determinant of the exposure.

This chapter discusses the results of a survey of usage pattern of the foreign currency derivatives. In the previous chapter, the study proves that the usage of currency derivative reduces the exchange rate exposure of the firm. The exposure measured using capital market model, and cash flow model decreased with the use of currency derivatives. The chapter also includes two case studies of MRPL Ltd. and Aspinwall & Co. Ltd.

## 5.1 USAGE OF CURRENCY DERIVATIVES BY INDIAN FIRMS

The derivatives usage of the sample firms is reported in Table 5.1. From the table, it can be observed that over 69 percent of the firms in the 2011-12 hedged using the currency derivatives and it slightly increased to over 72 percent for the rest of the years. The number of firms using the currency derivatives remained the same during the study period. Clearly, the forward contract was the popular currency derivatives used by sample Indian firms as a hedging tool. All the firms using currency derivatives reported that the currency derivatives were used only for hedging purpose and not for speculation.

**Table 5.1 Hedging Practices in Non-financial Indian Firms**

| | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 |
|---|---|---|---|---|---|
| Total Number of Firms | 387 | 387 | 387 | 387 | 387 |
| Firms Using Currency Derivatives | 270 | 280 | 280 | 279 | 279 |
| Hedging Using Forward Contract | 268 | 271 | 272 | 273 | 269 |
| Hedging Using Futures Contract | 7 | 6 | 6 | 6 | 7 |
| Hedging Using Options Contract | 73 | 74 | 72 | 70 | 70 |
| Hedging Using Swap Contract | 73 | 76 | 76 | 75 | 77 |

The exchange-traded products were not a preferred instrument to hedge in the global context was found to be true even in the Indian context. The reason could be the flexibility offered by the forward contract. The forward contract is not a standardized contract. The contracts are available for any amount and the delivery date which is not true with the currency futures (Maurer and Valiani 2007). The findings of Chan et al. (2003) suggest that the effectiveness of currency forwards was more than the currency options and other synthetic products. Hence the currency forwards is the most preferred derivative instrument to hedge the transaction exposure. The results are in agreement with the findings of Sahoo (2016).

Currency futures were the least preferred instrument by the sample Indian non-financial firms. There are two reasons why currency futures are not preferred. First, currency futures are the standardized contracts offers very less flexibility in terms of amount and maturity. Second, the lack of depth in the Indian currency futures market. NSE is the first stock exchange in India to receive approval from SEBI for launching currency derivative segment in India. The currency derivative market was first set up on 29$^{th}$ August 2008 by introducing currency futures on USD/INR for trading. Gradually Indian Rupee was allowed to trade against other currencies such as Great Britain Pound, Euro, and the Japanese Yen in March 2010. It has shown slow growth in terms of a number of contracts and volume traded on the exchange. The annual turnover in the currency futures segment, in fact, decreased from ₹ 2.74 trillion in the year 2014-15 to ₹ 2.12 trillion during the year 2015-16. This clearly indicates that the currency futures are no longer attractive for hedgers.

The usage of options contract was 10 times more than futures. The options were particularly popular among firms with contingent exposure. For instance, a firm which has submitted a proposal for construction of airport may be worried about the unfavorable exchange rate movements affecting the pricing ex-ante. The use of currency forwards or futures may not help as the contract is not yet awarded. To hedge such exposures the currency options become very attractive (Eun and Resnick 2012).

The cross currency interest rate swap was also used by the firms to cover the foreign currency borrowing. Principal only swaps (POS) was also used in some cases. From the above findings, it can be noted that the second generation and third generation currency derivative products were not popular. Especially, the third-generation derivative instruments are still in a nascent stage in India. In spite of the innovations and the cost advantages offered by some of the hybrid products, the forward contract still is a most preferred instrument to hedge the exchange rate exposure.

## 5.2 CASE OF MRPL LTD.

MRPL Ltd. was started as a joint venture Oil Refinery promoted by Hindustan Petroleum Corporation Limited (HPCL), one of India's largest oil marketing company and IRIL & Associates a private sector company owned by AV Birla Group in the year 1988. In the year 1993 ONGC Ltd. acquired the total shareholding of A.V. Birla Group thus making MRPL subsidiary of ONGC Ltd. and the public sector undertaking (PSU). MRPL categorized under schedule 'A' Miniratna, Central Public Sector Enterprise (CPSE) by the Ministry of Petroleum & Natural Gas, Government of India. Currently, MRPL is one of the largest public sector refineries in the countries. The summary of the financial statements is presented in Table 5.2.

**Table 5.2 Summary of Financial Statements of MRPL**

| | 2015-16 | 2014-15 | 2013-14 | 2012-13 | 2011-12 |
|---|---|---|---|---|---|
| Net Sales | 396.474 | 574.625 | 718.148 | 656.957 | 537.703 |
| Exports Sales (₹ in billion) | 87.461 | 195.078 | 339.524 | 321.798 | 234.183 |
| Export sales as a percentage of net sales (%) | 22.060 | 33.949 | 47.278 | 48.983 | 43.553 |
| Total Expenditure (₹ in billion) | 378.599 | 595.518 | 708.102 | 654.056 | 521.612 |
| Import Cost (₹ in billion) | 309.224 | 488.557 | 654.808 | 559.225 | 476.503 |
| Cost of import as a percentage of total expenditure (%) | 81.676 | 82.039 | 92.474 | 85.501 | 91.352 |
| Loss on foreign exchange fluctuations (₹ in billion) | 11.903 | 6.835 | 0.019 | 5.365 | 6.482 |
| PAT (₹ in billion) | 11.482 | -17.122 | 6.012 | -7.569 | 9.086 |
| PAT Margin (%) | 2.896 | -2.980 | 0.837 | -1.152 | 1.690 |

*Source: Compiled from the Annual Reports of MRPL Ltd.*

The net sales of MRPL for the year ended March 2016 was ₹ 396.47 billion which decreased from ₹ 574.62 billion in the year 2014-15. The primary reason for the reduction in the value of sales is the decrease in the global crude oil prices. In spite of the decline in sales, MRPL reported a net profit of ₹ 11.482 billion in the year 2015-16. It can be observed that export sales constituted over 22 percent of the net sales and the cost of import constituted 81.67 percent of the total expenditure. It can be noted that during all the five years studied MRPL reported the loss on foreign exchange fluctuations. In the year ended March 2016, the loss was ₹ 11.90 billion.

The loss on foreign exchange fluctuations clearly affected the profit margin of the firm which was in the range of -3 per cent to 3 per cent. Clearly, the fluctuation in the exchange rates affects the profit margin of MRPL.

The note on Foreign Exchange Exposures in the the annual report of the company for the year ended March 2016 stated that "*The Company has receivables and payables in foreign currency as at the Balance Sheet date. These foreign currency exposures are not hedged by any derivative instruments or otherwise*" (page 91) (MRPL 2016). The reason for this decision was found in Management Discussion and Analysis Report, which stated that "*Your Company has engaged the consultant to advise on the Foreign Exchange fluctuation risk and measures for mitigating the same. However, looking into the higher hedge cost as compared to the volatility in the Foreign Exchange market. Hedge is not resorted by the Company*" (section 5, page 34). In spite of huge foreign exchange losses the management's decision not to hedge was surprising.

To understand the decision-making and the motives behind the management of currency risk, Mr. A K Sahoo, Director Finance of MRPL was interviewed. The summary of the interview is discussed below.

MRPL has appointed A.V. Rajwade & Co. Pvt. Ltd. as the external risk management consultant who advises the management about managing the risks faced by the firm. At the beginning of the financial year, the consultant submits the report on risk management strategies to be followed by MRPL. The Financial Risk Management Committee (FRMC), the board level committee then reviews the report and takes the necessary actions.

According to Mr. A K Sahoo, MRPL has a natural hedge to the extent of foreign currency receivables. The team of 4 employees match the maturities of the receivables and payables to the extent possible and create the natural hedge. The company believes that using derivatives would is not value adding as the cost of hedging is more than the benefit of hedging. The cost of hedging is around 6-7 per cent while the volatility in USD/INR exchange rates is less than 5 percent. Hence the management believes, not hedging would increase the firm value.

One of the important reasons for MRPL's huge foreign exchange losses during last five years was the trade payables of ₹ 177,990.35 million for the year ended March 2016 which was ₹ 147,854.73 million for the year ended March 2015 being overdue amount payable to National Iranian Oil Company (NIOC) pending settlement due the UN/ US/EU backed sanctions on Iran. Due to the sanctions, banking channels were not available to make the settlement. The amount was getting accumulated in the Balance Sheet of MRPL, and the Indian accounting standard required the company to translate the trade payable at the current rate resulting in huge mark-to-market foreign exchange losses.

During the year 2011 to 2013 part payments to NIOC were done through Union Bank of India via Istambul based Halk Bank. However, US/EU closed this route by through tougher sanctions in the year February 2013. In the agreement between India and Iran in the year August 2013, both the countries agreed that 45 percent of the amount due would be settled denominated in Indian Rupees immediately and balance 55 percent denominated in Euro would be settled whenever the banking channels were available. These payments were being routed through India's state-owned UCO Bank. MRPL Ltd. Thus, MRPL reduced a portion of its liability in the year 2013.

Nevertheless, foreign currency liability is a source of exchange rate exposure and needs to be hedged. But to hedge, the company must know the amount and maturity. In this case, the amount was known, but the maturity was not known as lifting the sanctions on Iran is a political issue and difficult to predict Mr. Sahoo adds. The effort to make the settlement was under process.

To understand the capital market perception about the MRPL's decision not to hedge, the exchange rate exposure of MRPL was estimated using the capital market model specified in equation (4). The results are displayed in Table 5.3. The stock returns of MRPL were positively related to the changes in the USD/INR exchange rates. For one per cent depreciation in Indian Rupee, the stock price would decrease by 0.234 percent. But the exposure was not statistically significant. Therefore, it can be concluded that the decision of MRPL not to hedge did not increase the exchange rate exposure and may be seen as a value-adding decision.

**Table 5.3 Exchange Rate Exposure of MRPL. Ltd.**

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* |
|---|---|---|---|---|
| Intercept | 0.001 | 0.002 | 0.380 | 0.704 |
| $F_{mt}$ | 1.468 | 0.173 | 8.469 | 0.000 |
| USD/INR | 0.234 | 0.607 | 0.386 | 0.700 |

*F-statistic = 45.12***, $R^2$ = 0.27, observations = 240*

*$F_{mt}$ is the market return orthogonal to exchange rate changes. USD/INR is the exchange rate changes between Indian Rupees and US Dollars.*

In the year 2016, Indian Prime Minister visited Iran. The process of settlement of liability restarted. MRPL turned to State Bank of India and Germany-based bank Europaeisch-Iranische Handelsbank AG (EIH) to speed payment of billions of Iranian oil dues they still owe to NIOC. The dues were completely settled during the year 2016. The settlements were done at the historical exchange rates and no interest was paid by MRPL on the payment which was due. The results reported in Table 5.3 indicates that the market discounted this factor hence the exposure to exchange rate movements were not significant.

## 5.3 CASE OF ASPINWALL & CO. LTD.

Aspinwall & Co. Ltd. is one of the pre-independence company established by John H. Aspinwall in the year 1867 headquartered in Cochin, Kerala. After the Indian independence, Aspinwall became a public limited company in 1956, with Erstwhile Travancore Royal family holding the controlling shares. Aspinwall & Co. Ltd. has diversified business interests in the areas such as Logistics, Specialty Coffee, Natural Fiber Products, and Natural Rubber.

The summary of financial statements of Aspinwall & Co. Ltd. for the period of five years is listed in Table 5.4 The net sales of the company were ₹ 2,378 million for the year ended March 2016. There was not much growth in the sales of Aspinwall over the five years. The export sales were 45.78 percent of the total sales for the year 2015-16, and it remained in the range of 41 per cent to 52 per cent. The import cost of the company was

less than half per cent for all the five years. The annual report stated that Aspinwall uses currency derivatives to hedge the currency exposures.

**Table 5.4 Summary of Financial Statements of Aspinwall & Co. Ltd.**

| | 2015-16 | 2014-15 | 2013-14 | 2012-13 | 2011-12 |
|---|---|---|---|---|---|
| Net Sales | 2378.60 | 2225.30 | 1943.60 | 2043.00 | 2366.20 |
| Exports Sales (₹ in million) | 1088.90 | 1138.10 | 923.40 | 1005.60 | 990.10 |
| Export sales as a percentage of net sales (%) | 45.78 | 51.14 | 47.51 | 49.22 | 41.84 |
| Total Expenditure (₹ in million) | 2227.30 | 2122.30 | 1791.30 | 1915.30 | 2149.70 |
| Import Cost (₹ in million) | 10.10 | 5.90 | 2.00 | 1.10 | 6.40 |
| Cost of import as a percentage of total expenditure (%) | 0.45 | 0.28 | 0.11 | 0.06 | 0.30 |
| Gain on foreign exchange fluctuations (₹ in million) | 2.60 | 0.60 | 2.60 | 2.00 | 0.20 |
| PAT (₹ in million) | 76.80 | 42.00 | 33.80 | 47.70 | 74.60 |
| PAT Margin (%) | 3.23 | 1.89 | 1.74 | 2.33 | 3.15 |

*Source: Compiled from the Annual Reports of Aspinwall & Co. Ltd.*

To understand the decision-making process and the motives behind the management of currency risk of Aspinwall, Mr. Gururaja Upadhyaya, Manager Finance in the Mangalore office was interviewed. The summary of the interview is discussed below.

The management of Aspinwall believed that all the foreign exchange transactions should be covered by hedging through currency forwards, even though the primary trend of domestic currency was favorable to the exporter. The forward contracts are booked through the HDFC Bank who is the banker of the firm. The audit committee of the company periodically reviews the risk management process of the company.

Further, this study investigates the effectiveness of the hedging by analyzing the transaction level data which was collected Mr. Guruaja. The data was pertaining only to the transactions entered by Mangalore office. The hedged revenue and unhedged revenue was computed. The comparison of the revenue is presented in Table 5.5.

**Table 5.5 Effectiveness of Hedging**

| | Hedged Rupee Revenue (₹ in million) | Un-Hedged Rupee Revenue (₹ in million) | Difference |
|---|---|---|---|
| 2011-12 | 689.13 | 701.91 | -12.78 |
| 2012-13 | 822.93 | 867.9 | -44.97 |
| 2013-14 | 995.28 | 967.32 | 27.96 |
| 2014-15 | 811.87 | 814.88 | -3.010 |
| 2015-16 | 570.73 | 560.98 | 09.75 |

The un-hedged revenue is computed by using the spot rate on the date when the payment of received by the company. Hedged revenue is the foreign currency revenue multiplied by the forward rate. The difference between the hedged revenue and un-hedged revenue is listed in the fourth column. The data analysis reveals that the Rupee revenue of the company would have been more than the hedged the revenue for three out of five years. During the financial year, 2015-16 and 2013-14 hedged revenue was higher than the unhedged revenue.

According to Mr. Gururaja Upadhyaya, the foreign currency would bring the stability to the cash flows and more importantly the company can lock the profit margin. The subsequent changes in the exchange rates would not affect the profit margins of the company. By hedging the entire foreign currency cash flows, the firm lost an opportunity of earning an abnormal return. The exchange rate exposure of Aspinwall was estimated using the capital market model specified in equation (4). The results are displayed in Table 5.6.

**Table 5.6 Exchange Rate Exposure of Aspinwall & Co. Ltd.**

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* |
|---|---|---|---|---|
| Intercept | 0.002 | 0.002 | 0.682 | 0.496 |
| $F_{mt}$ | 0.903 | 0.331 | 2.724 | 0.007 |
| USD/INR | -1.052 | 0.896 | -1.174 | 0.242 |

*F-statistic = 4.39***, $R^2$ = 0.07, observations = 228*

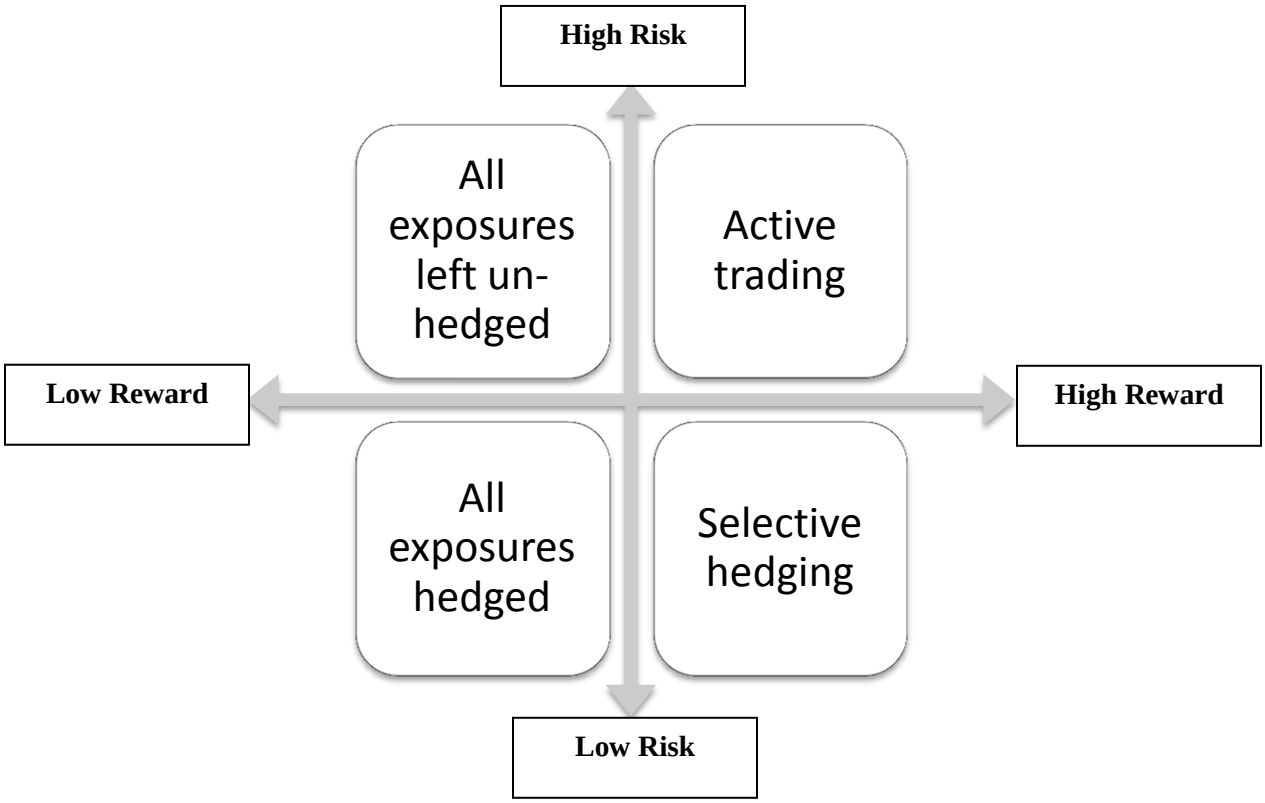
*$F_{mt}$ is the market return orthogonal to exchange rate changes. USD/INR is the exchange rate changes between Indian Rupees and US Dollars.*

The exposure estimated using the capital market model reveals that the stock returns of Aspinwall are negatively related to the exchange rates. One per cent appreciation in the Indian Rupee will lead to 1.05 per cent fall in the stock price. However, the coefficient was not statistically significant. Therefore, it is clear that the hedging using currency derivatives increases the firm value in spite of the fact that the cash flow of the firms would have been more had they not hedged.

## 5.4 CORPORATE PHILOSOPHY AND USAGE OF DERIVATIVES

From the above two case studies, it is clear that the usage of derivatives alone may not reduce the exchange rate exposure. It is important for the firms to understand the risks, measure the risks, scan the macroeconomic developments, the cost associated with hedging in order to increase the firm value. Figure 5.1 depicts the corporate philosophies of risk management.

**Figure 5.1 Exchange Rate Risk Management Strategies**



As can be seen in the figure below, the first quadrant (High Risk-Low Reward) is when the currency risk is not being hedged and perhaps the worst strategy. Second quadrant (High Risk-High Reward) is when a firm actively involves in the foreign exchange market and trading function to become a profit center. The third quadrant (Low risk-High reward) is the best strategy of all, requires quantification of expectations about the future and rewards would depend upon the accuracy of prediction. The fourth quadrant involves automatic hedging of all exposures. However, this is not the best among the four options the advantage of this strategy is that the transaction costs are known and the resulting stability of the cash flows.

## 6.1 SUMMARY OF FINDINGS AND CONCLUSION

The objective of the research was to investigate whether the changes in the exchange rate affects the value of the firm, to study the industry-wise exposure, to understand the factors determining the level of foreign exchange exposure and to analyze the usage of derivatives by non-financial firms.

The study provides evidence that throughout the study period of five years more than 50 percent of the firms had significant exchange rate exposure. The previous studies in the context of developed economies had limited success to detect the exposure which varied between 10 to 25 percent of the sample firms. The contribution of this study to the methodology includes the use of the log return and the market return orthogonal to exchange rate changes.

The industry-wise analysis of exposure revealed that the industries with a higher level of imports were significantly exposed to exchange rate risk. The industries with high imports such as Energy, Chemicals, Fertilizers and Pesticides and Metals exhibited higher levels of exposure. The industries with high exports such as IT and Pharmaceutical industries had lower exposure.

The summary of the hypotheses and the results is presented in Table 6.1. The empirical evidence suggests that the increase in financial distress will increase the firm's exchange rate exposure. In terms of firm size, the direction of the relationship is ambiguous. Larger firms may be both more exposed (due to the higher level of international activities) or may be less exposed (larger firms are more likely to hedge) than smaller firms. The result of this study suggests that firm size is positively related to the exposure.

**Table 6.1 Summary of the Findings**

| Null Hypotheses | Result |
|---|---|
| H1: Exchange rate fluctuations do not have any significant impact on the value of the firm | Rejected |
| H2: There is no relationship between financial distress and FX exposure | Rejected |
| H3: Firm size does not have a significant influence on the exchange rate exposure | Rejected |
| H4a: There is no relationship between the depth of international presence and exchange rate exposure. | Rejected |
| H4b: There is no relationship between breadth of international presence and exchange rate exposure. | Did not reject |
| H5: There is no relationship between liquidity and exchange rate exposure. | Did not reject |
| H6: There is no relationship between profitability and exchange rate exposure. | Rejected |
| H7: Currency derivatives have no significant impact on exchange rate exposure. | Rejected |
| H8: Foreign currency debt does not reduce the exchange rate exposure. | Did not reject |

The foreign sales ratio was found to be a significant determinant of the exchange rate exposure. The firms with higher foreign sales ratio had lower exposure compared to the firms with lower foreign sales ratio. The direction of the relationship was not consistent with the findings of earlier studies in the developed economies. The possible reason could be is that the domestic currency depreciation is favorable to exporters. Hence the firms with higher foreign sales would have gained from the changes in the exchange rates. Thus, the markets cheered the domestic currency depreciation as it would bring the short

term windfall gains from exchange rate changes. However, the foreign expense ratio was not significantly determined the exposure level.

The results of the study did not support the argument than the breadth of international which was measured in terms of geographical dispersion influences the exposure. Similarly, liquidity and foreign currency borrowings were not significantly related to the exposure. The exposure of the firms using currency derivatives was lower than the firms who did not use the currency derivatives. The results were robust as the direction of the relationship remained same for the results of fixed effects model and WLS method.

The study concludes that financial distress, firm size, profitability and use of currency derivatives are the significant factors that determines the level of firms exchange rate exposure.

The study revealed that the currency forwards was the most preferred currency derivative used for hedging the transaction exposure. The currency swaps were the second most frequently used currency derivative. Some of the hybrid instruments such as principal only swap, interest on only swaps and collars were used, but the number of firms using was very few. The currency options were popular to hedge the contingent exposure, and currency futures are very less frequently used to hedge the currency risk.

To understand the motives to use or not to use the currency derivatives, two case studies, one on the firm which does not use currency derivatives to hedge i.e. MRPL Ltd. The second case study was on the firm which completely hedged the exposure using the currency forwards i.e. Aspinwall & Co. Ltd. The analysis of case studies revealed that the usage of currency derivative per se would not reduce the exposure. The process of risk management is what determines the level of firm's exposure.

This study has important implications for management of the firm, shareholders and other stakeholders who are associated with the assessment of the firm's exposure to exchange rate risk. Corporate treasury managers can use the approach suggested in this study to precisely measure the exposure of their firm. With the understanding the determinant factors the managers would be able to manage the exchange rate exposure in a way that

adds value to the firm. For investors, perhaps examining the exposure to the exchange rate changes by forming industry based portfolios provides more meaningful information than looking at the firm level exposure to exchange rate risks.

## 6.2 SCOPE FOR FURTHER RESEARCH

The scope of this study was limited to non-financial firms listed on NSE. The future research may develop a model for measuring the exchange rate exposure of the highly regulated industry such as banks and financial institutions. Future research may also focus on the exposure of unlisted firms taking their earnings and cash flows as a proxy for firm value. This study included two case studies to understand the various corporate philosophies of exchange rate risk management. Future studies may survey some significant number of firms involved in the international business to bring out the behavioral issues in risk management.

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## Appendix I - List of Sample Companies

| SL. No. | Company | Industry |
|---|---|---|
| 1 | 3M India Ltd. | Services |
| 2 | Aarti Drugs Ltd. | Pharma |
| 3 | Aarti Industries Ltd. | Chemicals |
| 4 | Aban Offshore Ltd. | Energy |
| 5 | ABB India Ltd. | Industrial Manufacturing |
| 6 | ABG Shipyard Ltd. | Services |
| 7 | ACC Ltd. | Cement & Cement Products |
| 8 | Adani Enterprises Ltd. | Services |
| 9 | Adani Ports and Special Economic Zone Ltd. | Services |
| 10 | Adani Power Ltd. | Energy |
| 11 | Aegis Logistics Ltd. | Energy |
| 12 | Ahluwalia Contracts (India) Ltd. | Construction |
| 13 | AIA Engineering Ltd. | Industrial Manufacturing |
| 14 | Ajanta Pharma Ltd. | Pharma |
| 15 | Akzo Nobel India Ltd. | Consumer Goods |
| 16 | Allcargo Logistics Ltd. | Services |
| 17 | Alok Industries Ltd. | Textiles |
| 18 | Amara Raja Batteries Ltd. | Automobile |
| 19 | Ambuja Cements Ltd. | Cement & Cement Products |
| 20 | Amtek Auto Ltd. | Automobile |
| 21 | Anant Raj Ltd. | Construction |
| 22 | Apar Industries Ltd. | Industrial Manufacturing |
| 23 | Apollo Hospitals Enterprise Ltd. | Healthcare Services |
| 24 | Apollo Tyres Ltd. | Automobile |
| 25 | Arvind Ltd. | Textiles |
| 26 | Ashok Leyland Ltd. | Automobile |
| 27 | Ashoka Buildcon Ltd. | Construction |
| 28 | Asian Paints Ltd. | Consumer Goods |
| 29 | Astral Poly Technik Ltd. | Industrial Manufacturing |
| 30 | Astrazeneca Pharma India Ltd. | Pharma |
| 31 | Atul Ltd. | Chemicals |
| 32 | Aurobindo Pharma Ltd. | Pharma |
| 33 | Avanti Feeds Ltd. | Consumer Goods |
| 34 | Bajaj Auto Ltd. | Automobile |
| 35 | Bajaj Corp Ltd. | Consumer Goods |
| 36 | Bajaj Electricals Ltd. | Consumer Goods |

| | | |
|---|---|---|
| 37 | Bajaj Hindusthan Sugar Ltd. | Consumer Goods |
| 38 | Balkrishna Industries Ltd. | Automobile |
| 39 | Ballarpur Industries Ltd. | Paper |
| 40 | Balmer Lawrie & Company Ltd. | Services |
| 41 | Balrampur Chini Mills Ltd. | Consumer Goods |
| 42 | BASF India Ltd. | Chemicals |
| 43 | Bata India Ltd. | Consumer Goods |
| 44 | BEML Ltd. | Industrial Manufacturing |
| 45 | Berger Paints India Ltd. | Consumer Goods |
| 46 | BF Utilities Ltd. | Construction |
| 47 | BGR Energy Systems Ltd. | Construction |
| 48 | Bharat Electronics Ltd. | Industrial Manufacturing |
| 49 | Bharat Forge Ltd. | Industrial Manufacturing |
| 50 | Bharat Heavy Electricals Ltd. | Industrial Manufacturing |
| 51 | Bharat Petroleum Corporation Ltd. | Energy |
| 52 | Bharti Airtel Ltd. | Telecom |
| 53 | Bhushan Steel Ltd. | Metals |
| 54 | Biocon Ltd. | Pharma |
| 55 | Birla Corporation Ltd. | Cement & Cement Products |
| 56 | Bliss GVS Pharma Ltd. | Pharma |
| 57 | Blue Dart Express Ltd. | Services |
| 58 | Blue Star Ltd. | Consumer Goods |
| 59 | Bombay Burmah Trading Corporation Ltd. | Consumer Goods |
| 60 | Bombay Dyeing & Manufacturing Company Ltd. | Textiles |
| 61 | Bombay Rayon Fashions Ltd. | Textiles |
| 62 | Bosch Ltd. | Automobile |
| 63 | Brigade Enterprises Ltd. | Construction |
| 64 | Britannia Industries Ltd. | Consumer Goods |
| 65 | Cadila Healthcare Ltd. | Pharma |
| 66 | Cairn India Ltd. | Energy |
| 67 | Castex Technologies Ltd. | Automobile |
| 68 | Castrol India Ltd. | Energy |
| 69 | CCL Products (India) Ltd. | Consumer Goods |
| 70 | Ceat Ltd. | Automobile |
| 71 | Century Plyboards (India) Ltd. | Consumer Goods |
| 72 | Century Textiles & Industries Ltd. | Cement & Cement Products |
| 73 | Cera Sanitaryware Ltd. | Construction |
| 74 | CESC Ltd. | Energy |
| 75 | Chambal Fertilisers & Chemicals Ltd. | Fertilisers & Pesticides |
| 76 | Chennai Petroleum Corporation Ltd. | Energy |

| | | |
|---|---|---|
| 77 | Cipla Ltd. | Pharma |
| 78 | Clariant Chemicals (India) Ltd. | Chemicals |
| 79 | Coal India Ltd. | Metals |
| 80 | Colgate-Palmolive (India) Ltd. | Consumer Goods |
| 81 | Container Corporation Of India Ltd. | Services |
| 82 | Coromandel International Ltd. | Fertilisers & Pesticides |
| 83 | Cox & Kings (India) Ltd. | Services |
| 84 | Cummins India Ltd. | Industrial Manufacturing |
| 85 | Cyient Ltd. | It |
| 86 | Dabur India Ltd. | Consumer Goods |
| 87 | Dalmia Bharat Ltd. | Cement & Cement Products |
| 88 | DB Corp Ltd. | Media & Entertainment |
| 89 | DB Realty Ltd. | Construction |
| 90 | DCM Shriram Ltd. | Consumer Goods |
| 91 | Deepak Fertilisers & Petrochemicals Corporation Ltd. | Chemicals |
| 92 | Delta Corp Ltd. | Construction |
| 93 | Den Networks Ltd. | Media & Entertainment |
| 94 | Dish TV India Ltd. | Media & Entertainment |
| 95 | Dishman Pharmaceuticals & Chemicals Ltd. | Pharma |
| 96 | Divis Laboratories Ltd. | Pharma |
| 97 | DLF Ltd. | Construction |
| 98 | Dr. Reddys Laboratories Ltd. | Pharma |
| 99 | Dredging Corporation Of India Ltd. | Services |
| 100 | Dynamatic Technologies Ltd. | Automobile |
| 101 | E.I.D. Parry (India) Ltd. | Fertilisers & Pesticides |
| 102 | eClerx Services Ltd. | It |
| 103 | Eicher Motors Ltd. | Automobile |
| 104 | EIH Ltd. | Services |
| 105 | Electrosteel Castings Ltd. | Industrial Manufacturing |
| 106 | Elgi Equipments Ltd. | Industrial Manufacturing |
| 107 | Emami Ltd. | Consumer Goods |
| 108 | Engineers India Ltd. | Construction |
| 109 | Eros International Media Ltd. | Media & Entertainment |
| 110 | Escorts Ltd. | Automobile |
| 111 | Ess Dee Aluminium Ltd. | Industrial Manufacturing |
| 112 | Essel Propack Ltd. | Industrial Manufacturing |
| 113 | Eveready Industries (India) Ltd. | Consumer Goods |
| 114 | Exide Industries Ltd. | Automobile |
| 115 | FAG Bearings India Ltd. | Industrial Manufacturing |
| 116 | FDC Ltd. | Pharma |

| | | |
|---|---|---|
| 117 | Finolex Cables Ltd. | Industrial Manufacturing |
| 118 | Finolex Industries Ltd. | Industrial Manufacturing |
| 119 | Firstsource Solutions Ltd. | It |
| 120 | Fortis Healthcare Ltd. | Healthcare Services |
| 121 | GAIL (India) Ltd. | Energy |
| 122 | Gateway Distriparks Ltd. | Services |
| 123 | GATI Ltd. | Services |
| 124 | GE Power India Ltd. | Industrial Manufacturing |
| 125 | GE T&D India Ltd. | Industrial Manufacturing |
| 126 | Gillette India Ltd. | Consumer Goods |
| 127 | Glaxosmithkline Consumer Healthcare Ltd. | Consumer Goods |
| 128 | Glaxosmithkline Pharmaceuticals Ltd. | Pharma |
| 129 | Glenmark Pharmaceuticals Ltd. | Pharma |
| 130 | Global Offshore Services Ltd. | Services |
| 131 | GMR Infrastructure Ltd. | Construction |
| 132 | Godfrey Phillips India Ltd. | Consumer Goods |
| 133 | Godrej Consumer Products Ltd. | Consumer Goods |
| 134 | Godrej Industries Ltd. | Consumer Goods |
| 135 | Godrej Properties Ltd. | Construction |
| 136 | Granules India Ltd. | Pharma |
| 137 | Grasim Industries Ltd. | Cement & Cement Products |
| 138 | Greaves Cotton Ltd. | Industrial Manufacturing |
| 139 | Greenply Industries Ltd. | Consumer Goods |
| 140 | Grindwell Norton Ltd. | Industrial Manufacturing |
| 141 | Gujarat Fluorochemicals Ltd. | Chemicals |
| 142 | Gujarat Mineral Development Corporation Ltd. | Metals |
| 143 | Gujarat Pipavav Port Ltd. | Services |
| 144 | Gujarat State Fertilizers & Chemicals Ltd. | Fertilisers & Pesticides |
| 145 | Gujarat State Petronet Ltd. | Energy |
| 146 | GVK Power & Infrastructure Ltd. | Construction |
| 147 | Hathway Cable & Datacom Ltd. | Media & Entertainment |
| 148 | Havells India Ltd. | Consumer Goods |
| 149 | HCL Infosystems Ltd. | It |
| 150 | HCL Technologies Ltd. | It |
| 151 | Heidelberg Cement India Ltd. | Cement & Cement Products |
| 152 | Hero MotoCorp Ltd. | Automobile |
| 153 | Hexaware Technologies Ltd. | It |
| 154 | Himachal Futuristic Communications Ltd. | Telecom |
| 155 | Himatsingka Seide Ltd. | Textiles |
| 156 | Hindalco Industries Ltd. | Metals |

| | | |
|---|---|---|
| 157 | Hindustan Construction Company Ltd. | Construction |
| 158 | Hindustan Copper Ltd. | Metals |
| 159 | Hindustan Media Ventures Ltd. | Media & Entertainment |
| 160 | Hindustan Petroleum Corporation Ltd. | Energy |
| 161 | Hindustan Unilever Ltd. | Consumer Goods |
| 162 | Hindustan Zinc Ltd. | Metals |
| 163 | HMT Ltd. | Consumer Goods |
| 164 | Honeywell Automation India Ltd. | Industrial Manufacturing |
| 165 | Hotel Leela Venture Ltd. | Services |
| 166 | HSIL Ltd. | Consumer Goods |
| 167 | HT Media Ltd. | Media & Entertainment |
| 168 | Idea Cellular Ltd. | Telecom |
| 169 | IFB Industries Ltd. | Consumer Goods |
| 170 | Igarashi Motors India Ltd. | Automobile |
| 171 | IL&FS Transportation Networks Ltd. | Services |
| 172 | Indiabulls Real Estate Ltd. | Construction |
| 173 | Indian Oil Corporation Ltd. | Energy |
| 174 | Indo Count Industries Ltd. | Textiles |
| 175 | Indoco Remedies Ltd. | Pharma |
| 176 | Indraprastha Gas Ltd. | Energy |
| 177 | INEOS Styrolution India Ltd. | Industrial Manufacturing |
| 178 | Info Edge (India) Ltd. | It |
| 179 | Infosys Ltd. | It |
| 180 | Ingersoll-Rand (India) Ltd. | Industrial Manufacturing |
| 181 | Inox Leisure Ltd. | Media & Entertainment |
| 182 | International Paper APPM Ltd. | Paper |
| 183 | Ipca Laboratories Ltd. | Pharma |
| 184 | IRB Infrastructure Developers Ltd. | Construction |
| 185 | ITC Ltd. | Consumer Goods |
| 186 | J Kumar Infraproject Ltd. | Construction |
| 187 | Jagran Prakashan Ltd. | Media & Entertainment |
| 188 | Jai Corp Ltd. | Industrial Manufacturing |
| 189 | Jain Irrigation Systems Ltd. | Industrial Manufacturing |
| 190 | Jaiprakash Associates Ltd. | Cement & Cement Products |
| 191 | Jaiprakash Power Ventures Ltd. | Energy |
| 192 | Jaypee Infratech Ltd. | Services |
| 193 | JB Chemicals & Pharmaceuticals Ltd. | Pharma |
| 194 | JBF Industries Ltd. | Textiles |
| 195 | Jet Airways (India) Ltd. | Services |
| 196 | Jindal Poly Films Ltd. | Industrial Manufacturing |
| 197 | Jindal Steel & Power Ltd. | Metals |

| | | |
|---|---|---|
| 198 | JK Cement Ltd. | Cement & Cement Products |
| 199 | JK Lakshmi Cement Ltd. | Cement & Cement Products |
| 200 | JK Tyre & Industries Ltd. | Automobile |
| 201 | JMT Auto Ltd. | Automobile |
| 202 | Johnson Controls - Hitachi Air Conditioning India Ltd. | Consumer Goods |
| 203 | JSW Energy Ltd. | Energy |
| 204 | JSW Steel Ltd. | Metals |
| 205 | Jubilant FoodWorks Ltd. | Consumer Goods |
| 206 | Jubilant Life Sciences Ltd. | Pharma |
| 207 | Jyothy Laboratories Ltd. | Consumer Goods |
| 208 | Kajaria Ceramics Ltd. | Construction |
| 209 | Kalpataru Power Transmission Ltd. | Energy |
| 210 | Kansai Nerolac Paints Ltd. | Consumer Goods |
| 211 | Kaveri Seed Company Ltd. | Consumer Goods |
| 212 | KEC International Ltd. | Construction |
| 213 | Kesoram Industries Ltd. | Automobile |
| 214 | Kirloskar Oil Engines Ltd. | Industrial Manufacturing |
| 215 | Kolte Patil Developers Ltd. | Construction |
| 216 | KPIT Technologies Ltd. | It |
| 217 | KPR Mill Ltd. | Textiles |
| 218 | KRBL Ltd. | Consumer Goods |
| 219 | KSK Energy Ventures Ltd. | Energy |
| 220 | Kwality Ltd. | Consumer Goods |
| 221 | La Opala RG Ltd. | Consumer Goods |
| 222 | Lakshmi Machine Works Ltd. | Industrial Manufacturing |
| 223 | Lanco Infratech Ltd. | Energy |
| 224 | Larsen & Toubro Ltd. | Construction |
| 225 | Lupin Ltd. | Pharma |
| 226 | Mahanagar Telephone Nigam Ltd. | Telecom |
| 227 | Mahindra & Mahindra Ltd. | Automobile |
| 228 | Mahindra CIE Automotive Ltd. | Industrial Manufacturing |
| 229 | Mahindra Holidays & Resorts India Ltd. | Services |
| 230 | Mahindra Lifespace Developers Ltd. | Construction |
| 231 | Mangalore Refinery & Petrochemicals Ltd. | Energy |
| 232 | Marico Ltd. | Consumer Goods |
| 233 | Marksans Pharma Ltd. | Pharma |
| 234 | Maruti Suzuki India Ltd. | Automobile |
| 235 | Mcleod Russel India Ltd. | Consumer Goods |
| 236 | Merck Ltd. | Pharma |
| 237 | Mindtree Ltd. | It |

| | | |
|---|---|---|
| 238 | MMTC Ltd. | Services |
| 239 | MOIL Ltd. | Metals |
| 240 | Monsanto India Ltd. | Fertilisers & Pesticides |
| 241 | Motherson Sumi Systems Ltd. | Automobile |
| 242 | Mphasis Ltd. | It |
| 243 | MRF Ltd. | Automobile |
| 244 | Natco Pharma Ltd. | Pharma |
| 245 | National Aluminium Company Ltd. | Metals |
| 246 | NCC Ltd. | Construction |
| 247 | Network 18 Media & Investment Ltd. | Media & Entertainment |
| 248 | NHPC Ltd. | Energy |
| 249 | NIIT Technologies Ltd. | It |
| 250 | Nitin Fire Protection Industries Ltd. | Industrial Manufacturing |
| 251 | NLC India Ltd. | Energy |
| 252 | NMDC Ltd. | Metals |
| 253 | NTPC Ltd. | Energy |
| 254 | Oberoi Realty Ltd. | Construction |
| 255 | Oil & Natural Gas Corporation Ltd. | Energy |
| 256 | Oil India Ltd. | Energy |
| 257 | Omaxe Ltd. | Construction |
| 258 | Oracle Financial Services Software Ltd. | It |
| 259 | Page Industries Ltd. | Textiles |
| 260 | Parsvnath Developers Ltd. | Construction |
| 261 | Persistent Systems Ltd. | It |
| 262 | Petronet LNG Ltd. | Energy |
| 263 | Pfizer Ltd. | Pharma |
| 264 | Phoenix Mills Ltd. | Construction |
| 265 | Pidilite Industries Ltd. | Chemicals |
| 266 | Piramal Enterprises Ltd. | Pharma |
| 267 | Polaris Consulting & Services Ltd. | It |
| 268 | Power Grid Corporation Of India Ltd. | Energy |
| 269 | Praj Industries Ltd. | Industrial Manufacturing |
| 270 | Prestige Estate Projects Ltd. | Construction |
| 271 | Prism Cement Ltd. | Cement & Cement Products |
| 272 | Procter & Gamble Hygiene & Health Care Ltd. | Consumer Goods |
| 273 | PTC India Ltd. | Energy |
| 274 | Punj Lloyd Ltd. | Construction |
| 275 | PVR Ltd. | Media & Entertainment |
| 276 | Radico Khaitan Ltd. | Consumer Goods |
| 277 | Rain Industries Ltd. | Chemicals |

| | | |
|---|---|---|
| 278 | Rajesh Exports Ltd. | Consumer Goods |
| 279 | Rallis India Ltd. | Fertilisers & Pesticides |
| 280 | Ramco Systems Ltd. | It |
| 281 | Ramkrishna Forgings Ltd. | Industrial Manufacturing |
| 282 | Rashtriya Chemicals & Fertilizers Ltd. | Fertilisers & Pesticides |
| 283 | Ratnamani Metals & Tubes Ltd. | Metals |
| 284 | RattanIndia Power Ltd. | Energy |
| 285 | Raymond Ltd. | Textiles |
| 286 | Redington (India) Ltd. | Services |
| 287 | Reliance Communications Ltd. | Telecom |
| 288 | Reliance Defence and Engineering Ltd. | Industrial Manufacturing |
| 289 | Reliance Industrial Infrastructure Ltd. | Industrial Manufacturing |
| 290 | Reliance Industries Ltd. | Energy |
| 291 | Reliance Infrastructure Ltd. | Energy |
| 292 | Reliance Power Ltd. | Energy |
| 293 | Rolta India Ltd. | It |
| 294 | Ruchi Soya Industries Ltd. | Consumer Goods |
| 295 | Sadbhav Engineering Ltd. | Construction |
| 296 | Sanofi India Ltd. | Pharma |
| 297 | Shilpa Medicare Ltd. | Pharma |
| 298 | Shipping Corporation Of India Ltd. | Services |
| 299 | Shoppers Stop Ltd. | Consumer Goods |
| 300 | Shree Cement Ltd. | Cement & Cement Products |
| 301 | Shree Renuka Sugars Ltd. | Consumer Goods |
| 302 | Siemens Ltd. | Industrial Manufacturing |
| 303 | Simplex Infrastructures Ltd. | Construction |
| 304 | Sintex Industries Ltd. | Industrial Manufacturing |
| 305 | Siti Networks Ltd. | Media & Entertainment |
| 306 | SJVN Ltd. | Energy |
| 307 | SKF India Ltd. | Industrial Manufacturing |
| 308 | SML Isuzu Ltd. | Automobile |
| 309 | Sobha Ltd. | Construction |
| 310 | Solar Industries (India) Ltd. | Chemicals |
| 311 | Somany Ceramics Ltd. | Construction |
| 312 | Sonata Software Ltd. | It |
| 313 | SRF Ltd. | Textiles |
| 314 | State Trading Corporation Of India Ltd. | Services |
| 315 | Steel Authority Of India Ltd. | Metals |
| 316 | Strides Shasun Ltd. | Pharma |
| 317 | Sun Pharma Advanced Research Company Ltd. | Pharma |

| | | |
|---|---|---|
| 318 | Sun Pharmaceutical Industries Ltd. | Pharma |
| 319 | Sun TV Network Ltd. | Media & Entertainment |
| 320 | Sundram Fasteners Ltd. | Automobile |
| 321 | Sunteck Realty Ltd. | Construction |
| 322 | Supreme Industries Ltd. | Industrial Manufacturing |
| 323 | Suven Life Sciences Ltd. | Pharma |
| 324 | Suzlon Energy Ltd. | Industrial Manufacturing |
| 325 | Take Solutions Ltd. | It |
| 326 | Tamil Nadu Newsprint & Papers Ltd. | Paper |
| 327 | Tata Chemicals Ltd. | Chemicals |
| 328 | Tata Coffee Ltd. | Consumer Goods |
| 329 | Tata Communications Ltd. | Telecom |
| 330 | Tata Consultancy Services Ltd. | It |
| 331 | Tata Elxsi Ltd. | It |
| 332 | Tata Global Beverages Ltd. | Consumer Goods |
| 333 | Tata Motors Ltd. | Automobile |
| 334 | Tata Power Company Ltd. | Energy |
| 335 | Tata Sponge Iron Ltd. | Metals |
| 336 | Tata Steel Ltd. | Metals |
| 337 | Tata Teleservices (Maharashtra) Ltd. | Telecom |
| 338 | Tech Mahindra Ltd. | It |
| 339 | Techno Electric & Engineering Company Ltd. | Construction |
| 340 | Texmaco Rail & Engineering Ltd. | Industrial Manufacturing |
| 341 | The Great Eastern Shipping Company Ltd. | Services |
| 342 | The India Cements Ltd. | Cement & Cement Products |
| 343 | The Indian Hotels Company Ltd. | Services |
| 344 | The Ramco Cements Ltd. | Cement & Cement Products |
| 345 | Thermax Ltd. | Industrial Manufacturing |
| 346 | Thomas Cook (India) Ltd. | Services |
| 347 | Tide Water Oil Company (India) Ltd. | Energy |
| 348 | Timken India Ltd. | Industrial Manufacturing |
| 349 | Titan Company Ltd. | Consumer Goods |
| 350 | Torrent Pharmaceuticals Ltd. | Pharma |
| 351 | Torrent Power Ltd. | Energy |
| 352 | Trent Ltd. | Consumer Goods |
| 353 | Trident Ltd. | Textiles |
| 354 | TTK Prestige Ltd. | Consumer Goods |
| 355 | Tube Investments Of India Ltd. | Automobile |
| 356 | TV Today Network Ltd. | Media & Entertainment |
| 357 | TV18 Broadcast Ltd. | Media & Entertainment |
| 358 | TVS Motor Company Ltd. | Automobile |

| | | |
|---|---|---|
| 359 | TVS Srichakra Ltd. | Automobile |
| 360 | Uflex Ltd. | Industrial Manufacturing |
| 361 | Ultratech Cement Ltd. | Cement & Cement Products |
| 362 | Unichem Laboratories Ltd. | Pharma |
| 363 | Unitech Ltd. | Construction |
| 364 | United Breweries Ltd. | Consumer Goods |
| 365 | United Spirits Ltd. | Consumer Goods |
| 366 | UPL Ltd. | Fertilisers & Pesticides |
| 367 | VA Tech Wabag Ltd. | Services |
| 368 | Vaibhav Global Ltd. | Consumer Goods |
| 369 | Vakrangee Ltd. | It |
| 370 | Vardhman Textiles Ltd. | Textiles |
| 371 | Vedanta Ltd. | Metals |
| 372 | V-Guard Industries Ltd. | Industrial Manufacturing |
| 373 | Videocon Industries Ltd. | Consumer Goods |
| 374 | Vinati Organics Ltd. | Chemicals |
| 375 | VIP Industries Ltd. | Consumer Goods |
| 376 | Voltas Ltd. | Construction |
| 377 | VST Industries Ltd. | Consumer Goods |
| 378 | Wabco India Ltd. | Automobile |
| 379 | Welspun Corp Ltd. | Metals |
| 380 | Welspun India Ltd. | Textiles |
| 381 | Whirlpool Of India Ltd. | Consumer Goods |
| 382 | Wipro Ltd. | It |
| 383 | Wockhardt Ltd. | Pharma |
| 384 | Zee Entertainment Enterprises Ltd. | Media & Entertainment |
| 385 | Zee Learn Ltd. | Media & Entertainment |
| 386 | Zensar Technologies Ltd. | It |
| 387 | Zydus Wellness Ltd. | Consumer Goods |

## Appendix II – Exchange Rate Exposure of Sample Firms

| SL. No. | Company | 2015-16 | | 2014-15 | | 2013-14 | | 2012-13 | | 2011-12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Coefficient | p-value | Coefficient | p-value | Coefficient | p-value | Coefficient | p-value | Coefficient | p-value |
| 1 | 3M India Ltd. | 1.72 | 0.00 | 0.77 | 0.04 | 0.13 | 0.31 | 0.24 | 0.21 | 0.05 | 0.85 |
| 2 | Aarti Drugs Ltd. | 1.63 | 0.00 | 1.13 | 0.06 | 0.59 | 0.02 | 0.38 | 0.25 | 0.60 | 0.09 |
| 3 | Aarti Industries Ltd. | 1.23 | 0.00 | 1.45 | 0.01 | 0.07 | 0.76 | 0.50 | 0.05 | 0.82 | 0.01 |
| 4 | Aban Offshore Ltd. | 1.92 | 0.00 | 2.07 | 0.00 | 1.27 | 0.00 | 0.74 | 0.00 | 2.33 | 0.00 |
| 5 | ABB India Ltd. | 0.48 | 0.19 | 0.57 | 0.16 | 0.80 | 0.00 | 0.55 | 0.00 | 0.87 | 0.00 |
| 6 | ABG Shipyard Ltd. | 1.32 | 0.10 | 1.14 | 0.07 | -0.09 | 0.76 | -0.15 | 0.61 | 0.85 | 0.00 |
| 7 | ACC Ltd. | 1.08 | 0.00 | 0.71 | 0.02 | 0.99 | 0.00 | 0.53 | 0.01 | 0.38 | 0.13 |
| 8 | Adani Enterprises Ltd. | 4.32 | 0.03 | 1.69 | 0.00 | 0.94 | 0.00 | 1.25 | 0.00 | 2.43 | 0.00 |
| 9 | Adani Ports and Special Economic Zone Ltd. | 1.53 | 0.00 | 1.47 | 0.00 | 0.86 | 0.00 | 0.74 | 0.01 | 0.98 | 0.02 |
| 10 | Adani Power Ltd. | 2.91 | 0.00 | 2.41 | 0.00 | 0.32 | 0.26 | 1.14 | 0.00 | 1.01 | 0.02 |
| 11 | Aegis Logistics Ltd. | 2.43 | 0.00 | 1.19 | 0.06 | 0.97 | 0.00 | 0.45 | 0.19 | 0.70 | 0.12 |
| 12 | Ahluwalia Contracts (India) Ltd. | 2.15 | 0.00 | 1.63 | 0.03 | 0.38 | 0.26 | 0.32 | 0.28 | 1.59 | 0.00 |
| 13 | AIA Engineering Ltd. | 0.67 | 0.06 | 0.32 | 0.49 | 0.42 | 0.04 | 0.38 | 0.04 | 0.91 | 0.00 |
| 14 | Ajanta Pharma Ltd. | 1.33 | 0.00 | -0.16 | 0.75 | 0.16 | 0.58 | 0.14 | 0.70 | 0.13 | 0.70 |
| 15 | Akzo Nobel India Ltd. | 1.04 | 0.00 | 0.68 | 0.04 | 0.29 | 0.05 | 0.08 | 0.59 | 0.31 | 0.24 |
| 16 | Allcargo Logistics Ltd. | 1.87 | 0.00 | 1.40 | 0.01 | 0.26 | 0.34 | 0.20 | 0.38 | 0.62 | 0.07 |
| 17 | Alok Industries Ltd. | 2.86 | 0.00 | 1.40 | 0.05 | 0.57 | 0.01 | 0.55 | 0.07 | 1.68 | 0.00 |
| 18 | Amara Raja Batteries | 1.25 | 0.00 | 0.48 | 0.24 | 0.38 | 0.08 | -0.01 | 0.98 | 0.96 | 0.00 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ltd. | | | | | | | | | | |
| 19 | Ambuja Cements Ltd. | 1.01 | 0.00 | 0.99 | 0.00 | 0.93 | 0.00 | 0.90 | 0.00 | 0.57 | 0.07 |
| 20 | Amtek Auto Ltd. | 3.16 | 0.00 | 1.33 | 0.03 | 0.69 | 0.02 | 0.76 | 0.01 | 0.78 | 0.09 |
| 21 | Anant Raj Ltd. | 2.80 | 0.00 | 1.91 | 0.00 | 1.13 | 0.00 | 0.89 | 0.04 | 2.55 | 0.00 |
| 22 | Apar Industries Ltd. | 1.49 | 0.00 | 1.38 | 0.02 | 0.40 | 0.10 | 0.41 | 0.17 | 0.64 | 0.09 |
| 23 | Apollo Hospitals Enterprise Ltd. | 1.41 | 0.00 | 1.02 | 0.01 | 0.66 | 0.00 | 0.08 | 0.73 | 0.85 | 0.02 |
| 24 | Apollo Tyres Ltd. | 1.74 | 0.00 | 1.69 | 0.00 | 0.84 | 0.00 | 0.57 | 0.01 | 0.62 | 0.11 |
| 25 | Arvind Ltd. | 2.76 | 0.00 | 1.54 | 0.00 | 0.78 | 0.00 | 0.31 | 0.29 | 1.34 | 0.00 |
| 26 | Ashok Leyland Ltd. | 2.51 | 0.00 | 2.12 | 0.00 | 1.01 | 0.00 | 0.40 | 0.10 | 0.93 | 0.01 |
| 27 | Ashoka Buildcon Ltd. | 1.51 | 0.00 | 0.75 | 0.22 | 0.28 | 0.33 | -0.04 | 0.87 | 0.04 | 0.88 |
| 28 | Asian Paints Ltd. | 0.95 | 0.00 | 0.79 | 0.02 | 0.97 | 0.00 | 0.31 | 0.07 | 0.29 | 0.21 |
| 29 | Astral Poly Technik Ltd. | 0.60 | 0.07 | 0.11 | 0.80 | 0.41 | 0.12 | 0.73 | 0.00 | 0.14 | 0.72 |
| 30 | Astrazeneca Pharma India Ltd. | 0.82 | 0.06 | 0.62 | 0.06 | 0.55 | 0.08 | -0.15 | 0.68 | 0.44 | 0.17 |
| 31 | Atul Ltd. | 1.84 | 0.00 | 0.14 | 0.81 | 0.78 | 0.00 | 0.36 | 0.25 | 1.14 | 0.00 |
| 32 | Aurobindo Pharma Ltd. | 2.51 | 0.00 | 1.16 | 0.01 | 0.48 | 0.07 | 0.68 | 0.03 | 0.66 | 0.16 |
| 33 | Avanti Feeds Ltd. | 1.80 | 0.00 | 1.32 | 0.05 | -0.34 | 0.28 | 0.31 | 0.44 | 0.13 | 0.85 |
| 34 | Bajaj Auto Ltd. | 1.21 | 0.00 | 0.42 | 0.11 | 0.77 | 0.00 | 0.11 | 0.54 | 0.91 | 0.00 |
| 35 | Bajaj Corp Ltd. | 0.66 | 0.04 | 0.85 | 0.06 | 0.66 | 0.00 | 0.45 | 0.06 | 0.21 | 0.50 |
| 36 | Bajaj Electricals Ltd. | 1.20 | 0.00 | 1.88 | 0.00 | 0.57 | 0.01 | -0.11 | 0.67 | 0.50 | 0.17 |
| 37 | Bajaj Hindusthan Sugar Ltd. | 2.29 | 0.00 | 1.56 | 0.02 | 0.30 | 0.17 | 1.02 | 0.00 | 1.84 | 0.00 |
| 38 | Balkrishna Industries Ltd. | -0.06 | 0.80 | 0.88 | 0.06 | 0.30 | 0.16 | 0.41 | 0.06 | 0.47 | 0.16 |
| 39 | Ballarpur Industries Ltd. | 2.08 | 0.00 | 1.70 | 0.00 | 0.73 | 0.00 | 0.21 | 0.33 | 1.00 | 0.00 |
| 40 | Balmer Lawrie & Company Ltd. | 1.28 | 0.00 | 0.61 | 0.20 | 0.24 | 0.05 | 0.26 | 0.12 | 0.54 | 0.02 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 41 | Balrampur Chini Mills Ltd. | 1.97 | 0.00 | 0.74 | 0.17 | 0.15 | 0.52 | 0.86 | 0.01 | 1.67 | 0.00 |
| 42 | BASF India Ltd. | 1.85 | 0.00 | 1.76 | 0.00 | 0.36 | 0.03 | 0.30 | 0.20 | 0.25 | 0.34 |
| 43 | Bata India Ltd. | 1.19 | 0.00 | 1.01 | 0.00 | 0.66 | 0.00 | 0.40 | 0.03 | 1.35 | 0.00 |
| 44 | BEML Ltd. | 2.27 | 0.00 | 1.71 | 0.01 | 1.08 | 0.00 | 0.92 | 0.00 | 1.02 | 0.00 |
| 45 | Berger Paints India Ltd. | 0.95 | 0.00 | 0.99 | 0.04 | 0.55 | 0.00 | 0.03 | 0.92 | 0.27 | 0.39 |
| 46 | BF Utilities Ltd. | 3.67 | 0.00 | 1.57 | 0.03 | 1.20 | 0.00 | 0.77 | 0.02 | 2.22 | 0.00 |
| 47 | BGR Energy Systems Ltd. | 3.02 | 0.00 | 2.24 | 0.00 | 1.16 | 0.00 | 0.70 | 0.00 | 1.73 | 0.00 |
| 48 | Bharat Electronics Ltd. | 1.57 | 0.00 | 1.26 | 0.02 | 0.38 | 0.01 | 0.44 | 0.03 | 0.37 | 0.09 |
| 49 | Bharat Forge Ltd. | 1.63 | 0.00 | 0.81 | 0.04 | 0.77 | 0.00 | 0.55 | 0.01 | 0.94 | 0.00 |
| 50 | Bharat Heavy Electricals Ltd. | 1.50 | 0.00 | 1.29 | 0.01 | 1.41 | 0.00 | 1.34 | 0.00 | 1.15 | 0.00 |
| 51 | Bharat Petroleum Corporation Ltd. | 0.92 | 0.01 | 1.04 | 0.01 | 1.32 | 0.00 | 0.78 | 0.00 | 0.74 | 0.01 |
| 52 | Bharti Airtel Ltd. | 0.78 | 0.01 | 0.62 | 0.07 | 1.28 | 0.00 | 0.92 | 0.00 | 0.76 | 0.01 |
| 53 | Bhushan Steel Ltd. | 2.09 | 0.00 | 1.24 | 0.07 | 0.18 | 0.00 | 0.11 | 0.45 | 0.78 | 0.01 |
| 54 | Biocon Ltd. | 1.50 | 0.00 | 0.74 | 0.04 | 0.41 | 0.03 | 0.25 | 0.21 | 0.56 | 0.08 |
| 55 | Birla Corporation Ltd. | 1.17 | 0.00 | 0.90 | 0.07 | 0.32 | 0.13 | 0.53 | 0.07 | 0.48 | 0.06 |
| 56 | Bliss GVS Pharma Ltd. | 2.74 | 0.00 | 0.18 | 0.79 | 0.33 | 0.12 | 0.94 | 0.01 | 0.34 | 0.34 |
| 57 | Blue Dart Express Ltd. | 0.94 | 0.01 | 1.29 | 0.00 | 0.28 | 0.13 | -0.01 | 0.97 | 0.61 | 0.10 |
| 58 | Blue Star Ltd. | 0.78 | 0.01 | 1.36 | 0.00 | 0.43 | 0.01 | 0.54 | 0.02 | 0.32 | 0.30 |
| 59 | Bombay Burmah Trading Corporation Ltd. | 2.83 | 0.00 | 3.08 | 0.00 | 0.64 | 0.01 | 0.67 | 0.04 | 0.88 | 0.03 |
| 60 | Bombay Dyeing & Manufacturing Company Ltd. | 2.79 | 0.00 | 1.96 | 0.00 | 0.55 | 0.05 | 0.49 | 0.09 | 1.23 | 0.00 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 61 | Bombay Rayon Fashions Ltd. | 0.95 | 0.05 | 0.56 | 0.23 | 0.00 | 1.00 | 0.25 | 0.12 | 0.16 | 0.43 |
| 62 | Bosch Ltd. | 1.37 | 0.00 | 1.09 | 0.00 | 0.19 | 0.10 | 0.48 | 0.00 | 0.32 | 0.08 |
| 63 | Brigade Enterprises Ltd. | 0.78 | 0.07 | 1.48 | 0.01 | 0.79 | 0.00 | 0.84 | 0.03 | 1.82 | 0.00 |
| 64 | Britannia Industries Ltd. | 0.82 | 0.01 | 0.42 | 0.26 | 0.24 | 0.16 | 0.27 | 0.07 | 0.56 | 0.01 |
| 65 | Cadila Healthcare Ltd. | 0.82 | 0.04 | 0.56 | 0.11 | 0.27 | 0.06 | -0.21 | 0.31 | 0.36 | 0.15 |
| 66 | Cairn India Ltd. | 1.39 | 0.00 | 1.04 | 0.00 | 0.10 | 0.48 | 0.21 | 0.28 | 0.59 | 0.07 |
| 67 | Castex Technologies Ltd. | 0.26 | 0.75 | 0.96 | 0.13 | 1.37 | 0.00 | -0.11 | 0.75 | 0.78 | 0.06 |
| 68 | Castrol India Ltd. | 1.35 | 0.00 | 1.08 | 0.00 | 0.20 | 0.09 | 0.13 | 0.46 | 0.25 | 0.38 |
| 69 | CCL Products (India) Ltd. | 2.24 | 0.00 | 1.32 | 0.01 | 0.54 | 0.03 | 0.79 | 0.01 | 0.52 | 0.29 |
| 70 | Ceat Ltd. | 2.00 | 0.00 | 0.82 | 0.16 | 1.06 | 0.00 | 0.21 | 0.44 | 0.98 | 0.00 |
| 71 | Century Plyboards (India) Ltd. | 2.24 | 0.00 | 0.76 | 0.28 | 0.32 | 0.32 | 0.60 | 0.02 | 0.75 | 0.01 |
| 72 | Century Textiles & Industries Ltd. | 3.04 | 0.00 | 2.06 | 0.00 | 1.42 | 0.00 | 0.71 | 0.01 | 1.22 | 0.00 |
| 73 | Cera Sanitaryware Ltd. | 1.36 | 0.00 | 0.33 | 0.55 | 0.44 | 0.01 | 0.57 | 0.07 | 0.47 | 0.17 |
| 74 | CESC Ltd. | 1.93 | 0.00 | 0.96 | 0.06 | 0.49 | 0.02 | 0.55 | 0.03 | 2.04 | 0.00 |
| 75 | Chambal Fertilisers & Chemicals Ltd. | 1.54 | 0.00 | 1.29 | 0.01 | 0.46 | 0.01 | 0.87 | 0.00 | 1.19 | 0.01 |
| 76 | Chennai Petroleum Corporation Ltd. | 1.64 | 0.03 | 2.06 | 0.00 | 0.85 | 0.00 | 0.27 | 0.17 | 0.25 | 0.22 |
| 77 | Cipla Ltd. | 0.92 | 0.00 | 0.69 | 0.02 | 0.45 | 0.00 | 0.19 | 0.27 | 0.43 | 0.06 |
| 78 | Clariant Chemicals (India) Ltd. | 0.51 | 0.07 | 0.49 | 0.30 | 0.25 | 0.21 | 0.05 | 0.74 | 0.29 | 0.19 |
| 79 | Coal India Ltd. | 0.98 | 0.00 | 0.50 | 0.18 | 0.55 | 0.00 | 0.30 | 0.07 | 0.52 | 0.11 |
| 80 | Colgate-Palmolive (India) Ltd. | 0.57 | 0.02 | 0.54 | 0.07 | 0.37 | 0.01 | 0.02 | 0.90 | 0.47 | 0.04 |
| 81 | Container | 0.45 | 0.25 | 1.21 | 0.00 | 0.36 | 0.02 | 0.30 | 0.08 | 0.20 | 0.46 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| | Corporation Of India Ltd. | | | | | | | | | | |
| 82 | Coromandel International Ltd. | 0.42 | 0.23 | 0.50 | 0.22 | 0.28 | 0.18 | 0.16 | 0.40 | 0.93 | 0.00 |
| 83 | Cox & Kings (India) Ltd. | 2.06 | 0.00 | 1.41 | 0.01 | 0.74 | 0.00 | -0.06 | 0.84 | 1.05 | 0.02 |
| 84 | Cummins India Ltd. | 0.74 | 0.03 | 0.79 | 0.02 | 0.43 | 0.01 | 0.22 | 0.26 | 1.10 | 0.00 |
| 85 | Cyient Ltd. | 0.53 | 0.16 | -0.29 | 0.44 | 0.21 | 0.33 | -0.10 | 0.62 | 0.77 | 0.02 |
| 86 | Dabur India Ltd. | 1.18 | 0.00 | 0.70 | 0.02 | 0.59 | 0.00 | 0.27 | 0.11 | -0.27 | 0.25 |
| 87 | Dalmia Bharat Ltd. | 1.83 | 0.00 | 1.58 | 0.00 | 0.52 | 0.10 | 0.09 | 0.82 | 0.83 | 0.03 |
| 88 | DB Corp Ltd. | 0.60 | 0.01 | 0.11 | 0.73 | 0.38 | 0.03 | 0.10 | 0.61 | -0.17 | 0.47 |
| 89 | DB Realty Ltd. | 2.18 | 0.00 | 2.15 | 0.01 | 0.52 | 0.04 | -0.18 | 0.70 | 1.63 | 0.01 |
| 90 | DCM Shriram Ltd. | 1.61 | 0.00 | 0.41 | 0.54 | 0.34 | 0.18 | -0.16 | 0.65 | 0.38 | 0.23 |
| 91 | Deepak Fertilisers & Petrochemicals Corporation Ltd. | 0.98 | 0.00 | 0.74 | 0.08 | 0.29 | 0.08 | 0.22 | 0.22 | 0.31 | 0.30 |
| 92 | Delta Corp Ltd. | 2.94 | 0.00 | 1.67 | 0.00 | 1.15 | 0.00 | 0.62 | 0.09 | 2.09 | 0.00 |
| 93 | Den Networks Ltd. | 2.77 | 0.00 | 0.68 | 0.28 | 0.79 | 0.00 | 0.80 | 0.01 | 2.17 | 0.00 |
| 94 | Dish TV India Ltd. | 2.38 | 0.00 | 1.54 | 0.00 | 0.48 | 0.02 | 0.74 | 0.00 | 1.38 | 0.00 |
| 95 | Dishman Pharmaceuticals & Chemicals Ltd. | 2.51 | 0.00 | 1.26 | 0.05 | 1.45 | 0.00 | 0.02 | 0.96 | 0.91 | 0.02 |
| 96 | Divis Laboratories Ltd. | 0.55 | 0.07 | 0.21 | 0.46 | 0.38 | 0.02 | 0.11 | 0.58 | 0.66 | 0.00 |
| 97 | DLF Ltd. | 3.43 | 0.00 | 1.78 | 0.02 | 1.03 | 0.00 | 1.96 | 0.00 | 1.69 | 0.00 |
| 98 | Dr. Reddys Laboratories Ltd. | 0.69 | 0.06 | 0.24 | 0.44 | 0.48 | 0.00 | 0.10 | 0.47 | 0.35 | 0.09 |
| 99 | Dredging Corporation Of India Ltd. | 2.07 | 0.00 | 1.38 | 0.04 | 0.72 | 0.01 | 0.04 | 0.87 | 0.57 | 0.14 |
| 100 | Dynamatic Technologies Ltd. | 1.60 | 0.00 | 1.12 | 0.13 | 0.18 | 0.74 | 0.02 | 0.96 | 1.36 | 0.00 |
| 101 | E.I.D. Parry (India) Ltd. | 1.22 | 0.01 | 1.00 | 0.01 | 0.42 | 0.04 | 0.14 | 0.52 | 0.59 | 0.02 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 102 | eClerx Services Ltd. | 0.60 | 0.08 | -0.19 | 0.64 | -0.13 | 0.53 | 0.37 | 0.15 | 0.64 | 0.01 |
| 103 | Eicher Motors Ltd. | 1.81 | 0.00 | 0.26 | 0.52 | 0.24 | 0.23 | -0.05 | 0.83 | 0.29 | 0.29 |
| 104 | EIH Ltd. | 0.75 | 0.02 | 0.50 | 0.20 | 0.53 | 0.00 | 0.33 | 0.03 | 0.17 | 0.48 |
| 105 | Electrosteel Castings Ltd. | 2.33 | 0.00 | 0.98 | 0.16 | 0.80 | 0.00 | 0.49 | 0.14 | 0.48 | 0.22 |
| 106 | Elgi Equipments Ltd. | 0.29 | 0.44 | 0.78 | 0.07 | 0.09 | 0.58 | 0.70 | 0.00 | 0.25 | 0.38 |
| 107 | Emami Ltd. | 1.24 | 0.00 | 0.73 | 0.06 | 0.52 | 0.01 | 0.10 | 0.58 | 0.35 | 0.17 |
| 108 | Engineers India Ltd. | 2.51 | 0.00 | 1.79 | 0.00 | 0.64 | 0.00 | 0.14 | 0.43 | 0.43 | 0.15 |
| 109 | Eros International Media Ltd. | 2.03 | 0.01 | 0.93 | 0.10 | 0.48 | 0.03 | -0.18 | 0.50 | 0.22 | 0.59 |
| 110 | Escorts Ltd. | 2.86 | 0.00 | 1.43 | 0.01 | 0.99 | 0.00 | 0.50 | 0.03 | 1.18 | 0.01 |
| 111 | Ess Dee Aluminium Ltd. | 2.99 | 0.00 | 0.68 | 0.32 | 0.40 | 0.18 | 0.36 | 0.41 | 1.02 | 0.02 |
| 112 | Essel Propack Ltd. | 2.09 | 0.00 | 0.86 | 0.10 | 0.58 | 0.02 | -0.28 | 0.38 | 1.07 | 0.00 |
| 113 | Eveready Industries (India) Ltd. | 2.87 | 0.00 | 1.09 | 0.04 | 0.59 | 0.02 | 0.57 | 0.08 | 0.75 | 0.04 |
| 114 | Exide Industries Ltd. | 1.37 | 0.00 | 1.29 | 0.00 | 0.83 | 0.00 | 0.03 | 0.89 | 0.88 | 0.01 |
| 115 | FAG Bearings India Ltd. | 0.70 | 0.01 | 0.58 | 0.09 | 0.51 | 0.00 | 0.23 | 0.21 | 0.22 | 0.48 |
| 116 | FDC Ltd. | 1.22 | 0.01 | 0.12 | 0.76 | 0.33 | 0.08 | -0.17 | 0.36 | 0.16 | 0.55 |
| 117 | Finolex Cables Ltd. | 1.39 | 0.00 | 0.92 | 0.08 | 0.48 | 0.04 | -0.10 | 0.75 | 1.07 | 0.00 |
| 118 | Finolex Industries Ltd. | 0.92 | 0.01 | 1.26 | 0.01 | -0.11 | 0.66 | 0.43 | 0.15 | 1.24 | 0.00 |
| 119 | Firstsource Solutions Ltd. | 2.66 | 0.00 | 0.37 | 0.52 | 0.75 | 0.02 | 1.21 | 0.00 | 1.38 | 0.02 |
| 120 | Fortis Healthcare Ltd. | 1.95 | 0.00 | 0.66 | 0.13 | 0.24 | 0.08 | 0.62 | 0.00 | 1.19 | 0.00 |
| 121 | GAIL (India) Ltd. | 1.62 | 0.00 | 0.73 | 0.04 | 0.47 | 0.00 | 0.94 | 0.00 | 0.73 | 0.00 |
| 122 | Gateway Distriparks Ltd. | 1.31 | 0.00 | 1.04 | 0.04 | 0.28 | 0.14 | 0.30 | 0.13 | 0.53 | 0.04 |
| 123 | GATI Ltd. | 2.69 | 0.00 | 1.46 | 0.04 | 0.52 | 0.09 | -0.14 | 0.63 | 1.23 | 0.09 |
| 124 | GE Power India Ltd. | 0.99 | 0.00 | 1.31 | 0.00 | 0.47 | 0.01 | 0.55 | 0.01 | 1.25 | 0.00 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 125 | GE T&D India Ltd. | 0.82 | 0.02 | 1.06 | 0.02 | 0.70 | 0.01 | 0.29 | 0.20 | 1.00 | 0.02 |
| 126 | Gillette India Ltd. | 1.00 | 0.00 | 0.43 | 0.25 | 0.30 | 0.06 | 0.12 | 0.45 | 0.50 | 0.04 |
| 127 | Glaxosmithkline Consumer Healthcare Ltd. | 0.86 | 0.00 | 0.42 | 0.13 | 0.75 | 0.00 | -0.18 | 0.41 | 0.24 | 0.25 |
| 128 | Glaxosmithkline Pharmaceuticals Ltd. | 0.71 | 0.00 | 1.16 | 0.00 | 0.29 | 0.13 | 0.06 | 0.62 | 0.62 | 0.00 |
| 129 | Glenmark Pharmaceuticals Ltd. | 1.40 | 0.00 | 0.01 | 0.99 | 0.57 | 0.00 | -0.28 | 0.26 | 0.34 | 0.28 |
| 130 | Global Offshore Services Ltd. | 0.66 | 0.37 | 0.74 | 0.25 | 0.02 | 0.96 | 1.23 | 0.00 | 0.85 | 0.10 |
| 131 | GMR Infrastructure Ltd. | 3.57 | 0.00 | 2.04 | 0.00 | 0.82 | 0.00 | 1.52 | 0.00 | 1.14 | 0.01 |
| 132 | Godfrey Phillips India Ltd. | 2.55 | 0.00 | 1.21 | 0.00 | -0.03 | 0.89 | 0.24 | 0.30 | 1.05 | 0.01 |
| 133 | Godrej Consumer Products Ltd. | 0.60 | 0.12 | 1.84 | 0.00 | 0.52 | 0.01 | -0.11 | 0.61 | 0.37 | 0.11 |
| 134 | Godrej Industries Ltd. | 2.12 | 0.00 | 1.43 | 0.00 | 0.65 | 0.00 | 0.34 | 0.13 | 1.14 | 0.00 |
| 135 | Godrej Properties Ltd. | 1.64 | 0.00 | 1.31 | 0.00 | 0.66 | 0.00 | -0.16 | 0.33 | 0.93 | 0.00 |
| 136 | Granules India Ltd. | 3.06 | 0.00 | 0.41 | 0.49 | 0.59 | 0.04 | 0.15 | 0.71 | 0.55 | 0.10 |
| 137 | Grasim Industries Ltd. | 0.88 | 0.00 | 0.87 | 0.01 | 0.71 | 0.00 | 0.73 | 0.00 | 0.78 | 0.00 |
| 138 | Greaves Cotton Ltd. | 0.33 | 0.36 | 0.84 | 0.06 | 0.43 | 0.02 | 0.13 | 0.57 | 0.70 | 0.03 |
| 139 | Greenply Industries Ltd. | 1.14 | 0.00 | 1.43 | 0.03 | 0.51 | 0.02 | 0.11 | 0.70 | 0.65 | 0.09 |
| 140 | Grindwell Norton Ltd. | 1.02 | 0.00 | 0.66 | 0.11 | -0.18 | 0.24 | 0.27 | 0.11 | 0.77 | 0.00 |
| 141 | Gujarat Fluorochemicals Ltd. | 1.07 | 0.01 | 0.49 | 0.21 | 0.85 | 0.00 | 0.67 | 0.01 | 0.89 | 0.03 |
| 142 | Gujarat Mineral Development Corporation Ltd. | 1.53 | 0.00 | 0.45 | 0.25 | 0.78 | 0.00 | 0.26 | 0.17 | 0.84 | 0.01 |
| 143 | Gujarat Pipavav Port Ltd. | 1.52 | 0.00 | 1.30 | 0.03 | -0.07 | 0.75 | -0.06 | 0.78 | 0.46 | 0.14 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 144 | Gujarat State Fertilizers & Chemicals Ltd. | 1.80 | 0.00 | 1.52 | 0.02 | 0.59 | 0.00 | 0.37 | 0.11 | 0.91 | 0.00 |
| 145 | Gujarat State Petronet Ltd. | 1.12 | 0.00 | 0.11 | 0.82 | 0.47 | 0.01 | 0.59 | 0.01 | 0.96 | 0.00 |
| 146 | GVK Power & Infrastructure Ltd. | 2.29 | 0.00 | 2.50 | 0.00 | 1.20 | 0.00 | 1.48 | 0.00 | 1.57 | 0.00 |
| 147 | Hathway Cable & Datacom Ltd. | 1.64 | 0.00 | 0.14 | 0.78 | 0.39 | 0.03 | 0.59 | 0.07 | 1.39 | 0.01 |
| 148 | Havells India Ltd. | 1.01 | 0.00 | 1.40 | 0.00 | 0.84 | 0.00 | 0.39 | 0.07 | 0.68 | 0.04 |
| 149 | HCL Infosystems Ltd. | 3.76 | 0.00 | 1.74 | 0.05 | 0.85 | 0.00 | 0.37 | 0.24 | 0.69 | 0.03 |
| 150 | HCL Technologies Ltd. | 0.37 | 0.26 | 0.08 | 0.83 | 0.22 | 0.23 | 0.28 | 0.13 | 0.99 | 0.00 |
| 151 | Heidelberg Cement India Ltd. | 1.44 | 0.00 | 1.48 | 0.01 | 0.72 | 0.01 | 0.85 | 0.00 | 0.66 | 0.06 |
| 152 | Hero MotoCorp Ltd. | 1.12 | 0.00 | 0.68 | 0.03 | 0.67 | 0.00 | 0.15 | 0.42 | 0.42 | 0.19 |
| 153 | Hexaware Technologies Ltd. | 2.37 | 0.00 | 0.73 | 0.13 | 0.09 | 0.68 | -0.12 | 0.67 | 1.19 | 0.01 |
| 154 | Himachal Futuristic Communications Ltd. | 3.53 | 0.00 | 2.75 | 0.00 | 0.67 | 0.01 | 0.80 | 0.02 | 1.32 | 0.02 |
| 155 | Himatsingka Seide Ltd. | 2.34 | 0.00 | 0.64 | 0.24 | 0.53 | 0.02 | 0.61 | 0.00 | 0.43 | 0.24 |
| 156 | Hindalco Industries Ltd. | 1.91 | 0.00 | 1.13 | 0.02 | 0.86 | 0.00 | 1.12 | 0.00 | 1.74 | 0.00 |
| 157 | Hindustan Construction Company Ltd. | 3.06 | 0.00 | 2.78 | 0.00 | 0.69 | 0.03 | 1.36 | 0.00 | 1.47 | 0.00 |
| 158 | Hindustan Copper Ltd. | 1.91 | 0.00 | 1.56 | 0.00 | 0.95 | 0.00 | 0.16 | 0.62 | 1.03 | 0.03 |
| 159 | Hindustan Media Ventures Ltd. | 1.06 | 0.00 | 1.01 | 0.02 | 0.24 | 0.23 | 0.23 | 0.35 | 0.34 | 0.28 |
| 160 | Hindustan Petroleum Corporation Ltd. | 1.78 | 0.00 | 1.44 | 0.00 | 1.20 | 0.00 | 0.49 | 0.03 | 0.42 | 0.19 |
| 161 | Hindustan Unilever Ltd. | 0.74 | 0.00 | 0.38 | 0.21 | 0.53 | 0.00 | -0.08 | 0.66 | 0.23 | 0.35 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 162 | Hindustan Zinc Ltd. | 0.93 | 0.01 | 0.69 | 0.06 | 0.58 | 0.00 | 0.40 | 0.05 | 1.06 | 0.00 |
| 163 | HMT Ltd. | 3.70 | 0.00 | 1.41 | 0.11 | 0.94 | 0.00 | 0.45 | 0.14 | 1.31 | 0.01 |
| 164 | Honeywell Automation India Ltd. | 0.94 | 0.00 | 0.33 | 0.39 | 0.58 | 0.00 | 0.03 | 0.93 | 0.71 | 0.04 |
| 165 | Hotel Leela Venture Ltd. | 1.74 | 0.00 | 2.02 | 0.00 | 0.34 | 0.13 | 0.22 | 0.35 | 0.81 | 0.06 |
| 166 | HSIL Ltd. | 1.46 | 0.00 | 0.77 | 0.15 | 0.39 | 0.09 | 0.27 | 0.40 | 1.17 | 0.00 |
| 167 | HT Media Ltd. | 0.87 | 0.01 | 0.49 | 0.27 | 0.31 | 0.11 | 0.44 | 0.05 | 0.34 | 0.27 |
| 168 | Idea Cellular Ltd. | 1.08 | 0.00 | 1.16 | 0.01 | 1.17 | 0.00 | 0.89 | 0.00 | 0.31 | 0.36 |
| 169 | IFB Industries Ltd. | 2.61 | 0.00 | 1.78 | 0.02 | 0.46 | 0.14 | 0.39 | 0.27 | 0.98 | 0.07 |
| 170 | Igarashi Motors India Ltd. | 2.69 | 0.00 | 1.33 | 0.04 | 0.60 | 0.11 | -0.29 | 0.46 | 1.41 | 0.00 |
| 171 | IL&FS Transportation Networks Ltd. | 1.46 | 0.00 | 1.11 | 0.04 | 0.40 | 0.08 | 0.75 | 0.00 | 0.69 | 0.05 |
| 172 | Indiabulls Real Estate Ltd. | 3.65 | 0.00 | 2.58 | 0.00 | 0.87 | 0.00 | 1.47 | 0.00 | 2.16 | 0.00 |
| 173 | Indian Oil Corporation Ltd. | 1.26 | 0.00 | 1.21 | 0.00 | 0.87 | 0.00 | 0.55 | 0.01 | 0.60 | 0.01 |
| 174 | Indo Count Industries Ltd. | 2.78 | 0.00 | 1.36 | 0.12 | 0.05 | 0.89 | -0.04 | 0.95 | 0.39 | 0.53 |
| 175 | Indoco Remedies Ltd. | 1.18 | 0.00 | 1.08 | 0.05 | 0.40 | 0.19 | -0.33 | 0.20 | 0.41 | 0.17 |
| 176 | Indraprastha Gas Ltd. | 1.53 | 0.00 | 1.05 | 0.00 | 0.42 | 0.01 | 1.38 | 0.00 | 0.63 | 0.02 |
| 177 | INEOS Styrolution India Ltd. | 2.26 | 0.00 | 0.84 | 0.02 | 0.61 | 0.00 | 0.07 | 0.75 | 0.06 | 0.85 |
| 178 | Info Edge (India) Ltd. | 0.78 | 0.04 | 0.61 | 0.17 | 0.43 | 0.06 | 0.11 | 0.56 | 0.07 | 0.76 |
| 179 | Infosys Ltd. | 0.81 | 0.01 | 0.28 | 0.37 | 0.03 | 0.90 | 0.11 | 0.65 | 0.35 | 0.21 |
| 180 | Ingersoll-Rand (India) Ltd. | 1.75 | 0.00 | 0.94 | 0.07 | 0.35 | 0.03 | 0.22 | 0.22 | 0.70 | 0.01 |
| 181 | Inox Leisure Ltd. | 1.55 | 0.00 | 0.80 | 0.06 | 0.81 | 0.00 | 0.39 | 0.28 | 1.27 | 0.01 |
| 182 | International Paper APPM Ltd. | 2.42 | 0.00 | 2.32 | 0.00 | 0.52 | 0.05 | -0.33 | 0.43 | 1.27 | 0.01 |

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| 183 | Ipca Laboratories Ltd. | 0.97 | 0.00 | -0.30 | 0.50 | 0.10 | 0.56 | -0.12 | 0.62 | 0.34 | 0.28 |
| 184 | IRB Infrastructure Developers Ltd. | 2.44 | 0.00 | 0.87 | 0.11 | 1.32 | 0.00 | 1.44 | 0.00 | 2.10 | 0.00 |
| 185 | ITC Ltd. | 0.67 | 0.01 | 0.36 | 0.28 | 0.63 | 0.00 | 0.13 | 0.44 | 0.36 | 0.08 |
| 186 | J Kumar Infraproject Ltd. | 1.48 | 0.00 | 0.85 | 0.10 | -0.02 | 0.89 | 0.17 | 0.47 | 0.91 | 0.04 |
| 187 | Jagran Prakashan Ltd. | 1.39 | 0.00 | 0.12 | 0.70 | 0.23 | 0.13 | 0.17 | 0.42 | 0.06 | 0.84 |
| 188 | Jai Corp Ltd. | 3.25 | 0.00 | 2.15 | 0.00 | 1.25 | 0.00 | 1.06 | 0.00 | 2.11 | 0.00 |
| 189 | Jain Irrigation Systems Ltd. | 2.92 | 0.00 | 1.78 | 0.00 | 0.92 | 0.00 | 0.44 | 0.16 | 0.98 | 0.06 |
| 190 | Jaiprakash Associates Ltd. | 4.04 | 0.00 | 2.57 | 0.00 | 1.41 | 0.00 | 1.47 | 0.00 | 1.71 | 0.00 |
| 191 | Jaiprakash Power Ventures Ltd. | 2.50 | 0.00 | 2.78 | 0.00 | 1.04 | 0.02 | 0.76 | 0.02 | 0.88 | 0.02 |
| 192 | Jaypee Infratech Ltd. | 2.78 | 0.00 | 1.54 | 0.04 | 1.08 | 0.00 | 0.85 | 0.01 | 1.21 | 0.02 |
| 193 | JB Chemicals & Pharmaceuticals Ltd. | 1.43 | 0.00 | 0.51 | 0.34 | 0.34 | 0.07 | 0.61 | 0.02 | 0.01 | 0.99 |
| 194 | JBF Industries Ltd. | 1.61 | 0.01 | 0.89 | 0.15 | 0.32 | 0.14 | 0.42 | 0.04 | 0.70 | 0.03 |
| 195 | Jet Airways (India) Ltd. | 3.17 | 0.00 | 1.24 | 0.09 | 0.82 | 0.00 | 0.25 | 0.55 | 1.78 | 0.00 |
| 196 | Jindal Poly Films Ltd. | 3.14 | 0.00 | 0.82 | 0.17 | 0.40 | 0.07 | 0.89 | 0.00 | 0.69 | 0.09 |
| 197 | Jindal Steel & Power Ltd. | 2.13 | 0.00 | 2.38 | 0.00 | 0.76 | 0.00 | 0.96 | 0.00 | 1.14 | 0.00 |
| 198 | JK Cement Ltd. | 1.30 | 0.00 | 0.50 | 0.30 | 0.57 | 0.02 | 0.63 | 0.09 | 0.66 | 0.05 |
| 199 | JK Lakshmi Cement Ltd. | 1.76 | 0.00 | 1.04 | 0.07 | 0.18 | 0.52 | 0.34 | 0.27 | 1.02 | 0.01 |
| 200 | JK Tyre & Industries Ltd. | 2.40 | 0.00 | 2.37 | 0.00 | 0.64 | 0.01 | 0.37 | 0.18 | 1.43 | 0.00 |
| 201 | JMT Auto Ltd. | 0.84 | 0.30 | -1.36 | 0.09 | 0.13 | 0.69 | -0.01 | 0.99 | -0.37 | 0.50 |
| 202 | Johnson Controls - Hitachi Air Conditioning India Ltd. | 1.91 | 0.00 | 0.38 | 0.56 | 0.96 | 0.00 | 0.18 | 0.60 | 1.36 | 0.00 |

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| 203 | JSW Energy Ltd. | 2.98 | 0.00 | 1.07 | 0.04 | 1.40 | 0.00 | 1.07 | 0.00 | 1.70 | 0.00 |
| 204 | JSW Steel Ltd. | 1.67 | 0.00 | 1.13 | 0.00 | 0.90 | 0.00 | 1.03 | 0.00 | 2.09 | 0.00 |
| 205 | Jubilant FoodWorks Ltd. | 1.82 | 0.00 | 1.08 | 0.01 | 0.28 | 0.16 | 0.40 | 0.14 | 1.18 | 0.03 |
| 206 | Jubilant Life Sciences Ltd. | 2.91 | 0.00 | 1.19 | 0.03 | 1.04 | 0.00 | 0.20 | 0.51 | 1.10 | 0.00 |
| 207 | Jyothy Laboratories Ltd. | 1.39 | 0.00 | 1.15 | 0.01 | 0.50 | 0.02 | -0.01 | 0.98 | 0.20 | 0.61 |
| 208 | Kajaria Ceramics Ltd. | 1.25 | 0.00 | 0.72 | 0.06 | 0.58 | 0.00 | 0.51 | 0.01 | 0.86 | 0.01 |
| 209 | Kalpataru Power Transmission Ltd. | 1.66 | 0.00 | 1.40 | 0.01 | 0.36 | 0.16 | 0.90 | 0.00 | 1.19 | 0.00 |
| 210 | Kansai Nerolac Paints Ltd. | 1.82 | 0.00 | 0.99 | 0.00 | 0.21 | 0.18 | 0.27 | 0.14 | 0.05 | 0.79 |
| 211 | Kaveri Seed Company Ltd. | 2.45 | 0.00 | 0.58 | 0.27 | 0.54 | 0.02 | -0.02 | 0.94 | 0.63 | 0.06 |
| 212 | KEC International Ltd. | 1.93 | 0.00 | 0.99 | 0.05 | 0.79 | 0.01 | 0.74 | 0.02 | 0.81 | 0.03 |
| 213 | Kesoram Industries Ltd. | 3.12 | 0.00 | 1.92 | 0.00 | 1.06 | 0.00 | 0.14 | 0.64 | 1.83 | 0.00 |
| 214 | Kirloskar Oil Engines Ltd. | 0.19 | 0.60 | 0.43 | 0.33 | 0.04 | 0.86 | -0.09 | 0.69 | 0.88 | 0.02 |
| 215 | Kolte Patil Developers Ltd. | 2.29 | 0.00 | 1.78 | 0.00 | 1.04 | 0.00 | 0.58 | 0.15 | 1.25 | 0.00 |
| 216 | KPIT Technologies Ltd. | 3.22 | 0.00 | 0.50 | 0.32 | 0.59 | 0.01 | 0.84 | 0.01 | 0.27 | 0.46 |
| 217 | KPR Mill Ltd. | 2.15 | 0.00 | 1.56 | 0.00 | 0.45 | 0.05 | 0.77 | 0.00 | 0.47 | 0.23 |
| 218 | KRBL Ltd. | 1.31 | 0.01 | 0.23 | 0.67 | 0.30 | 0.13 | 0.72 | 0.01 | 1.18 | 0.02 |
| 219 | KSK Energy Ventures Ltd. | 2.48 | 0.00 | 1.88 | 0.00 | 0.65 | 0.01 | 0.00 | 0.99 | 1.79 | 0.00 |
| 220 | Kwality Ltd. | 3.29 | 0.00 | 0.54 | 0.38 | 0.21 | 0.50 | 0.17 | 0.72 | -0.28 | 0.69 |
| 221 | La Opala RG Ltd. | 1.84 | 0.00 | 0.79 | 0.17 | 0.48 | 0.04 | 0.42 | 0.33 | 1.71 | 0.00 |
| 222 | Lakshmi Machine Works Ltd. | 1.17 | 0.00 | 1.07 | 0.00 | 0.17 | 0.28 | 0.07 | 0.72 | 0.90 | 0.00 |
| 223 | Lanco Infratech Ltd. | 3.61 | 0.00 | 2.87 | 0.00 | 0.91 | 0.00 | 1.74 | 0.00 | 1.65 | 0.00 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 224 | Larsen & Toubro Ltd. | 1.30 | 0.00 | 1.14 | 0.00 | 1.25 | 0.00 | 0.90 | 0.00 | 1.41 | 0.00 |
| 225 | Lupin Ltd. | 0.57 | 0.13 | 0.26 | 0.33 | 0.52 | 0.00 | -0.10 | 0.56 | 0.54 | 0.03 |
| 226 | Mahanagar Telephone Nigam Ltd. | 2.66 | 0.00 | 1.25 | 0.10 | 0.46 | 0.14 | 0.91 | 0.01 | 1.42 | 0.00 |
| 227 | Mahindra & Mahindra Ltd. | 1.44 | 0.00 | 0.57 | 0.08 | 0.80 | 0.00 | 0.44 | 0.01 | 1.15 | 0.00 |
| 228 | Mahindra CIE Automotive Ltd. | 2.09 | 0.00 | 1.13 | 0.13 | 0.46 | 0.16 | 0.68 | 0.01 | 1.15 | 0.01 |
| 229 | Mahindra Holidays & Resorts India Ltd. | 2.00 | 0.00 | 0.47 | 0.18 | 0.45 | 0.00 | -0.14 | 0.53 | 0.44 | 0.13 |
| 230 | Mahindra Lifespace Developers Ltd. | 1.08 | 0.00 | 0.33 | 0.38 | 0.37 | 0.01 | 0.44 | 0.01 | 0.56 | 0.06 |
| 231 | Mangalore Refinery & Petrochemicals Ltd. | 1.69 | 0.00 | 0.58 | 0.26 | 0.64 | 0.00 | 0.60 | 0.01 | 1.18 | 0.00 |
| 232 | Marico Ltd. | 0.83 | 0.01 | -0.10 | 0.74 | 0.28 | 0.04 | -0.05 | 0.82 | -0.06 | 0.84 |
| 233 | Marksans Pharma Ltd. | 4.23 | 0.00 | 0.98 | 0.24 | 0.61 | 0.11 | 0.59 | 0.16 | 0.56 | 0.35 |
| 234 | Maruti Suzuki India Ltd. | 1.34 | 0.00 | 1.10 | 0.00 | 0.61 | 0.00 | 0.49 | 0.03 | 1.00 | 0.00 |
| 235 | Mcleod Russel India Ltd. | 1.45 | 0.00 | 0.74 | 0.04 | 0.33 | 0.11 | 0.22 | 0.28 | 0.89 | 0.01 |
| 236 | Merck Ltd. | 1.49 | 0.00 | 1.27 | 0.00 | 0.24 | 0.09 | 0.34 | 0.02 | 0.50 | 0.01 |
| 237 | Mindtree Ltd. | 0.40 | 0.30 | -0.17 | 0.63 | 0.13 | 0.49 | 0.39 | 0.08 | 0.56 | 0.06 |
| 238 | MMTC Ltd. | 1.63 | 0.00 | 1.63 | 0.00 | 0.77 | 0.01 | -0.10 | 0.77 | 0.74 | 0.10 |
| 239 | MOIL Ltd. | 0.51 | 0.07 | 0.78 | 0.02 | 0.42 | 0.01 | 0.39 | 0.03 | 0.99 | 0.00 |
| 240 | Monsanto India Ltd. | 1.12 | 0.02 | 1.43 | 0.02 | 0.17 | 0.53 | 0.31 | 0.05 | 0.62 | 0.03 |
| 241 | Motherson Sumi Systems Ltd. | 1.15 | 0.01 | 0.42 | 0.29 | 0.54 | 0.02 | 0.34 | 0.12 | 0.61 | 0.08 |
| 242 | Mphasis Ltd. | 0.71 | 0.06 | 0.47 | 0.17 | 0.02 | 0.91 | 0.08 | 0.70 | 1.44 | 0.00 |
| 243 | MRF Ltd. | 1.74 | 0.00 | 1.20 | 0.00 | 0.50 | 0.00 | 0.60 | 0.00 | 1.01 | 0.00 |
| 244 | Natco Pharma Ltd. | 1.80 | 0.00 | 0.83 | 0.17 | 0.28 | 0.19 | 0.16 | 0.49 | 0.46 | 0.16 |

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| 245 | National Aluminium Company Ltd. | 0.71 | 0.08 | 1.43 | 0.01 | 0.55 | 0.01 | 0.12 | 0.60 | 1.19 | 0.00 |
| 246 | NCC Ltd. | 2.80 | 0.00 | 0.97 | 0.26 | 1.09 | 0.00 | 1.71 | 0.00 | 2.47 | 0.00 |
| 247 | Network 18 Media & Investment Ltd. | 2.54 | 0.00 | 1.31 | 0.04 | 1.16 | 0.00 | 0.65 | 0.10 | 0.32 | 0.53 |
| 248 | NHPC Ltd. | 2.19 | 0.00 | 1.54 | 0.00 | 0.56 | 0.00 | 0.27 | 0.37 | 0.67 | 0.00 |
| 249 | NIIT Technologies Ltd. | 1.90 | 0.00 | 0.54 | 0.25 | 0.29 | 0.10 | -0.07 | 0.79 | 0.66 | 0.08 |
| 250 | Nitin Fire Protection Industries Ltd. | 1.98 | 0.00 | 0.38 | 0.48 | 0.20 | 0.38 | -0.01 | 0.98 | 1.54 | 0.02 |
| 251 | NLC India Ltd. | 1.32 | 0.00 | 1.20 | 0.00 | 0.40 | 0.03 | 0.42 | 0.04 | 1.31 | 0.00 |
| 252 | NMDC Ltd. | 1.20 | 0.00 | 0.93 | 0.01 | 0.67 | 0.00 | 0.87 | 0.00 | 1.05 | 0.00 |
| 253 | NTPC Ltd. | 1.18 | 0.00 | 1.65 | 0.00 | 0.79 | 0.00 | 0.63 | 0.00 | 0.67 | 0.01 |
| 254 | Oberoi Realty Ltd. | 1.47 | 0.00 | 1.61 | 0.00 | 0.82 | 0.00 | 0.23 | 0.34 | 0.59 | 0.05 |
| 255 | Oil & Natural Gas Corporation Ltd. | 1.04 | 0.00 | 1.04 | 0.01 | 1.19 | 0.00 | 0.88 | 0.00 | 0.70 | 0.01 |
| 256 | Oil India Ltd. | 0.65 | 0.02 | 1.06 | 0.00 | 0.87 | 0.00 | 0.28 | 0.12 | 0.73 | 0.00 |
| 257 | Omaxe Ltd. | 0.50 | 0.00 | 0.61 | 0.00 | 0.31 | 0.02 | 0.49 | 0.00 | 0.79 | 0.00 |
| 258 | Oracle Financial Services Software Ltd. | 0.78 | 0.00 | 0.22 | 0.48 | 0.07 | 0.60 | 0.46 | 0.01 | 0.56 | 0.08 |
| 259 | Page Industries Ltd. | 1.71 | 0.00 | 0.75 | 0.06 | -0.02 | 0.92 | 0.15 | 0.49 | -0.11 | 0.77 |
| 260 | Parsvnath Developers Ltd. | 1.09 | 0.06 | 1.47 | 0.02 | 0.29 | 0.13 | 0.10 | 0.77 | 0.69 | 0.16 |
| 261 | Persistent Systems Ltd. | 0.91 | 0.01 | 0.84 | 0.09 | 0.08 | 0.65 | 0.20 | 0.39 | 0.12 | 0.65 |
| 262 | Petronet LNG Ltd. | 1.36 | 0.00 | 0.46 | 0.25 | 0.56 | 0.00 | 0.35 | 0.13 | 0.62 | 0.04 |
| 263 | Pfizer Ltd. | 1.35 | 0.00 | 0.39 | 0.27 | 0.10 | 0.69 | 0.19 | 0.20 | 0.25 | 0.29 |
| 264 | Phoenix Mills Ltd. | 0.85 | 0.02 | 0.38 | 0.36 | 0.25 | 0.12 | 0.40 | 0.10 | 0.91 | 0.00 |
| 265 | Pidilite Industries Ltd. | 0.66 | 0.01 | 0.27 | 0.43 | 0.34 | 0.02 | 0.29 | 0.18 | 0.44 | 0.06 |
| 266 | Piramal Enterprises | 1.10 | 0.00 | 0.38 | 0.32 | 0.69 | 0.00 | 0.19 | 0.36 | 0.24 | 0.34 |

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| | Ltd. | | | | | | | | | | |
| 267 | Polaris Consulting & Services Ltd. | 1.95 | 0.00 | 1.76 | 0.01 | 0.31 | 0.31 | 0.40 | 0.22 | 1.51 | 0.00 |
| 268 | Power Grid Corporation Of India Ltd. | 0.96 | 0.00 | 0.61 | 0.03 | 0.77 | 0.00 | -0.01 | 0.97 | 0.63 | 0.00 |
| 269 | Praj Industries Ltd. | 2.25 | 0.00 | 0.95 | 0.07 | 0.40 | 0.09 | 1.05 | 0.00 | 1.19 | 0.00 |
| 270 | Prestige Estate Projects Ltd. | 1.49 | 0.00 | 0.32 | 0.54 | 1.01 | 0.00 | 0.43 | 0.17 | 1.15 | 0.02 |
| 271 | Prism Cement Ltd. | 2.06 | 0.00 | 1.43 | 0.01 | 0.73 | 0.01 | 0.70 | 0.01 | 0.42 | 0.21 |
| 272 | Procter & Gamble Hygiene & Health Care Ltd. | 0.21 | 0.36 | 0.30 | 0.33 | 0.28 | 0.04 | 0.02 | 0.91 | 0.39 | 0.09 |
| 273 | PTC India Ltd. | 3.08 | 0.00 | 1.94 | 0.00 | 0.60 | 0.01 | 0.83 | 0.00 | 1.44 | 0.00 |
| 274 | Punj Lloyd Ltd. | 2.40 | 0.00 | 1.96 | 0.00 | 1.22 | 0.00 | 1.53 | 0.00 | 1.99 | 0.00 |
| 275 | PVR Ltd. | 0.98 | 0.00 | 0.10 | 0.81 | 0.13 | 0.56 | 0.21 | 0.53 | 0.33 | 0.37 |
| 276 | Radico Khaitan Ltd. | 1.76 | 0.00 | 0.89 | 0.07 | -0.20 | 0.30 | -0.03 | 0.88 | 0.11 | 0.58 |
| 277 | Rain Industries Ltd. | 2.57 | 0.00 | 0.89 | 0.10 | -0.18 | 0.42 | 0.66 | 0.01 | 0.23 | 0.57 |
| 278 | Rajesh Exports Ltd. | 1.76 | 0.00 | 1.33 | 0.05 | 0.53 | 0.03 | 0.04 | 0.87 | 0.50 | 0.17 |
| 279 | Rallis India Ltd. | 1.34 | 0.00 | 1.36 | 0.00 | 0.74 | 0.00 | -0.03 | 0.91 | 1.15 | 0.00 |
| 280 | Ramco Systems Ltd. | 2.41 | 0.00 | 1.64 | 0.01 | 0.87 | 0.01 | 0.43 | 0.23 | 1.14 | 0.02 |
| 281 | Ramkrishna Forgings Ltd. | 2.31 | 0.00 | 1.11 | 0.03 | 0.79 | 0.10 | 0.48 | 0.25 | 0.66 | 0.12 |
| 282 | Rashtriya Chemicals & Fertilizers Ltd. | 1.66 | 0.00 | 1.53 | 0.01 | 0.89 | 0.00 | 0.35 | 0.13 | 1.64 | 0.00 |
| 283 | Ratnamani Metals & Tubes Ltd. | 1.09 | 0.00 | 0.92 | 0.08 | 0.22 | 0.40 | -0.14 | 0.62 | 0.75 | 0.01 |
| 284 | RattanIndia Power Ltd. | 2.32 | 0.00 | 2.42 | 0.00 | 1.00 | 0.00 | 1.03 | 0.01 | 1.81 | 0.00 |
| 285 | Raymond Ltd. | 1.57 | 0.00 | 1.01 | 0.03 | 1.25 | 0.00 | 0.32 | 0.16 | 0.90 | 0.01 |
| 286 | Redington (India) Ltd. | 0.97 | 0.01 | 1.68 | 0.00 | 0.30 | 0.24 | 0.10 | 0.63 | 0.60 | 0.06 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 287 | Reliance Communications Ltd. | 2.92 | 0.00 | 1.43 | 0.00 | 0.84 | 0.00 | 1.46 | 0.00 | 1.77 | 0.00 |
| 288 | Reliance Defence and Engineering Ltd. | 1.08 | 0.02 | 1.22 | 0.10 | 0.21 | 0.26 | -0.16 | 0.59 | 0.34 | 0.40 |
| 289 | Reliance Industrial Infrastructure Ltd. | 2.34 | 0.00 | 1.80 | 0.00 | 0.94 | 0.00 | 0.76 | 0.00 | 1.79 | 0.00 |
| 290 | Reliance Industries Ltd. | 1.50 | 0.00 | 1.11 | 0.00 | 0.81 | 0.00 | 0.62 | 0.00 | 1.04 | 0.00 |
| 291 | Reliance Infrastructure Ltd. | 3.28 | 0.00 | 2.02 | 0.00 | 1.21 | 0.00 | 1.30 | 0.00 | 1.80 | 0.00 |
| 292 | Reliance Power Ltd. | 2.97 | 0.00 | 2.03 | 0.00 | 0.84 | 0.00 | 1.07 | 0.00 | 1.30 | 0.00 |
| 293 | Rolta India Ltd. | 2.99 | 0.00 | 0.94 | 0.12 | 0.28 | 0.20 | 0.41 | 0.10 | 1.50 | 0.00 |
| 294 | Ruchi Soya Industries Ltd. | 1.52 | 0.00 | 0.59 | 0.25 | -0.53 | 0.07 | 0.28 | 0.31 | 0.36 | 0.21 |
| 295 | Sadbhav Engineering Ltd. | 1.21 | 0.01 | 0.49 | 0.38 | 0.11 | 0.62 | 0.87 | 0.00 | 0.60 | 0.07 |
| 296 | Sanofi India Ltd. | 0.88 | 0.00 | -0.15 | 0.69 | 0.11 | 0.49 | 0.43 | 0.01 | -0.48 | 0.02 |
| 297 | Shilpa Medicare Ltd. | 1.95 | 0.00 | 0.78 | 0.14 | 0.32 | 0.36 | -0.18 | 0.47 | 1.98 | 0.00 |
| 298 | Shipping Corporation Of India Ltd. | 2.92 | 0.00 | 1.19 | 0.03 | 1.12 | 0.00 | 0.79 | 0.00 | 1.61 | 0.00 |
| 299 | Shoppers Stop Ltd. | 1.72 | 0.00 | 0.30 | 0.45 | 0.36 | 0.04 | 0.27 | 0.28 | 0.81 | 0.07 |
| 300 | Shree Cement Ltd. | 1.14 | 0.00 | 0.55 | 0.06 | 0.67 | 0.00 | 0.26 | 0.23 | -0.11 | 0.66 |
| 301 | Shree Renuka Sugars Ltd. | 2.16 | 0.00 | 0.89 | 0.07 | 0.57 | 0.05 | 1.14 | 0.00 | 2.14 | 0.00 |
| 302 | Siemens Ltd. | 2.14 | 0.00 | 1.85 | 0.00 | 1.03 | 0.00 | 0.90 | 0.00 | 0.94 | 0.00 |
| 303 | Simplex Infrastructures Ltd. | 0.91 | 0.02 | 1.63 | 0.03 | 1.19 | 0.00 | 0.45 | 0.11 | 0.72 | 0.05 |
| 304 | Sintex Industries Ltd. | 2.63 | 0.00 | 3.42 | 0.00 | 1.06 | 0.00 | 1.40 | 0.00 | 1.39 | 0.01 |
| 305 | Siti Networks Ltd. | 0.72 | 0.01 | 0.49 | 0.20 | 1.13 | 0.00 | 0.31 | 0.46 | 1.39 | 0.00 |
| 306 | SJVN Ltd. | 0.86 | 0.00 | 1.28 | 0.00 | -0.11 | 0.38 | 0.25 | 0.12 | -0.15 | 0.32 |
| 307 | SKF India Ltd. | 0.35 | 0.17 | 0.59 | 0.10 | 0.46 | 0.00 | 0.15 | 0.30 | 0.33 | 0.14 |
| 308 | SML Isuzu Ltd. | 2.76 | 0.00 | 0.55 | 0.43 | 0.44 | 0.08 | 0.22 | 0.37 | 0.49 | 0.20 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 309 | Sobha Ltd. | 1.68 | 0.00 | 0.80 | 0.11 | 0.71 | 0.00 | 0.56 | 0.04 | 1.33 | 0.00 |
| 310 | Solar Industries (India) Ltd. | 0.98 | 0.00 | 1.09 | 0.02 | 0.27 | 0.09 | -0.21 | 0.23 | 0.33 | 0.10 |
| 311 | Somany Ceramics Ltd. | 1.55 | 0.00 | 0.19 | 0.72 | 0.25 | 0.41 | 0.23 | 0.55 | 1.21 | 0.01 |
| 312 | Sonata Software Ltd. | 1.43 | 0.00 | 0.88 | 0.14 | 0.61 | 0.02 | -0.03 | 0.92 | 1.07 | 0.01 |
| 313 | SRF Ltd. | 2.64 | 0.00 | 0.70 | 0.18 | 0.17 | 0.50 | 0.34 | 0.12 | 0.26 | 0.35 |
| 314 | State Trading Corporation Of India Ltd. | 2.28 | 0.00 | 1.47 | 0.00 | 0.60 | 0.12 | -0.12 | 0.72 | 1.30 | 0.01 |
| 315 | Steel Authority Of India Ltd. | 2.25 | 0.00 | 0.76 | 0.09 | 0.63 | 0.00 | 0.59 | 0.01 | 1.59 | 0.00 |
| 316 | Strides Shasun Ltd. | 2.49 | 0.00 | 1.75 | 0.00 | -0.38 | 0.51 | 0.14 | 0.65 | -0.27 | 0.48 |
| 317 | Sun Pharma Advanced Research Company Ltd. | 1.78 | 0.00 | 2.12 | 0.00 | 0.89 | 0.00 | 0.62 | 0.07 | 0.85 | 0.03 |
| 318 | Sun Pharmaceutical Industries Ltd. | 0.44 | 0.26 | 0.16 | 0.63 | 0.56 | 0.00 | 0.22 | 0.14 | 0.13 | 0.60 |
| 319 | Sun TV Network Ltd. | 2.06 | 0.00 | 1.01 | 0.04 | 0.53 | 0.02 | 1.26 | 0.00 | 0.97 | 0.08 |
| 320 | Sundram Fasteners Ltd. | 1.24 | 0.00 | 1.50 | 0.00 | 0.58 | 0.01 | 0.35 | 0.11 | 0.87 | 0.00 |
| 321 | Sunteck Realty Ltd. | 1.11 | 0.01 | 0.33 | 0.40 | 0.08 | 0.64 | 0.16 | 0.31 | -0.36 | 0.49 |
| 322 | Supreme Industries Ltd. | 1.34 | 0.00 | 1.08 | 0.00 | 0.24 | 0.16 | -0.11 | 0.48 | 0.60 | 0.01 |
| 323 | Suven Life Sciences Ltd. | 2.34 | 0.00 | 1.38 | 0.05 | 0.11 | 0.73 | 0.33 | 0.42 | 0.61 | 0.12 |
| 324 | Suzlon Energy Ltd. | 2.26 | 0.00 | 1.09 | 0.24 | 0.89 | 0.00 | 1.51 | 0.00 | 1.78 | 0.00 |
| 325 | Take Solutions Ltd. | 4.51 | 0.00 | 1.73 | 0.03 | 0.28 | 0.24 | -0.34 | 0.32 | 0.57 | 0.16 |
| 326 | Tamil Nadu Newsprint & Papers Ltd. | 2.13 | 0.00 | 0.92 | 0.00 | 0.15 | 0.28 | -0.04 | 0.82 | 0.58 | 0.02 |
| 327 | Tata Chemicals Ltd. | 1.80 | 0.00 | 0.85 | 0.01 | 0.49 | 0.00 | 0.40 | 0.01 | 0.46 | 0.04 |
| 328 | Tata Coffee Ltd. | 1.51 | 0.00 | 0.75 | 0.01 | 0.54 | 0.01 | 0.51 | 0.04 | 0.69 | 0.05 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 329 | Tata Communications Ltd. | 2.12 | 0.00 | 1.20 | 0.00 | 0.41 | 0.07 | 0.65 | 0.00 | 1.09 | 0.00 |
| 330 | Tata Consultancy Services Ltd. | 0.68 | 0.00 | 0.23 | 0.44 | 0.09 | 0.57 | -0.21 | 0.29 | 0.48 | 0.10 |
| 331 | Tata Elxsi Ltd. | 3.04 | 0.00 | 1.34 | 0.02 | 0.59 | 0.04 | 0.63 | 0.00 | 1.05 | 0.00 |
| 332 | Tata Global Beverages Ltd. | 2.46 | 0.00 | 1.37 | 0.00 | 0.48 | 0.01 | 0.34 | 0.16 | 1.59 | 0.00 |
| 333 | Tata Motors Ltd. | 1.61 | 0.00 | 1.36 | 0.00 | 1.19 | 0.00 | 0.61 | 0.04 | 1.86 | 0.00 |
| 334 | Tata Power Company Ltd. | 1.59 | 0.00 | 1.47 | 0.00 | 0.51 | 0.02 | 0.61 | 0.00 | 1.09 | 0.00 |
| 335 | Tata Sponge Iron Ltd. | 2.63 | 0.00 | 1.75 | 0.01 | 0.18 | 0.43 | -0.02 | 0.93 | 1.07 | 0.00 |
| 336 | Tata Steel Ltd. | 2.41 | 0.00 | 0.75 | 0.04 | 0.53 | 0.02 | 0.77 | 0.00 | 1.72 | 0.00 |
| 337 | Tata Teleservices (Maharashtra) Ltd. | 1.34 | 0.01 | 1.70 | 0.01 | 0.06 | 0.87 | 0.79 | 0.00 | 1.38 | 0.00 |
| 338 | Tech Mahindra Ltd. | 0.91 | 0.01 | 0.68 | 0.01 | 0.25 | 0.16 | 0.37 | 0.08 | 0.63 | 0.05 |
| 339 | Techno Electric & Engineering Company Ltd. | 1.14 | 0.00 | 0.18 | 0.76 | 0.65 | 0.02 | 0.61 | 0.02 | 0.69 | 0.05 |
| 340 | Texmaco Rail & Engineering Ltd. | 2.64 | 0.00 | 1.43 | 0.08 | 0.47 | 0.09 | 0.56 | 0.03 | 0.57 | 0.14 |
| 341 | The Great Eastern Shipping Company Ltd. | 1.18 | 0.00 | 0.55 | 0.14 | 0.16 | 0.32 | 0.09 | 0.64 | 0.54 | 0.10 |
| 342 | The India Cements Ltd. | 3.28 | 0.00 | 2.25 | 0.00 | 0.66 | 0.01 | 0.95 | 0.00 | 1.14 | 0.01 |
| 343 | The Indian Hotels Company Ltd. | 0.67 | 0.05 | 0.73 | 0.08 | 0.66 | 0.00 | 0.68 | 0.00 | 0.77 | 0.01 |
| 344 | The Ramco Cements Ltd. | 1.16 | 0.00 | 0.82 | 0.05 | 0.64 | 0.00 | 0.50 | 0.02 | 0.45 | 0.16 |
| 345 | Thermax Ltd. | 0.76 | 0.02 | 0.79 | 0.06 | 0.32 | 0.04 | 0.59 | 0.00 | 0.75 | 0.02 |
| 346 | Thomas Cook (India) Ltd. | 1.30 | 0.00 | 0.19 | 0.71 | 0.55 | 0.02 | -0.05 | 0.85 | 1.03 | 0.02 |
| 347 | Tide Water Oil Company (India) Ltd. | 1.10 | 0.03 | 0.68 | 0.13 | 0.28 | 0.01 | 0.20 | 0.13 | 1.19 | 0.00 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 348 | Timken India Ltd. | 1.60 | 0.00 | 0.87 | 0.10 | 0.18 | 0.36 | -0.18 | 0.55 | 1.35 | 0.00 |
| 349 | Titan Company Ltd. | 0.40 | 0.22 | 1.45 | 0.00 | 0.92 | 0.00 | 0.48 | 0.05 | 1.41 | 0.00 |
| 350 | Torrent Pharmaceuticals Ltd. | 1.16 | 0.00 | 0.90 | 0.02 | 0.26 | 0.17 | 0.19 | 0.25 | 0.23 | 0.27 |
| 351 | Torrent Power Ltd. | 2.52 | 0.00 | 1.57 | 0.01 | 0.41 | 0.13 | 0.34 | 0.16 | 0.95 | 0.00 |
| 352 | Trent Ltd. | 1.74 | 0.00 | 0.56 | 0.10 | 0.26 | 0.11 | 0.16 | 0.41 | 0.92 | 0.00 |
| 353 | Trident Ltd. | 3.98 | 0.00 | 1.12 | 0.11 | 0.41 | 0.23 | 0.44 | 0.07 | 1.32 | 0.00 |
| 354 | TTK Prestige Ltd. | 0.01 | 0.97 | 1.47 | 0.00 | 0.67 | 0.00 | -0.01 | 0.97 | 0.00 | 1.00 |
| 355 | Tube Investments Of India Ltd. | 0.76 | 0.02 | 0.45 | 0.29 | 0.27 | 0.21 | 0.32 | 0.22 | 0.91 | 0.00 |
| 356 | TV Today Network Ltd. | 2.43 | 0.00 | 1.05 | 0.11 | 0.85 | 0.02 | 0.04 | 0.91 | 0.78 | 0.05 |
| 357 | TV18 Broadcast Ltd. | 2.80 | 0.00 | 1.88 | 0.00 | 1.24 | 0.00 | 1.04 | 0.03 | 1.33 | 0.01 |
| 358 | TVS Motor Company Ltd. | 1.48 | 0.00 | 1.22 | 0.02 | 0.73 | 0.01 | 0.25 | 0.37 | 1.04 | 0.00 |
| 359 | TVS Srichakra Ltd. | 1.53 | 0.00 | 0.88 | 0.17 | 0.54 | 0.02 | 0.12 | 0.61 | 0.19 | 0.57 |
| 360 | Uflex Ltd. | 3.50 | 0.00 | 2.01 | 0.00 | 0.71 | 0.00 | 0.38 | 0.18 | 0.74 | 0.17 |
| 361 | Ultratech Cement Ltd. | 1.23 | 0.00 | 0.75 | 0.03 | 0.90 | 0.00 | 0.57 | 0.00 | 0.64 | 0.01 |
| 362 | Unichem Laboratories Ltd. | 1.59 | 0.00 | 0.37 | 0.39 | 0.42 | 0.03 | 0.09 | 0.71 | 0.46 | 0.27 |
| 363 | Unitech Ltd. | 3.38 | 0.00 | 3.15 | 0.00 | 1.01 | 0.00 | 1.56 | 0.00 | 1.96 | 0.00 |
| 364 | United Breweries Ltd. | 1.26 | 0.00 | 2.00 | 0.00 | 0.95 | 0.00 | 0.02 | 0.97 | 1.09 | 0.02 |
| 365 | United Spirits Ltd. | 1.32 | 0.00 | 0.69 | 0.08 | 0.66 | 0.00 | 1.03 | 0.02 | 1.03 | 0.02 |
| 366 | UPL Ltd. | 1.43 | 0.00 | 1.44 | 0.00 | 0.12 | 0.55 | 0.37 | 0.13 | 1.03 | 0.00 |
| 367 | VA Tech Wabag Ltd. | 1.28 | 0.00 | 1.38 | 0.00 | 0.61 | 0.00 | -0.04 | 0.86 | 0.64 | 0.05 |
| 368 | Vaibhav Global Ltd. | 0.22 | 0.68 | 0.36 | 0.46 | -0.03 | 0.91 | 0.60 | 0.21 | 0.95 | 0.08 |
| 369 | Vakrangee Ltd. | 3.63 | 0.00 | 0.84 | 0.05 | 0.17 | 0.50 | 0.50 | 0.05 | -0.08 | 0.82 |
| 370 | Vardhman Textiles Ltd. | 1.37 | 0.00 | 0.82 | 0.05 | 0.37 | 0.03 | 0.18 | 0.45 | 0.26 | 0.39 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 371 | Vedanta Ltd. | 2.65 | 0.00 | 1.84 | 0.00 | 0.77 | 0.00 | 0.92 | 0.00 | 1.89 | 0.00 |
| 372 | V-Guard Industries Ltd. | 1.02 | 0.00 | 0.48 | 0.24 | 0.47 | 0.01 | 0.27 | 0.38 | 0.79 | 0.01 |
| 373 | Videocon Industries Ltd. | 0.12 | 0.73 | 0.39 | 0.33 | 0.07 | 0.61 | 0.27 | 0.27 | 0.36 | 0.15 |
| 374 | Vinati Organics Ltd. | 0.97 | 0.01 | 0.82 | 0.09 | 0.46 | 0.07 | 0.02 | 0.94 | 0.50 | 0.03 |
| 375 | VIP Industries Ltd. | 2.53 | 0.00 | 2.06 | 0.00 | 1.25 | 0.00 | 0.83 | 0.00 | 1.64 | 0.00 |
| 376 | Voltas Ltd. | 2.31 | 0.00 | 1.30 | 0.02 | 1.00 | 0.00 | 0.67 | 0.02 | 1.41 | 0.00 |
| 377 | VST Industries Ltd. | 1.17 | 0.00 | 0.88 | 0.02 | 0.06 | 0.61 | -0.20 | 0.39 | 1.06 | 0.01 |
| 378 | Wabco India Ltd. | 1.52 | 0.00 | 0.61 | 0.12 | 0.45 | 0.02 | -0.03 | 0.88 | 0.15 | 0.59 |
| 379 | Welspun Corp Ltd. | 2.54 | 0.00 | 2.04 | 0.00 | 0.50 | 0.16 | -0.04 | 0.89 | 1.18 | 0.01 |
| 380 | Welspun India Ltd. | 1.48 | 0.01 | 1.41 | 0.01 | 0.57 | 0.01 | 0.45 | 0.16 | 1.03 | 0.04 |
| 381 | Whirlpool Of India Ltd. | 1.04 | 0.00 | 1.33 | 0.01 | 1.21 | 0.00 | 0.27 | 0.23 | 1.06 | 0.00 |
| 382 | Wipro Ltd. | 0.84 | 0.00 | 0.73 | 0.02 | 0.00 | 1.00 | 0.10 | 0.64 | -0.04 | 0.89 |
| 383 | Wockhardt Ltd. | 3.34 | 0.00 | 1.17 | 0.07 | 0.92 | 0.03 | -0.54 | 0.10 | 0.82 | 0.08 |
| 384 | Zee Entertainment Enterprises Ltd. | 1.34 | 0.00 | 0.48 | 0.15 | 0.77 | 0.00 | 0.25 | 0.35 | 0.40 | 0.18 |
| 385 | Zee Learn Ltd. | 0.50 | 0.21 | 0.64 | 0.20 | 0.26 | 0.26 | 0.18 | 0.53 | 1.33 | 0.00 |
| 386 | Zensar Technologies Ltd. | 2.01 | 0.00 | 0.16 | 0.75 | -0.14 | 0.45 | 0.19 | 0.54 | 0.53 | 0.10 |
| 387 | Zydus Wellness Ltd. | 1.07 | 0.00 | 0.76 | 0.08 | 0.67 | 0.00 | 0.27 | 0.22 | 1.07 | 0.00 |

**Appendix III – Results of Panel Regression with Fixed Effects – Model 1**

Fixed-effects, using 1935 observations
Included 387 cross-sectional units
Time-series length = 5
Dependent variable: Exchange Rate Exposure ($\lambda_1$)
Robust (HAC) standard errors

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | |
|---|---|---|---|---|---|
| const | −2.8861 | 0.72707 | -3.9695 | 0.00008 | *** |
| FD | −0.0205921 | 0.00213531 | -9.6436 | <0.00001 | *** |
| SIZE | 1.63771 | 0.183157 | 8.9416 | <0.00001 | *** |
| FCR/TR | −0.258035 | 0.0846208 | -3.0493 | 0.00233 | *** |
| FCE/TE | −0.337626 | 0.219002 | -1.5417 | 0.12336 | |
| BREADTH | −0.0899708 | 0.131006 | -0.6868 | 0.49233 | |
| LQDTY | −0.0108518 | 0.00639333 | -1.6974 | 0.08983 | * |
| PFT | −0.109173 | 0.101084 | -1.0800 | 0.28030 | |
| FCD | −0.683827 | 0.211236 | -3.2373 | 0.00123 | *** |
| FCB | −0.017965 | 0.094995 | -0.1891 | 0.85003 | |
| NI | −0.127868 | 0.0834637 | -1.5320 | 0.12572 | |

| | | | |
|---|---|---|---|
| Mean dependent var | 0.912144 | S.D. dependent var | 0.746788 |
| Sum squared resid | 598.7491 | S.E. of regression | 0.623942 |
| LSDV R-squared | 0.444871 | Within R-squared | 0.185037 |
| LSDV F(396, 1538) | 3.112447 | P-value(F) | 1.03e-55 |
| Log-likelihood | −1610.749 | Akaike criterion | 4015.499 |
| Schwarz criterion | 6225.940 | Hannan-Quinn | 4828.484 |
| rho | 0.045077 | Durbin-Watson | 1.362150 |

Joint test on named regressors -
Test statistic: F(10, 1538) = 34.9202
with p-value = P(F(10, 1538) > 34.9202) = 8.18887e-062

Test for differing group intercepts -
Null hypothesis: The groups have a common intercept
Test statistic: F(386, 1538) = 1.37964
with p-value = P(F(386, 1538) > 1.37964) = 1.74818e-005

## Appendix IV – Results of Weighted Least Square Regression – Model 1

WLS, using 1935 observations
Included 387 cross-sectional units
Dependent variable: Exchange Rate Exposure ($\lambda_1$)
Weights based on per-unit error variances

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | |
|---|---|---|---|---|---|
| const | 1.13091 | 0.0798649 | 14.1603 | <0.00001 | *** |
| FD | −0.0235694 | 0.000768011 | -30.6889 | <0.00001 | *** |
| SIZE | 0.249177 | 0.0155799 | 15.9935 | <0.00001 | *** |
| FCR/TR | −0.175728 | 0.0501454 | -3.5044 | 0.00047 | *** |
| FCE/TE | −0.0407839 | 0.0537906 | -0.7582 | 0.44843 | |
| BREADTH | 0.0152342 | 0.0290479 | 0.5244 | 0.60003 | |
| LQDTY | 0.00084182 | 0.00507494 | 0.1659 | 0.86827 | |
| PFT | −0.117542 | 0.044711 | -2.6289 | 0.00863 | *** |
| FCD | −0.0289931 | 0.0574121 | -1.9802 | 0.09368 | * |
| FCB | −0.0163234 | 0.0211983 | -0.7700 | 0.44137 | |
| NI | 0.0391165 | 0.0252611 | 1.6485 | 0.12167 | |

Statistics based on the weighted data:

| | | | |
|---|---|---|---|
| Sum squared resid | 1910.539 | S.E. of regression | 0.996496 |
| R-squared | 0.405689 | Adjusted R-squared | 0.402600 |
| F(10, 1924) | 131.3364 | P-value(F) | 3.9e-209 |
| Log-likelihood | −2733.338 | Akaike criterion | 5488.676 |
| Schwarz criterion | 5549.922 | Hannan-Quinn | 5511.202 |

Statistics based on the original data:

| | | | |
|---|---|---|---|
| Mean dependent var | 0.912144 | S.D. dependent var | 0.746788 |
| Sum squared resid | 811.3258 | S.E. of regression | 0.649374 |

## Appendix V – Results of Panel Regression with Fixed Effects – Model 2

Fixed-effects, using 1935 observations
Included 387 cross-sectional units
Time-series length = 5
Dependent variable: Exchange Rate Exposure (δ)
Robust (HAC) standard errors

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | |
|---|---|---|---|---|---|
| const | 9.19265 | 68.7431 | 0.1337 | 0.89364 | |
| FD | −0.695631 | 0.312931 | -2.2230 | 0.02636 | ** |
| SIZE | −11.474 | 19.4076 | -0.5912 | 0.55446 | |
| BREADTH | 1.20662 | 17.4618 | 0.0691 | 0.94492 | |
| LQDTY | −0.928258 | 0.777097 | -1.1945 | 0.23246 | |
| PFT | 57.3064 | 27.0695 | 2.1170 | 0.03442 | ** |
| FCD | 9.50657 | 7.18311 | 1.3235 | 0.18588 | |
| FCB | −2.8233 | 4.04411 | -0.6981 | 0.48520 | |
| NI | 5.3853 | 2.84787 | 1.89099 | 0.08036 | * |

| | | | |
|---|---|---|---|
| Mean dependent var | 0.676776 | S.D. dependent var | 141.1212 |
| Sum squared resid | 31086980 | S.E. of regression | 142.0787 |
| LSDV R-squared | 0.192881 | Within R-squared | 0.009883 |
| LSDV F(394, 1540) | 0.934064 | P-value(F) | 0.797437 |
| Log-likelihood | −12115.34 | Akaike criterion | 25020.68 |
| Schwarz criterion | 27219.98 | Hannan-Quinn | 25829.57 |
| rho | −0.296559 | Durbin-Watson | 2.082644 |

Joint test on named regressors -
Test statistic: F(8, 1540) = 1.92143
with p-value = P(F(8, 1540) > 1.92143) = 0.0531263

Test for differing group intercepts -
Null hypothesis: The groups have a common intercept
Test statistic: F(386, 1540) = 0.877067
with p-value = P(F(386, 1540) > 0.877067) = 0.944248

## Appendix VI – Results of Weighted Least Square Regression – Model 2

WLS, using 1935 observations
Included 387 cross-sectional units
Dependent variable: Exchange Rate Exposure (δ)
Weights based on per-unit error variances

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | |
|---|---|---|---|---|---|
| const | 9.2806 | 1.51892 | 6.1100 | <0.00001 | *** |
| FD | −0.0763195 | 0.0111664 | -6.8347 | <0.00001 | *** |
| SIZE | −1.83104 | 0.215292 | -8.5049 | <0.00001 | *** |
| BREADTH | −1.67164 | 0.331307 | -5.0456 | <0.00001 | *** |
| LQDTY | −0.0369773 | 0.083663 | -0.4420 | 0.65855 | |
| PFT | 5.51878 | 1.19499 | 4.6183 | <0.00001 | *** |
| FCD | −0.396573 | 0.306004 | -1.2960 | 0.19514 | |
| FCB | −0.448334 | 0.23794 | -1.8842 | 0.05968 | * |
| NI | −5.50941 | 0.252703 | -21.8019 | <0.00001 | *** |

Statistics based on the weighted data:

| | | | |
|---|---|---|---|
| Sum squared resid | 610.2621 | S.E. of regression | 0.562898 |
| R-squared | 0.260596 | Adjusted R-squared | 0.257525 |
| F(8, 1926) | 84.85025 | P-value(F) | 1.4e-120 |
| Log-likelihood | −1629.176 | Akaike criterion | 3276.352 |
| Schwarz criterion | 3326.463 | Hannan-Quinn | 3294.783 |

Statistics based on the original data:

| | | | |
|---|---|---|---|
| Mean dependent var | 0.676776 | S.D. dependent var | 141.1212 |
| Sum squared resid | 38308774 | S.E. of regression | 141.0331 |

## Appendix VII –Determinants of Net Exporter

Fixed-effects, using 885 observations
Included 177 cross-sectional units
Time-series length = 5
Dependent variable: Exchange Rate Exposure ($\lambda_1$)
Robust (HAC) standard errors

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | |
|---|---|---|---|---|---|
| const | −4.04751 | 1.17611 | -3.4414 | 0.00061 | *** |
| DistancetoDefault | −0.0208845 | 0.00348371 | -5.9949 | <0.00001 | *** |
| SIZE | 1.9975 | 0.298273 | 6.6969 | <0.00001 | *** |
| Dispersion | −0.108026 | 0.188003 | -0.5746 | 0.56575 | |
| QuickRatio | −0.0463518 | 0.0222537 | -2.0829 | 0.03762 | ** |
| Profitable | −0.144596 | 0.184208 | -0.7850 | 0.43274 | |
| Derivative | −0.628398 | 0.366673 | -1.7138 | 0.08701 | * |
| FCB | −0.0719258 | 0.151012 | -0.4763 | 0.63401 | |

| | | | |
|---|---|---|---|
| Mean dependent var | 0.862098 | S.D. dependent var | 0.780612 |
| Sum squared resid | 301.9616 | S.E. of regression | 0.656322 |
| LSDV R-squared | 0.439431 | Within R-squared | 0.211462 |
| LSDV F(183, 701) | 3.002813 | P-value(F) | 4.24e-25 |
| Log-likelihood | −779.9458 | Akaike criterion | 1927.892 |
| Schwarz criterion | 2808.440 | Hannan-Quinn | 2264.538 |
| rho | 0.037857 | Durbin-Watson | 1.341896 |

Joint test on named regressors -
Test statistic: F(7, 701) = 26.8553
with p-value = P(F(7, 701) > 26.8553) = 1.01496e-032

Test for differing group intercepts -
Null hypothesis: The groups have a common intercept
Test statistic: F(176, 701) = 1.42918
with p-value = P(F(176, 701) > 1.42918) = 0.000900242

## Appendix VII –Determinants of Net Importer

Model 1: Fixed-effects, using 1050 observations
Included 210 cross-sectional units
Time-series length = 5
Dependent variable: Exchange Rate Exposure ($\lambda_1$)
Robust (HAC) standard errors

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | |
|---|---|---|---|---|---|
| const | −1.84183 | 0.799167 | -2.3047 | 0.02143 | ** |
| DistancetoDefault | −0.0203609 | 0.00264937 | -7.6852 | <0.00001 | *** |
| SIZE | 1.24225 | 0.20999 | 5.9157 | <0.00001 | *** |
| Dispersion | −0.0766803 | 0.176338 | -0.4348 | 0.66379 | |
| QuickRatio | −0.00506471 | 0.004458 | -1.1361 | 0.25624 | |
| Profitable | −0.0845684 | 0.118625 | -0.7129 | 0.47610 | |
| Derivative | −0.73804 | 0.238397 | -3.0958 | 0.00203 | *** |
| FCB | 0.0224422 | 0.103233 | 0.2174 | 0.82796 | |

| | | | |
|---|---|---|---|
| Mean dependent var | 0.954326 | S.D. dependent var | 0.714698 |
| Sum squared resid | 297.2491 | S.E. of regression | 0.597362 |
| LSDV R-squared | 0.445247 | Within R-squared | 0.154957 |
| LSDV F(216, 833) | 3.095229 | P-value(F) | 5.73e-31 |
| Log-likelihood | −827.3487 | Akaike criterion | 2088.697 |
| Schwarz criterion | 3164.268 | Hannan-Quinn | 2496.520 |
| rho | 0.060599 | Durbin-Watson | 1.368935 |

Joint test on named regressors -
Test statistic: F(7, 833) = 21.8212
with p-value = P(F(7, 833) > 21.8212) = 3.68879e-027

Test for differing group intercepts -
Null hypothesis: The groups have a common intercept
Test statistic: F(209, 833) = 1.29262
with p-value = P(F(209, 833) > 1.29262) = 0.00763721

## Accepted for Publication

### Journal

Prasad, K., Suprabha, K. R. & Shridev. Influence of Influence of Financial Distress on Exchange Rate Exposure: Evidence from India. *Afro-Asian Journal of Finance and Accounting.* Scpous Indexed and ABDC listed.

### Book Chapter

Prasad, Krishna, and K R Suprabha. "Exchange Rate Exposure and Usage of Foreign Currency Derivatives by Indian Non-Financial Firms." *The Impact of Globalization on International Finance and Accounting*. Ed. David Procházka. Gewerbestrasse: Springer International Publishing AG, 2017. https://doi.org/doi:10.1007/978-3-319-68762.

## List of Publications

### Journal

Prasad, K., & Suprabha, K. R. (2016). Exchange Rate Exposure of Indian Firms Using Capital Market Approach. *Journal of Accounting & Marketing*, *5*(2), 1–5. https://doi.org/doi:10.4172/2168-9601.1000165. EBSCO Indexed.

Prasad, K., & Suprabha, K. R. (2014). Measurement of Exchange Rate Exposure Using Two Factor Model: Evidence from CNX 100 Firms. *International Finance eJournal*, *6*(129).

### Conference Proceedings

Prasad, K., & Suprabha, K. R. (2015). Measurement of Exchange Rate Exposure: Capital Market Approach versus Cash Flow Approach. *Procedia Economics and Finance*, *25*(15), 394–399. https://doi.org/10.1016/S2212-5671(15)00750-9. Indexed in Thomson Reuters' Conference Proceedings Citation Index.

Prasad, K., & Suprabha, K. R. (2014). Exchange Rate Exposure: Evidence from Indian Firms. In N. R. Prashuram & U. Rao (Eds.), *Emerging Trends in Finance and Accounting* (pp. 1–11). Mysore: SDMIMD.

**BIO-DATA**

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## Educational Qualification

Pursuing Ph.D on the topic *Determinants of Exchnage Rate Exposure: Evidence from Indian Firms* from National Institute of Technology Karnataka (NITK), Surathkal. Expected to submit the thesis by May 2017.

Post Graduation- **MBA** Specializing in Finance from **Justice K S Hegde Institute of Management, Nitte,** with CGPA of 8.6/10.

AMFI Certified Financial Planner (**NCFM- AMFI Adivosry Module**).

Graduated in commerce (**B.Com**) from Mangalore University with distinction (71%).

Completed **PEE I** exam conducted by **Institute of Chartered Accountants of India** in 2009.

Completed 250 hours of **Compulsory Computer Training** course for PEE II students conducted by **Institute of Chartered Accountants of India** in 2006**.**

## Research Projects Completed

1. Co-Investigator in the research project titled *Bank Finance for Agribusiness: A Case Study of Dakshina Kananda District* sponsoored by Indian Institute of Banking and Finance (IIBF), Mumbai. Completed and the report submitted to IIBF in the year 2012.

## Publications

1. Authored the research paper titled *Measurement of Exchange Rate Exposure: Capital Market Approach versus Cash Flow Approach*, Procedia Economics and Finance (Elsevier Journal), Vol.25, 2015 (available at http://www.sciencedirect.com/science/article/pii/S2212567115007509).
2. Authored the research paper titled *Exchange Rate Exposure: Evidence from Indian Firms*, Conference Proceedings (ISBN 978-93-83302-02-4**),** 3rd International Conference on Emerging Trends in Finance & Accounting.
3. Authored the research paper titled *Anomalies in Maturity Gap: Evidence from Scheduled Commercial Banks in India*, Procedia Economics and Finance (Elsevier Journal), Vol.11, 2014 (available at http://www.sciencedirect.com/science/article/pii/S2212567114002093).

4. Authored the research paper titled *Bad Loans in Good Banks: Recent Expericnces in India* published by Nitte Management Review (ISSN NO. 2231-6043) Vol. 7 (2), 2013.
5. Co-authored the research paper titled *Bank Finance for Agribusiness in Dynamic Setting* published by Nitte Management Review (ISSN NO. 2231-6043) Vol. 6 (2), 2012.

**Conferences Attended**

1. Presented the research paper titled *Exchange Rate Exposure and Usage of Foreign Currency Derivatives by Indian Non-financial Firms* at **18th Annual Conference on Finance and Accounting** on 26th May 2017 organized by Faculty of Finance and Accounting, University of Economics, Prague, Czech Republic.
2. Presented the research proposal titled *Determinants of Exchange Rate Exposure: A Study of Indian Firms* at **TAPMI-CSU Doctoral Colloquium in Finance - 2015** on 17th April 2015 jointly organized by T A Pai Management Institute, Manipal and Colorado State University College of Business, USA.
3. Presented a research paper titled *Exchange Rate Exposure: Evidence from Indian Firms,* in the **International Conference on Emerging Trends in Finance & Accounting** on 12th and 13th September, 2014 organized by SDMIMD, Mysore.
4. Presented a research paper titled *Rising Anomalies in Maturity Gap: Evidence from Scheduled Commercial Banks in India,* in the **Symbiosis Institute Annual Research Conference (SIMSARC)** on 12th and 13th December, 2013 organized by Symbiosis Institute of Management Studies, Pune.
5. Presented a research paper titled *Rising NPAs in SCBs of India: Is Securitization a Solution?* in the Conference on **Emerging Trends in Banking and Finance** on 13th September, 2013 organized by Great Lakes Institute of Management, Chennai and Union Bank of India, Chennai.
6. Presented a research paper titled *Changing Role of Mutual Fund Industry in the Development of Indian Financial Market,* in the National Conference on **Development Challenges in 12th Five Year Plan** on 29-30 December, 2012 organized by JKSHIM, Nitte.
7. Presented a research paper titled *Leave Trading System* in the International Conference on **Innovations in Management Education** organized by Kristu Jayanthi Institute of Management, Bangalore, 2011.

**Working Papers**

1. *Influence of Ownership Structure in Managerial Remuneration in India,* co-authored by Dr. K. Sankaran. The paper attempts to study the paradox in the managerial remuneration paid in the Indian firms with different ownership styles such as Indian Private companies, Foreign Private Companies, PSUs and Non-dominant promoter firms.

2. *Sustainability Reporting and Indian Companies: A Cross-Sectional Study to Evaluate the Extent of GRI Compliance*, co-authored by Dr. Sudhir M. The paper is intended to calculate the GRI compliance index of companies constituted in

CNX 500 index of NSE and the factors influencing the extent of GRI compliance in the light of Legitimacy theory and Stockholder dispersion theory.