Operational Currency Mismatch and Firm Level Performance: Evidence from India

Dhasmana, Anubha

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Abstract

This paper looks at the determinants and effects of exchange rate exposure using data on 500 Indian firms over the period 1995-2011. Unlike the existing papers in the literature, we use a measure of `operational` currency exposure based on foreign currency revenues and costs of firms. Among other factors, exchange rate volatility appears as a significant determinant of average firm level exposure with the direction of relationship supporting the presence of `Moral Hazard` in firm's risk taking behavior. Further large `operational` exposure is associated with significantly lower output growth, profitability and capital expenditure during episodes of large currency depreciation at the firm level. Together this indicates that the policy makers must take into account the incentive effects of their intervention in foreign exchange markets.

Key Words: Operational Currency Exposure, Moral Hazard, Exchange Rate Volatility

Introduction

Impact of exchange rate movements on economic performance is one of the key questions in international economics. Exchange rates were one of the channels through which the recent global financial crisis affected many emerging market and developing economies across the world; especially those with balance sheet mismatches (see Ranciere, Tornell and Vamvakidis (2010)). Theoretically, exchange rate movements can affect economic performance through a number of channels, such as raising the cost of imported inputs relative to other factors of production, providing exporters with a relative cost advantage relative to foreign competitors, or generating higher borrowing costs and a contraction in lending. Which of these channels becomes the dominant one is therefore a question of empirical investigation.

This paper looks at the firm level exchange rate exposure and its impact on firms' performance during episodes of large currency depreciations using data on 500 Indian firms for the period 1995 to 2011. We use the measure of currency exposure suggested by Bodnar and Marston (2000)[1] who present a measure of exchange rate exposure elasticity based on differences in revenues and costs of emerging market firms[2]. Exchange rate elasticity is defined as the percentage change in firm's cash flow in response to a one percent change in exchange rate[3].

Two key results emerge out of our analysis. First, exchange rate volatility is inversely associated with operational exposure elasticity. In other words, periods of low exchange rate volatility are associated with higher average absolute exposure amongst the Indian firms and *vice versa*. This supports the `Moral Hazard` hypothesis of risk taking behavior amongst Indian firms. Periods of low exchange rate volatility (associated with greater central bank intervention to support the value of rupee or manage rupee volatility) encourage firms to take on more risk through higher operational exposure to exchange rate changes as measured by the absolute level of exposure elasticity. One would not expect to see such an association where un-hedged exchange rate exposure is a result of incomplete markets.

Second, `high` exposure elasticity has a significant adverse impact on firm level performance during episodes of `large` currency depreciations (both `high` exposure elasticity and `large` currency depreciations are defined in detail below). Using alternative measures of firm level performance such as output growth, earnings per share and capital expenditure, we find that the firms with `high` exposure elasticity perform much more poorly compared to the rest during episodes of large Rupee depreciations even though overall the Indian firms seem to benefit from a weaker rupee. Together these results suggest that Indian policy makers should be careful regarding the incentive effects of their intervention in foreign exchange markets. Further, there is need to focus on `operational` mismatches arising out of mismatches in cost and revenue streams of firms apart from the usually discussed asset-liability mismatches .

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[1] Unpublished manuscript available at http://finance.wharton.upenn.edu/weiss/wpapers/2000/00-3.pdf

[2] Details of this measure are presented in the next section.

[3] Exchange rate is defined as domestic currency (Rupee) per unit of foreign currency.

Our paper is related to a large body of microeconomic literature looking at the impact of exchange rate fluctuations on firm level performance. A section of this literature looks at the impact of exchange rate changes on firm's value measured by stock returns. Examples of this literature include Adler and Dumas (1984), Jorion (1990), Bodnar and Wong (2000), Dominguez and Tesar (2006), Parsley and Popper (2006). Another strand of the same literature looks at the issue of pricing policies in response to currency fluctuations (for e.g. Goldeberg and Knetter (1997)). Finally a small section of this literature looks at the impact of currency fluctuations on firm level investment (e.g. Goldberg (1993), Campa and Goldberg (1995), Campa and Goldberg (1999), Nucci and Pozzollo (2001)). While this paper is most closely related to the last strand of literature, most of the existing papers in this literature look at developing countries with little attention being paid to the emerging markets such as India. One of the reasons for this gap is the lack of good quality firm level data. In that respect our paper contributes to the existing literature by putting together a large firm level dataset for an emerging economy that can be used to answer questions regarding impact of macroeconomic variables such as exchange rates on firms.

At the same time this paper is also related to the large macroeconomic literature on currency mismatch and its impact on growth in emerging markets. Key contributions in this literature include Goldstein and Turner (2004), Eichengreen, Hausmann and Pannizza (2007) and Ranciere, Tornell and Vamkvakidis (2010). In most of these papers the focus is on the mismatch between the currency denomination of assets and liabilities. Little attention has been paid to the currency mismatch between costs and revenues of the firms. Such `operational` mismatches are potentially equally important and deserve attention of policy makers and academics alike. Firms with same degree of mismatch in their assets and liabilities can have very different level of vulnerability to exchange rate shocks depending upon whether they produce tradable or non-tradable goods or the extent to which they depend upon imported inputs. This paper fills an important gap in the literature on currency mismatch by focusing on the `operational` mismatch between firm's costs and revenues.

Finally our paper is also linked to the literature on cost of sharp currency devaluations. While theory has been ambivalent regarding the impact of currency devaluations on real activity, empirical literature has also provided mixed evidence regarding the economic impact of sharp currency devaluations (see for example Hutchison and Noy (2005), Hong and Tornell (2005) and Gupta et al (2007)). Unlike most papers in this literature however, we use firm-level longitudinal data set for an emerging market that allows us to take in to account firm level characteristics.

Our paper is organized as follows: Section 2 describes the data and our measure of currency exposure. Section 3 looks at the determinants of currency exposure while section 4 looks at the impact of exchange rate exposure on firm level performance. Section 5 discusses the policy implications of our results and concludes.

Data

Our data covers 500 Indian firms listed under the BSE 500 Index. Most of the data comes from their Annual Financial Statements and covers the period 1995 to 2011. Firms included under the index represent roughly 93 percent of the total market capitalization on the BSE and cover all the major industries in the Indian economy including construction, infrastructure, as well as non-traditional services such as software and ITeS. The time period covered by our data includes three important economic crisis of the twentieth century – the East Asian crisis; the 2001 dotcom bubble and the 2007 Global financial meltdown. Key variables of interest in our model are growth in output and earnings per share. We use them along with the level of capital expenditure as indicators of firm performance. Our objective is to study the impact of currency exposure on firm level performance as measured by output growth and earnings per share. The key explanatory variable for our analysis is therefore the measure of currency exposure.

Studies trying to measure currency exposure of firms often rely on stock returns data. They estimate exposure of individual firms in `excess` to the overall market exposure to exchange rate changes by regressing firm level stock returns on market level returns and exchange rate returns (see Adler and Dumas, 1984). However, since we need a measure of `absolute` exchange rate exposure at the firm level and not `excess` exposure we use the measure suggested by Bodnar and Marston (2000) instead. We describe the construction of this measure in detail below.

Measuring `Operational` Currency Exposure

Important as it is for the firms and policy makers alike, measuring exchange rate exposure is fraught with various difficulties starting from the lack of data to need for proper theoretical framework. The literature has estimated currency mismatch based on two main, straightforward measures. The first is based on the net national debt or debt service requirements to the net exports of a country. The second is based on the ratio of foreign currency denominated liabilities to foreign currency denominated assets of the banking sector. Goldstein and Turner (2004) and Eichengreen, Hausmann and Panizza (2007) provide a review of the first strand of this literature while Lane and Ferretti (2007) and Ranciere et.al. (2010) are the latest example of the second strand. These measures have the virtue of being simple but they suffer from two important drawbacks. First they lack an underlying theoretical foundation. Second, they ignore the fact that in many cases firms might use off balance sheet transactions to hedge or take on risks. These measures are not able to capture such off balance sheet risks and hedges. Equally important can be the operational `hedges` arising out of firm's decisions regarding location of production, sourcing of inputs etc.

Bodnar and Marston (2000) develop a model of foreign exchange exposure dependent on only three variables, the percentage of the firm's revenues and expenses denominated in foreign currency and its profit rate. `Exposure elasticity` is defined as the percentage change in the firm's profit in response to a one percent change in exchange rate defined as domestic currency per unit of foreign currency. Using the model of a profit maximizing monopoly firm producing and selling goods at home and abroad, they derive the expression of exposure elasticity as follows:

$$\delta = h_1 + (h_1 - h_2)((1/r) - 1) \qquad (1)$$

Where

δ is the exposure elasticity or percentage change in firm's cash flow in response to a change in exchange rate.

h_1 is the foreign currency-denominated revenue as a percentage of total revenue

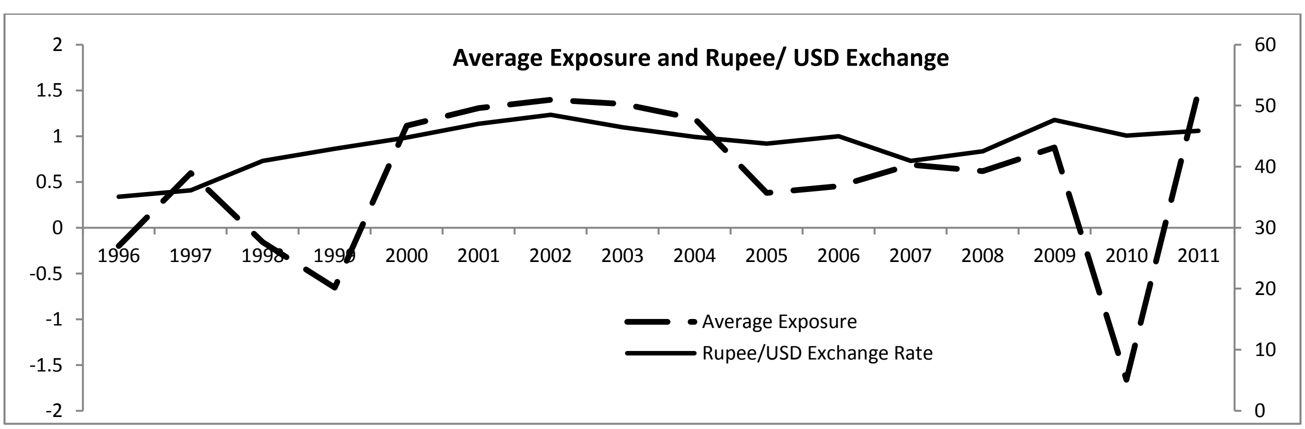
h_2 is the foreign currency-denominated costs as a percentage of total costs

And r is the profit rate (i.e., profits as a percent of total revenues)

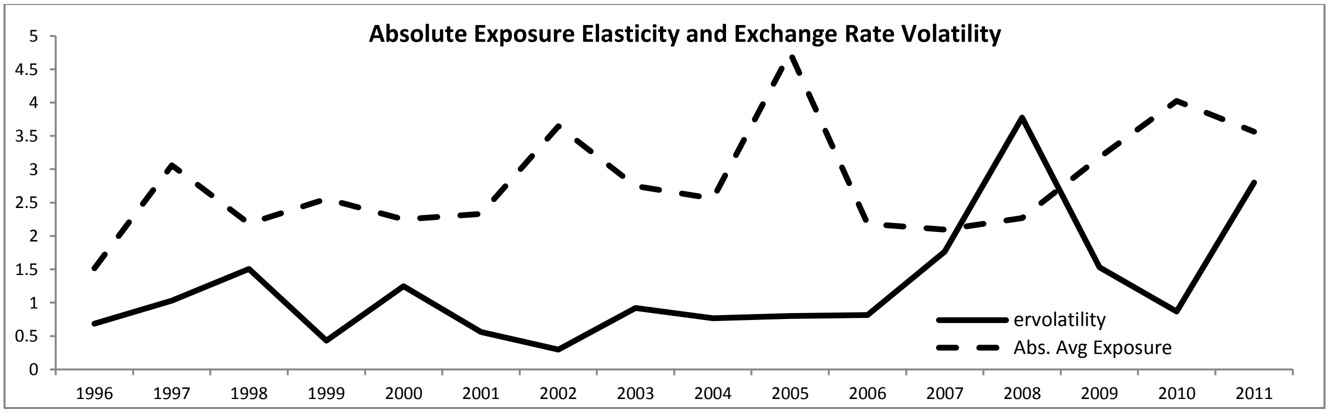
Equation 1 implies that higher the share of foreign currency revenues and smaller the share of foreign currency costs the greater is the decrease in firm's value in response to a depreciation of the home currency. Further, higher profit after tax would lower the exposure elasticity in `absolute` term.

We use data on foreign currency costs, foreign currency revenues and profits from CMIE's PROWESS database to calculate exposure elasticity of the firms in our sample for the period 1995-2011. Top panel of Text Figure [1] plots the cross-sectional average of exposure elasticity between 1995 and 2011 along with annual average monthly Rupee-USD exchange rate. As we can see, average exposure elasticity for Indian firms has been positive for most years between 1995 and 2011 indicating that overall, the Indian firms benefitted from exchange rate depreciation and were adversely affected by an exchange rate appreciation during this period. Bottom panel of the same figure plots the average absolute exposure elasticity across Indian firms along with annual volatility of weekly Rupee-USD log returns. This plot shows that periods of low exchange rate volatility are associated with higher absolute exposure elasticity. This indicates the presence of `moral hazard` type behavior amongst Indian firms whereby lower exchange rate volatility prompts firms to take on higher exchange rate risk. We try to explore this hypothesis further in the next section.

Text Figure [1]



Panel 1

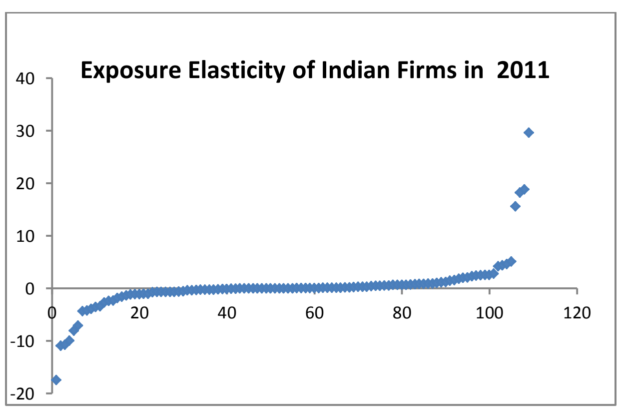


Panel 2

Industry-wise Exposure Elasticity

Average exposure elasticity can hide significant variation across industries. We therefore look at the industry-wise decomposition of exchange rate exposure in Text Figure [2] and [3]. We rely on the industry classification provided by the CMIE in what follows (list of all the industries is available upon request from the authors). Text Figure 2 plots the industry wise average exposure elasticity in year 2011 for the firms in our sample[4]. For most industries exposure elasticity is small (below 1) but there are a few industries with very large positive / negative operational exposures. Mean exposure elasticity of Indian industries was 1.9 in 2011 with the lowest quartile being -0.64 and the highest quartile being 181. Overall, a majority of Indian industries had positive exposure elasticity in 2011 indicating that at the industry level, more Indian industries were likely to gain from an exchange rate depreciation compared to the number of industries that would lose from such an event.

Text Figure [2]



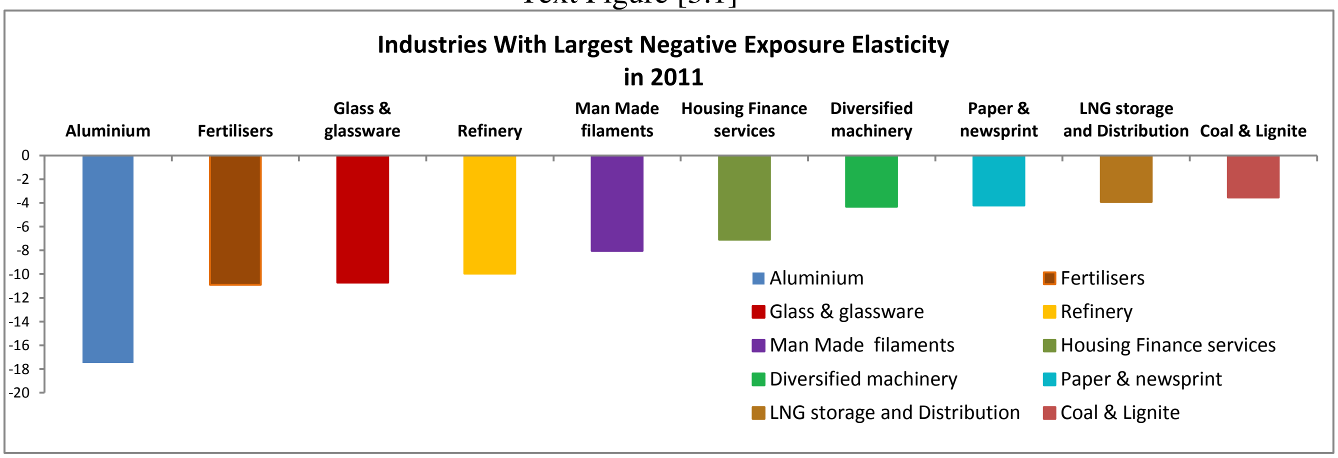
Text figure 3 presents top 10 industries with largest negative and positive exposure in 2011. From the top panel we can see that Aluminum industry had the largest `negative` exposure

[4] We exclude Air Transport industry from this plot as it appears to be an outlier, to give a better picture for the remaining industries.

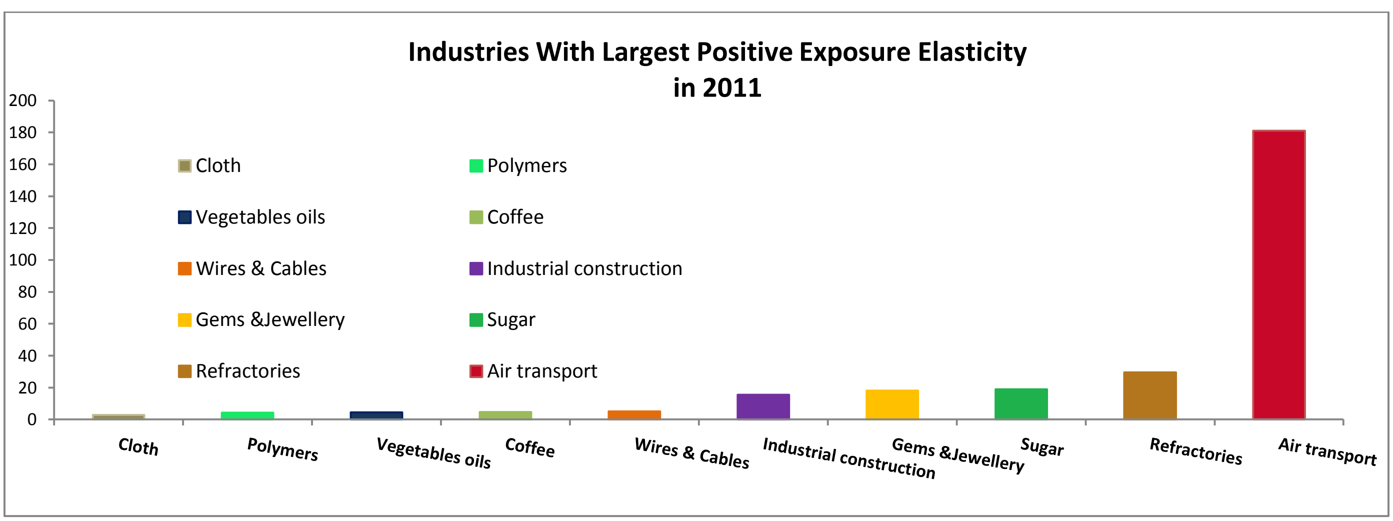
elasticity followed by fertilizers, glass and glass ware and refining industry. As explained above, a negative exposure elasticity implies that these industries would be hurt by a Rupee depreciation given their cost and revenue profiles. Bottom panel of the same figure shows the industries with largest positive exposure elasticity or industries likely to benefit the most from Rupee depreciation. These include Air transport which has the largest positive exchange rate exposure followed by refractories, sugar, gems and jewellery and industrial construction.

Overall, industries with large negative exposure are the ones with a very high share of imported inputs in their total cost relative to the share of foreign income in their total income. (e.g. imports comprised about 40 percent of the total cost in Aluminum industry while its share of foreign exchange earnings was only 30 percent of its total income in 2011). Opposite is true for firms with large positive exposure elasticity. Air transport services, for example, had 1.5 percent of its total costs going towards imports even though its share of foreign income in the total income was 18.5 percent. What matters for the exposure elasticity (both its size and direction), therefore, is the relative difference between the foreign currency costs and revenues.

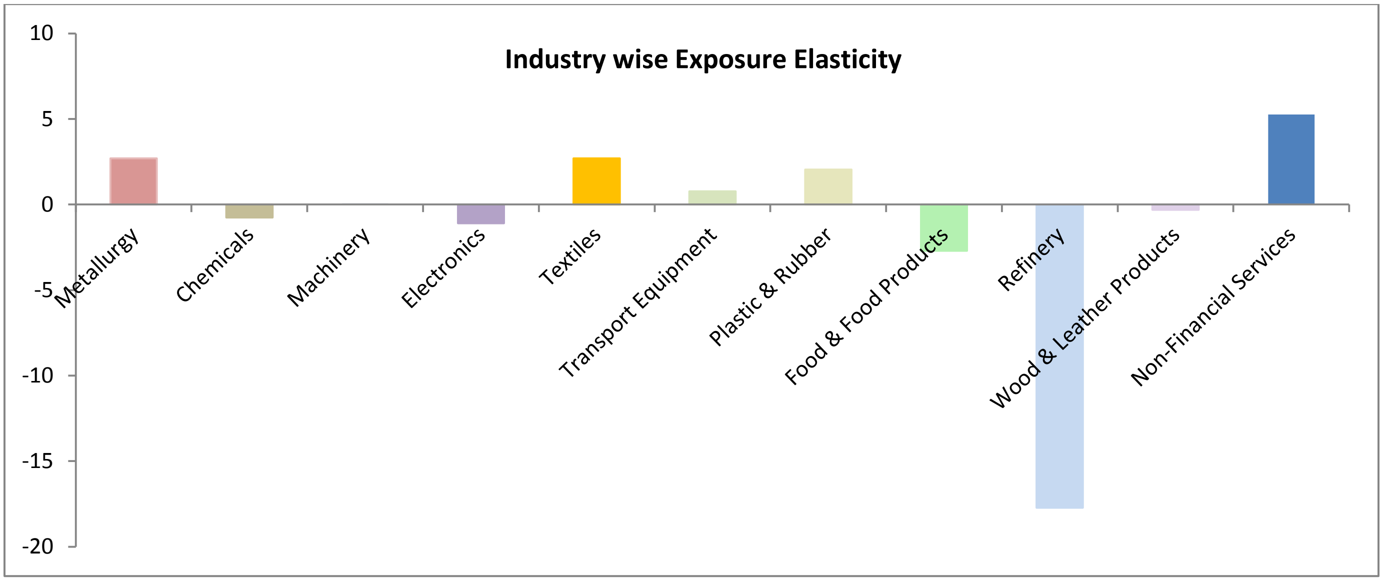
Text Figure [3.1]



Text Figure [3.2]



Text Figure [4]



To get a better picture of the industry-wise exposure we further club these industries in to eleven broad categories and look at their average exchange rate exposure over time (see Appendix for detailed data). Text Figure 4 plots the average exposure elasticity for these eleven industries between 1995 and 2011. A careful look at this figure provides important insights in to the sectorial impact of exchange rate movements in the case of Indian economy.

Non-financial services which include Business consultancy and IT & ITES have the largest positive exposure elasticity followed by metallurgy and textiles. Services, especially non-traditional services such as IT and ITES, are a growing component of India's economy and external trade. Similarly, textiles are one of the key traditional exports of India and an important source of manufacturing employment. Rupee depreciation clearly benefits these important sectors.

At the same time, sectors such as refinery (oil) and food that are a source of key inputs for other sectors exhibit a negative exchange rate exposure thereby presenting a dilemma for the policy makers. Next section tries to identify the determinants of this operational currency mismatch.

Operational Exposure Elasticity and Exchange Rate Regime

Theory gives different explanations for the presence if currency mismatch in emerging markets which can be broadly divided in to two categories – 'Moral Hazard` and `Incomplete Markets'. While the former explanation looks at implicit or explicit government guarantees in the form of bank bailouts and fixed exchange rate regimes, the latter looks at market frictions resulting in inadequate provision against exchange rate risk. The former explanation implies that the degree of central bank intervention would have a direct impact on the risk taking behavior of individual firms. In the latter case, one would not expect to see any discernible relationship between exchange rate regime and currency exposure.

Based on this insight Shah and Patnaik (2010) test the `moral hazard` hypothesis in the case of India. India presents a unique natural experiment that can be used to test the impact of differing exchange rate volatility on firm level exchange rate exposure. Shah and Patnaik (2010) use Bai and Perron (2003) algorithm to identify structural breaks in the volatility of weekly Rupee – Dollar returns. They use this to test the impact of exchange rate regime on un-hedged currency exposure amongst a set of 100 Indian firms and find evidence in support of the moral hazard hypothesis. In similar spirit, we try to test whether operational mismatches in costs and revenues are related to exchange rate regimes.

We divide the entire sample in to four time periods for our analysis. Division of the sample is based loosely on the study by Shah and Patnaik (2010). Using squared weekly returns on the Rupee-USD exchange rate between April 1993 and February 2007, they identify four distinct breaks in India's exchange rate regime. Given that we have annual data unlike Shah and Patnaik (2010) that uses weekly data; we use their break points and match them with our annual series. Column 1 in the table below gives the four sub-periods used by us while column 2 gives the corresponding periods of exchange rate regime shifts identified in Shah and Patnaik (2010). Notice that Shah and Pattnaik (2010) only cover period till February 2007 which leaves out the period since year 2007. The period after 2007 saw the global financial crisis unfolding. That is likely to have affected firm's exposure elasticity through changes in exports, imports and profit margins. We therefore use the period between 2009 and 2011 as the last period of our analysis in this section so as to avoid confounding our results due to the impact of global financial crisis.

Text Table [1]: Summary Statistics of Delta

Period	Exchange Rate Regime (Shah & Pattnaik)	Average Exposure Elasticity	Mean	Volatility INR/USD	Reserve Accumulation as Percentage of Net Capital Inflows
1996-1998	1995-02-17 - 1998-08-21	$\overline{\delta_1}$	0.30	0.53	26.86
1999-2003	1998-08-21 - 2004-03-19	$\overline{\delta_2}$	0.87	0.046	84.3
2004-2006	2004-03-19 - 2007-02-12	$\overline{\delta_3}$	0.71	0.22	47.0
2009-2011		$\overline{\delta_4}$	0.21	1.01	0.09

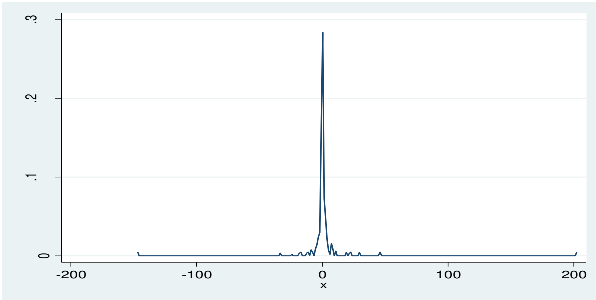
Text Table [1] gives the average exposure elasticity `delta' of Indian firms in the four periods along with the volatility in INR/USD weekly returns in those periods. The first thing to note is that the volatility of INR-USD weekly returns varies substantially across the four periods even though India has had a *de jure* 'managed float' throughout this period. This result is in line with Shah and Patnaik (2010, 2011). Thus, even though India had a managed floating exchange rate regime throughout this period the extent to which the central bank authorities intervened in the foreign exchange market and tried to control rupee volatility varied over time. Again in line with the findings in Shah and Patnaik (2010), rupee volatility was higher in the first period that included the Asian financial crisis. It came down during the next five year period between 1999 and 2003 following which the volatility increased again. During the latest period (between years 2009-2011) volatility of Rupee has gone up even further (this holds true even if we exclude the year 2011).

Column 3 above shows the mean exposure elasticity of the firms in our sample during different periods. Average exposure elasticity of the firms in our sample is positive for all the four periods under consideration. This indicates that overall, Indian firms have tended to benefit from Rupee depreciation on account of their operational currency mismatch. At the same time, the average exposure elasticity has been higher in periods when the exchange rate volatility was lower. Average exposure elasticity increased from 0.3 in the first period (volatility 0.53) to 0.87 (volatility 0.046) in the second period. Subsequently, as the exchange rate volatility increased the average exposure elasticity came down.

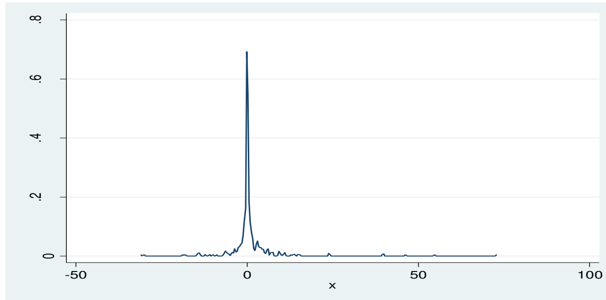
On an average, Indian firms have tended to expose themselves more heavily to a Rupee appreciation risk during periods of low exchange rate volatility. This is most likely a reflection of the fact that periods of low exchange rate volatility in India have been associated with a higher net inflow of foreign capital that were sterilized by the authorities in order to prevent Rupee appreciation and used to build up reserves. The last column in Table 1 provides some evidence to this effect. It presents the ratio of average reserve accumulation to average net capital inflow for the four periods. As we can see, periods of low exchange rate volatility are associated with a higher ratio of reserve accumulation to net capital inflows which is reflective of monetary sterilization of foreign exchange inflow by the central bank.

The kernel density plots of average delta for the four periods are presented below. While a large number of firms have exposure elasticity clustered around zero, there has been a significant increase in large sized exposures (both negative and positive) in recent years concomitant with the rise in exchange rate volatility. It is therefore important for policy analysts and firms alike to focus on the determinants and effects of large `operational` currency mismatches in their costs and revenues. The next two sections of the paper attempt to do that.

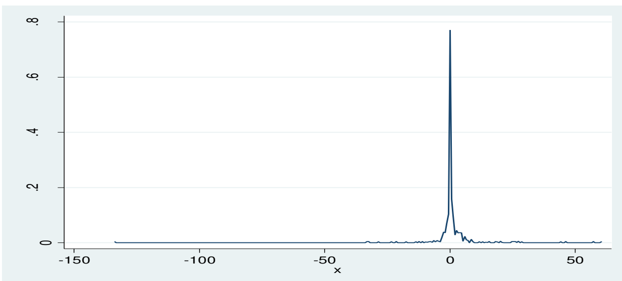
Text Figure 5 Kernel Density



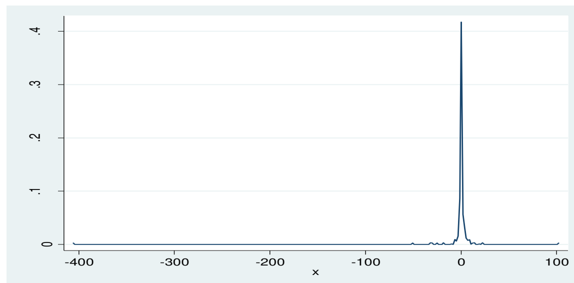
1996-1998



1999-2003



2004-2006



2009-11

Determinants of Firm Level Exposure

As discussed above, recent years have seen an increase in the size of currency mismatch between the costs and revenue sides of Indian firms. In this section we explore the factors affecting the size of exchange rate exposure elasticity of firms. We would like to study the factors that are associated with higher absolute level of currency exposure at the firm level especially those directly or indirectly related to government policies. In this regard, the key variable for interest for us in this exercise is the volatility in exchange rate. Exchange rate in India has been market determined but subject to the Central Bank intervention that has tried to keep its volatility under check. Text Table [1] highlighted the effect of this intervention on the direction of average exchange rate exposure. If foreign exchange intervention does have an impact on the risk taking behavior of the firms then one would expect to see a positive correlation between the absolute size of currency exposure and volatility of exchange rate. Empirical exercise in this section provides a formal test of the `Moral Hazard` hypothesis apart from identifying firm level characteristics determining the absolute size of firm level currency exposure. The econometric model used for this exercise is given below:

$$\left|\delta_{i,t}\right| = \alpha_i + \beta_i X_{i,t} + \varepsilon_{i,t} \qquad (2)$$

Our dependent variable is the absolute size of $|\delta_{i,t}|$ or the exchange rate exposure elasticity calculated above. The set of explanatory variables $X_{i,t}$ includes share of exports in sales, growth rate of sales, volatility in exchange rate and log of market capitalization. Hausman's specification test between random and fixed effects estimator selected the former hence we used it for estimating equation (1)[5]. Text Table (2) presents the results from this exercise. Column 1 presents the results from the entire sample while the remaining columns present the results of different sub-samples. We begin by discussing the results for exchange rate volatility which is the key variable of interest for us.

Exchange rate volatility has a negative and significant coefficient in our model. This indicates that higher exchange rate volatility as measured by the annual standard deviation of weekly log returns on Rupee/ USD exchange rate is associated with lower absolute value of `operational` currency exposure on average. This can be due to a greater mismatch between their foreign exchange revenues and costs or due to a lower profit rate or both. To check which of these is true, we regress growth in profits and absolute size of revenue-cost mismatch (absolute value of the difference between h_1 and h_2) on a set of time and firm specific fixed effects and exchange rate volatility. Results from this exercise are given in the Appendix. We find that exchange rate volatility does not have a statistically significant effect on the growth of firm's profits (in fact it has a positive coefficient), though it is significantly and positively associated with the `operational` foreign currency mismatch as measured by the absolute value of the difference between h_1 and h_2.

Our result is therefore in line with the findings of Shah and Patnaik (2010) and supports the `Moral Hazard` hypothesis. Periods of high exchange rate volatility are associated with higher absolute level of exposure elasticity as compared to the periods with low exchange rate volatility indicating that whenever government tries to stabilize the exchange rate in order to keep its volatility under check, the result is an increase in the risk taking behavior of the private sector as reflected in higher exposure elasticity as well as higher `operational` currency mismatch.

Share of exports in total sales is positively related with the size of exposure elasticity indicating that more export oriented firms tend to see much higher levels of exposure elasticity. On an average, a one percent increase in the share of exports in total sales is associated with a 2.8 basis points increase in the size of exposure elasticity. This result holds across different sub-samples as shown by the remaining columns. To check for the direction of exposure we replace absolute value of delta with the actual exposure elasticity delta in the same model as above and find that share of exports is positively related to delta indicating that firms with higher share of exports

[5] Hausman's Specification test: Chi sq (4) = 21.6, p-val. =0.00

have more `positive` exposure elasticity or they tend to benefit from an exchange rate depreciation on an average, *ceteris paribus*[6].

Growth rate of sales is positively associated with the size of exposure elasticity. Firms with better growth prospects as reflected in higher sales growth exhibit higher exposure elasticity. At the same time, exposure elasticity is negatively related to the firm size as measured by their market capitalization. Larger firms tend to have smaller exchange rate exposure elasticity.

One possible explanation of the last result might be that market capitalization is positively correlated with the profit rate indicating that smaller exposure elasticity of `large` firms reflects their higher profitability. `Smaller` firms are more vulnerable to exchange rate changes due to lower profit margins. There is some evidence to support this view. However, since our main focus is on the relationship between exchange rate volatility and firm level exposure, we leave this hypothesis for future research.

Text Table [2]

Dependent Variable: $\lvert\delta_{i,t}\rvert$	**Entire Sample**	**Excluding Mining**	**Excluding Services**	**Manufacturing**
Exports as a Percentage of Sales	0.028*** [0.005]	0.029*** [0.005]	0.028*** [0.005]	0.032*** [0.008]
Growth in Sales	0.16** [0.066]	0.17** [0.068]	0.18** [0.07]	0.21** [0.10]
Exchange Rate Volatility	-0.11*** [0.03]	-0.11*** [0.03]	-0.11*** [0.03]	-0.11*** [0.04]
Market Capitalization	-0.24*** [0.05]	-0.26*** [0.05]	-0.22*** [0.05]	-0.27*** [0.07]
R-Sq	0.33	0.36	0.22	0.25
Total No. of Obs.	3615	3491	3138	2448
No. of Groups	346	331	284	209

Note: *** Denotes `significant at 1%`. Terms inside the brackets are standard errors adjusted for Hetrosckadasticity across clusters.

[6] Results for this exercise are available upon request from the authors.

It is possible that more `open' firms, i.e., firms with high export and/or import intensity, react differently to exchange rate volatility as compared to the rest. This might be on account of greater access to and reliance on financial instruments for hedging exchange rate risks by more open firms. To check our hypothesis we divide our sample in to `export intensive` and 'import' intensive firms and estimate the model in equation (2) separately for each sub-sample. Firms are classified as having `high` export intensity if the share of exports in their total sales is above ninety percent[7]. Similarly, firms are classified as import intensive if the ratio of imported inputs to their total income is above 25 percent. Text Table 3 presents the results from this exercise.

Text Table [3]

Dependent Variable: $\left\|\delta_{i,t}\right\|$	**High Export Intensity Firms**	**Low Export Intensity Firms**	**High Import Intensity Firms**	**Low Import Intensity Firms**
Exports as a Percentage of Sales	0.027*** [0.00]	0.022*** [0.00]	-0.015 [0.01]	0.03*** [0.00]
Growth in Sales	0.21** [0.09]	0.05 [0.07]	-0.11 [0.20]	0.17** [0.07]
Exchange Rate Volatility	0.04 [0.07]	-0.18*** [0.04]	-0.33** [0.13]	-0.09*** [0.03]
Market Capitalization	-0.22*** [0.07]	-0.34*** [0.10]	-0.32*** [0.17]	-0.24*** [0.05]
R-Sq	0.28	0.21	0.001	0.39
Total No. of Obs.	2168	1447	226	3387
No. of Groups	258	318	25	321

Note: *** Denotes `significant at 1%`. Terms inside the brackets are standard errors adjusted for Hetrosckadasticity across clusters.

[7] The cut-off of 90 percent represents the 95th percentile of firms in terms of their export share. Similarly, cut-off of 25 percent represents 95th percentile of firms in terms of their import intensity (imports/income).

We start by focusing on the coefficient on exchange rate volatility – the key variable of interest for us. The coefficient on it is no longer significant for firms with a high level of export intensity. In fact it carries a positive sign. For firms with low export intensity, however, the coefficient on exchange rate volatility remains negative and significant. This result seems to support our hypothesis that firms with a `high` degree of export intensity respond differently to exchange rate volatility possibly on account of greater reliance on financial instrument for hedging exchange rate risks. Unfortunately at this stage we do not have data on the use of exchange rate derivatives by these firms to test this hypothesis directly.

Looking at the firms with high import intensity, we find that their exposure elasticity is negatively related to exchange rate volatility in line with our earlier results. In fact, the coefficient on exchange rate volatility is much larger in size for `high` import intensity firms than for `low` import intensity firms. This makes intuitive sense since firms with `high` import intensity are affected much more by volatility in exchange rate as compared to firms with `low` import intensity. Another interesting result is that share of exports in total sales is not significantly related to the size of operational currency mismatch in the case of `high` import intensity firms even though it is significantly related in the case of low import intensity firms. Coefficients on the remaining variables are unchanged in sign and significance.

Next section looks at the relationship between exposure elasticity and firm level performance measured by their output growth and earnings per share.

Aggregate Exchange Rate Exposure and Firm Level Performance

Objective of this exercise is to look at the impact of large currency exposure on firm level performance. We use the measure of exposure elasticity described above to do so. Details of the models and their estimation are provided below.

Output Growth And Exposure

$$(1)\ \ Y_{i,t} = \alpha_i + \beta X_{i,t} + \sum_{t=0}^{p} \gamma_i D_t + \sum_{t=0}^{q} \lambda \times D_t \times Exposure_{i,t} + \sum_{t=0}^{s} \theta \times Exposure_{i,t} + \varepsilon_{i,t}$$

Our first specification is given above. The dependent variable in the above equation is the growth rate of output. $X_{i,t}$ is a set of explanatory variables that vary across firms and time periods. These include the growth rates of *employment (*as measured by the number of workers) and *unit labor cost* (defined as Total Emoluments to Workers divided by the Total Value of Output) along with growth in *market capitalization* and *share of exports in total sales*[8].

As we saw in section 2, there has been a significant increase in large sized exposures (both negative and positive) in recent years concomitant with the rise in exchange rate volatility. We therefore try to capture the impact of large exposure elasticity on firm performance by using a

[8] Fisher's Unit Root Test allows us to reject the null hypothesis of a unit root for all the variables (including output growth) in our model.

dummy. $Exposure_{t,t}$ is the exposure elasticity dummy that takes a value 1 whenever the absolute value of exposure elasticity $\delta_{i,t}$ is greater than 2.5[9] and zero otherwise. We also try to include absolute exposure elasticity in levels but it does not have a significant coefficient and our main results remain unchanged even after its inclusion. Hence we do not report those results separately.

Since our focus is on the impact of exchange rate exposure of firms which would be expected to have a greater impact during episodes of large currency changes we include a dummy for large nominal depreciation of Rupee and its interaction with the exposure dummy in our analysis. D_t is the dummy for large nominal depreciation of Rupee which takes a value of one whenever the annual rate of increase in the monthly Rupee/USD exchange rate is more than one standard deviation above the average annual rate of exchange rate change for this period and zero otherwise. With this criterion, currency devaluations are defined as sharp decline in Rupee / USD exchange rate exceeding 10 percent on an annual basis. The reason for using nominal Rupee USD exchange rate for defining depreciation episodes is that Indian Rupee has been de-facto pegged to USD (Ref. Patnaik and Shah (2010))[i]. This definition helps us identify four episodes of large depreciations in Indian Rupee – 1995, 1998, 2008 and 2011.

The interaction term between the crisis dummy and firm level exposure dummy captures the impact of higher level of exchange rate exposure on firm's output growth during episodes of large exchange rate depreciations. An overall exposure elasticity of 1 increases the output growth of firms in our sample by θ during `normal` times. At the same time, an exposure elasticity of 1 changes the output growth of firms by $\theta + \lambda$ during currency depreciation episodes. $\varepsilon_{i,t}$ is the random error. In addition to the above variables we also try a number of industry and firm level fixed effects to capture the impact of omitted variables. They do not, however, affect our main results. The entire sample consists of 500 firms over a period of 17 years or 8500 firm-years of data. Table [4] gives the results from this exercise. We discuss the results in the following paragraphs.

The second column of Table 4 gives the estimation results for the entire sample. The key variable of interest for our analysis is the exposure dummy which enters with a positive coefficient in the estimated equation indicating that a higher level of exposure elasticity is associated with a higher level of output growth. Though the coefficient on the exposure dummy is not significant, this none the less indicates that firms tend to take on currency exposure as a rational response to the higher output growth associated with it during normal times. This result holds across different sub-samples as seen from the remaining columns.

Next two rows give the coefficients on current and lagged dummy for large currency depreciations. While literature has found both positive and negative effects of currency depreciations on growth, theory is not clear regarding the direction of this relationship. Large currency depreciations can help growth by boosting exports. At the same time they can also have an adverse impact on growth through a rise in the cost of imported inputs, worsening of balance

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[9] The cut-off value of 2.5 represents the top 2.5 percentile of the distribution of $|\delta_{i,t}|$. Using alternative values of this cut-off does not change our results significantly.

sheets and an increase in the financial fragility. Large currency depreciations are associated with a decline in output growth as seen from the negative coefficients on the current and lagged dummies. However, coefficients on these dummies are insignificant except for the case of manufacturing firms where the coefficient is large and significant. Episodes of large Rupee depreciation reduce the output growth of manufacturing firms by nine percent on average with a lag of one year. One possible explanation for this result can be greater reliance of manufacturing sector on imported inputs with few domestic substitutes. The other reason can be greater reliance of manufacturing firms on external finance due to relatively less own equity capital. However, further exploration of this result would require more detailed data than is currently available. We therefore leave it for future research.

Finally, we look at the interaction term between the depreciation dummy and the exposure size dummy. The coefficient on this interaction term is negative and significant for all the subsamples in our study. Thus, large currency depreciations reduce the output growth in firms with `high exposure elasticity' (i.e. firms with exposure elasticity above 2.5) by a much higher percentage compared to the rest. For the entire sample, the average loss in output growth due to large currency depreciation is almost three percentage points higher in firms with `high` exposure elasticity as compared to the rest. Thus, policy makers and business managers alike should monitor their `operational` exposure to exchange rate fluctuations.

Of the other variables used in the model employment growth is the only one which has a significant coefficient. The rest do not appear to have a significant impact on output growth. Higher employment growth is associated with a faster output growth as expected. Employment elasticity of output growth is higher for non-manufacturing firms when compared to manufacturing firms.

It is quite possible that large negative and positive exposure elasticity has different impact on firm level performance. We therefore repeat our analysis with separate dummies for large negative and positive exposures. However, Wald test for coefficient restrictions showed that the coefficients on them were not significantly different from each other. We therefore continue with our original specification.

Text Table [4]

Dependent Variable: Output Growth	**Entire Sample**	**Manufacturing**	**Non-Manufacturing**	**Excluding Mining**	**Excluding Services**
Exposure Dummy	0.02 [0.05]	0.02 [0.05]	0.07 [0.10]	0.05 [0.028]	0.00 [0.05]
Depreciation Dummy	-0.027 [0.05]	-0.037 [0.05]	-0.15 [0.15]	-0.02 [0.05]	-0.02 [0.05]
Lag Depreciation Dummy	-0.07 [0.05]	-0.09** [0.04]	-0.00 [0.14]	-0.07 [0.06]	-0.05 [0.05]
Deprecation Dummy *Exposure Dummy	-0.027*** [0.004]	-0.047** [0.02]	-0.027*** [0.006]	-0.04** [0.01]	-0.03*** [0.003]
Employment Growth	0.27** [0.13]	0.15** [0.07]	0.73*** [0.17]	0.015** [0.07]	0.26** [0.13]
Unit Labor Cost Growth	0.013 [0.04]	0.02 [0.04]	0.03 [0.05]	0.03 [0.03]	0.00 [0.04]
△ Market Capitalization	-0.02 [0.05]	0.03 [0.05]	-0.15 [0.09]	-0.05 [0.05]	-0.01 [0.05]
R-sq	0.05	0.03	0.12	0.027	0.06
Total No. of Obs.	1409	1025	384	1289	1351
No. of Groups	222	157	65	207	208

Note: ` ***` & `**` denote significance at 1 and 5 percent level respectively. Figures inside the brackets are robust standard errors corrected for intragroup correlation.

Profitability and Exposure

The key insight from the above exercise is that higher level of exchange rate exposure elasticity is associated with a greater loss in output growth during episodes of large Rupee depreciation even though it appears to affect output growth positively during `normal` times. We next try to do the same analysis for earnings per share which is used as a measure of firm's profitability. Our model is the same as in equation 1 except that the dependent variable is now earnings per share[10]. Table [5] presents the results from this exercise.

The first row of Table [5] gives the coefficient on exposure dummy. Unlike the model for output growth, the sign of the coefficient on exposure dummy changes across different sub-samples in case of the model for earnings per share. The coefficients are insignificant in all the cases, though. Overall, there does not appear to be a strong relationship between `high` exposure elasticity and firm level profitability.

[10] We tested for the presence of unit roots in all our series using Fisher's panel unit root test and were able to reject the null of unit root for all of them.

Looking at the depreciation dummy we find that the coefficient is positive but insignificant for all the sub-samples. Since the coefficient on depreciation dummy gives the average impact of large currency depreciations on earnings per share when the exposure dummy is zero, a positive coefficient indicates that large currency depreciations tend to raise earnings per share for firms with exposure elasticity below the threshold of 2.5. In other words, currency depreciation are beneficial for firms with 'low' exposure elasticity.

Third row of the table below gives the coefficient on the interaction term between the depreciation dummy and the exposure dummy. The coefficient on the interaction term is negative and significant for all the sub-samples except for non-manufacturing firms where the coefficient is insignificant though of correct sign.

Of the remaining variables, unit labor cost and growth in market capitalization are significantly correlated with earnings per share. While higher unit labor cost is associated with lower earnings per share as expected, the coefficient is significant for manufacturing firms only at 10 percent level of significance. Growth in market capitalization is positively related to earnings per share. In the last case, the direction of causality can actually run from earnings per share to the growth in market capitalization as high earnings per share increases the market price of share and hence the value of company's outstanding capital stock. We therefore try to use lagged growth in market capitalization as an instrument. Our results remain unchanged with lagged market capitalization as instrument. One possible explanation for this result is that higher market capitalization, by lowering the cost of raising capital increases earnings per share of firms.

Once again, `high` exposure elasticity (elasticity above 2.5) significantly raises the cost of currency depreciations in terms of lower earnings per share. While earnings per share increases slightly in response to currency depreciation for firms with `low' exposure elasticity, it declines significantly in case of firms with `high' exposure elasticity. The difference is especially noticeable for manufacturing firms.

In the next section we try to explore possible transmission channel from exposure elasticity to firm level output growth.

Text Table [5]

Dependent Variable: **Earnings Per Share**	**Entire Sample**	**Manufacturing**	**Non-Manufacturing**	**Excluding Mining**	**Excluding Services**
Exposure Dummy	-0.82 [1.5]	-2.2 [2.16]	1.2 [2.2]	-0.67 [1.6]	-2.8 [1.8]
Depreciation Dummy	0.59 [1.3]	0.62 [2.1]	0.51 [1.7]	0.70 [1.3]	0.49 [1.7]
Depreciation Dummy *Exposure Dummy	-4.2** [1.7]	-5.3** [2.4]	-2.5 [2.5]	-3.9** [1.7]	-4.4** [2.1]
Employment Growth	-0.32 [0.85]	1.9 [0.99]	-1.29 [1.1]	-0.31 [0.92]	1.8 [0.97]
Unit Labor Cost Growth	-1.17** [0.50]	-1.96 [1.1]	-1.16** [0.53]	-1.2** [0.54]	-1.6 [0.9]
△ Market Capitalization	4.49*** [0.75]	5.1*** [1.3]	4.3*** [0.94]	4.6*** [0.79]	5.7*** [0.97]
R-sq	0.14	0.17	0.13	0.16	0.13
Total No. of Obs.	1409	1025	384	1289	1351
No. of Groups	222	157	65	207	208

Note: ` ***` & `**` denote significance at 1 and 5 percent level respectively. Figures inside the brackets are robust standard errors corrected for intragroup correlation.

Capital Expenditure and Exposure Elasticity

One of channels through which high exposure elasticity can lead to a reduction in output growth is through lower investment. We try to explore that channel in this section. Below we present the estimates of a model for firm level capital expenditure augmented with variables capturing firm level exposure. Unfortunately we do not have data on capital expenditure for the firms in our sample prior to year 2002 hence we have to restrict this part of our analysis to period after year 2002.

Text table 6 presents the results from this exercise. Our dependent variable is the log of capital expenditure[11]. We use a log-linear specification with a single lag of the dependent variable for the benchmark model. Since there are well known problems of estimating dynamic panel models with lagged dependent variable¸ we use the system GMM estimator suggested by Arellano and Bover (1995) and fully developed by Blundell and Bond (1998) for our analysis. Key variables of interest for us are the dummies for exposure and currency depreciation along with their interaction term. However, we also use several firm specific variables that can potentially affect the level of capital expenditure by the firm. At the same time we also include industry specific

[11] We test for the presence of unit root in the series for capital expenditure using Fisher's panel unit root test and are able to reject the null hypothesis of unit root. The test however does point towards persistence in the series in the form of lagged dependent variable.

time effects to capture industry specific omitted variables that vary over time. These omitted variables could include industry specific shocks to demand and/or productivity along with industry specific policy shocks.

The first row in Table 6 gives the coefficient on the lagged dependent variable which is positive and significant for all the specifications. Capital expenditure does seem to exhibit strong persistence. Given that the decisions regarding capital expenditure are long-term, persistence in shocks to capital expenditure makes intuitive sense.

The second row shows the coefficient on the dummy for large currency depreciation. In combination with the interaction term in column 4, this coefficient can be interpreted as the impact of large currency depreciation on firms with `low`[12] exposure elasticity. Large currency depreciation seems to boost the level of capital expenditure for firms with `low' exposure elasticity *ceteris paribus* (though the coefficient is not significant). On the other hand, firms with `high` exposure elasticity see a significant reduction in their capital expenditure during episodes of large currency depreciations as seen from the negative and significant coefficient on the interaction term between the depreciation and exposure dummies. To elaborate further, firms with `large` exchange rate exposure elasticity see a reduction in their capital expenditure by about 25 basis points relative to the rest during episodes of large currency depreciation. On the whole, firms with large exchange rate exposure see a reduction in their capital expenditure by around 15 to 18 basis point during episodes of large currency depreciation while `low` exposure firms see an increase in their capital expenditure by around 10 to 12 basis points.

Next we look at the dummy for `high` currency exposure (column 3 in Table 6). Firms with `high` exchange rate exposure (exposure elasticity above 2.5) tend to have a higher level of capital expenditure compared to the rest as seen from the positive and significant coefficient on the exposure dummy. Compared to the `low` exposure firm; firms with `high` exposure elasticity have a capital expenditure level that is 24 to 25 basis points higher on average. However, this gap is reversed during periods of large currency depreciations. Firms with `high` exchange rate exposure tend to see a capital expenditure level that is 2 to 3 basis points lower than the low exposure firms on average. Thus firms with `high` exposure elasticity perform better than the rest during `normal` periods but are worse off than the rest during periods of large currency depreciation when we look at the level of capital expenditure. It must be emphasized that these correlations do not necessarily imply a causal relationship between exposure elasticity and the level of capital expenditure. Establishing such a causal relationship would require further analysis beyond the scope of this study.

The remaining variables do not exhibit a significant relationship with the level of capital expenditure once we have taken in to account time varying industry level fixed effects.

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[12] `Low` exposure elasticity is defined as `adelta`<2.5 while `High` exposure elasticity is defined as `adelta`>2.5.

The key insight of our analysis in this section is that, just like in the case of output growth and earnings per share, `high` exchange rate exposure elasticity is associated with a lower level of capital expenditure during episodes of large currency depreciation even though it is associated with a higher level of capital expenditure during `normal` time. This provides one potential channel through which `high` exposure elasticity leads to a lower output growth and lower earnings per share during periods of large currency depreciation.

Text Table [6]

Dependent Variable: Log(Capital Expenditure)	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Log(Capital Expenditure[t-1])	0.50*** [0.16]	0.53*** [0.09]	0.52*** [0.08]	0.54*** [0.09]
Depreciation Dummy	0.12 [0.07]	0.11 [0.07]	0.12 [0.07]	0.12 [0.07]
Exposure Dummy	0.25** [0.1]	0.27** [0.10]	0.27** [0.09]	0.27** [0.10]
Depreciation Dummy* Exposure Dummy	-0.27** [0.12]	-0.27** [0.11]	-0.29** [0.12]	-0.29** [0.10]
Log(Market Capitalization)	0.16 [0.09]	0.15 [0.09]	0.17** [0.06]	0.17** [0.06]
Log(Income)		-0.17 [0.15]		-0.06 [0.14]
Exports as Percentage of Sales			-0.00*** [0.00]	-0.00*** [0.00]
Constant	9.7** [4.1]	10.5*** [2.39]	9.2*** [2.2]	9.3*** [4.1]
Sargan's Test (P-Val.) Total No. of Obs. No. of Groups	0.096 2477 405	0.26 2476 405	0.028 2445 402	0.057 2456 402

Conclusion

This paper aims at exploring the causes and effects of large `operational` currency exposure in one of the key emerging markets of the world – India. We use a firm level panel data set covering the period between 1995 and 2011. The key findings of the paper can be summarized as follows – exchange rate volatility has a significant effect on the level of currency exposure of Indian firms apart from firm specific factors such as size growth. Further, large `operational` exposures have significant impact on the level of output growth, earnings per share and capital expenditures of the firms during episodes of large exchange rate depreciations even though they seem to encourage higher capital expenditure and output growth during `normal` times. The results have important implications for policy makers worried about mitigating the impact of exogenous shocks. Implicit and explicit guarantees with regards to the value of exchange rate tend to raise the vulnerability of the economy to exchange rate shocks at same time that they encourage capital expenditures and possibly output growth during ‘normal’ times.

References

Adler, M. and B. Dumas, ``Exposure to Currency Risk: Definition and Measurement," *Financial Management* 13 (1984), 41-50.

Bai, J. and P. Perron, “Computation and Analysis of Multiple Structural Change Models," *Journal of Applied Econometrics* 18 (2003), 1-22.

Bodnar, G. M. and M. H. F. Wong, “Estimating Exchange Rate Exposures: Some "Weighty" Issues," Technical Report, NBER, 2000

Bodnar, G.M. and R.C. Marston, ”A Simple Model of Foreign Exchange Exposure,” Working Papers, University of Pennsylvania, Wharton School, Weiss Center, Link: http://finance.wharton.upenn.edu/weiss/wpapers/2000/00-3.pdf

Dominguez, K. M. and L. L. Tesar, “Exchange rate exposure,” *Journal of International Economics,* Volume 68, January 2006, 188-218.

Eichengreen, Barry, Ricardo Hausmann, and Ugo Panizza, 2007, “Currency Mismatches, Debt Intolerance, and the Original Sin: Why They Are Not the same and Why It Matters,” in Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences, edited by Sebastian Edwards, NBER, University of Chicago Press

Goldberg, P. and M.M. Knetter,” Goods Prices and Exchange Rates: What Have We Learned?” *Journal of Economic Literature*, 1997, vol. 35, issue 3, 1243-1272

Goldber, L.,” Exchange Rates and Investment in United States Industry,” *The Review of Economics and Statistics*, Vol. 75, No. 4, November 1993, 575-588

Goldberg, L. and J.M. Campa,” Investment in Manufacturing, Exchange Rates and External Exposure,” Journal *of International Economics*, Volume 38, Issues 3–4, May 1995, 297–320

Goldberg, L. and J.M. Campa,” Investment, Pass-Through and Exchange Rates: A Cross-Country Comparison” *International Economic Review*, Vol. 40, No. 2, May 1999, 287-314

Goldstein, M. and P. Turner, “Controlling Currency Mismatches in Emerging Market Economies,” April 2004, Institute of International Economics, Washington

Gupta, P., D. Mishra and R. Sahay,"Behavior of Output During Currency Crisis," *Journal of International Economics* , Volume 72, Issue 2, July 2007, 428-450

Hong, K. and A. Tornell," Recovery from a Currency Crisis: Some Stylized Facts," *Journal of Development Economics*, Volume 76, Issue 1, February 2005, 71–96

Hutchinson, M.M. and I. Noy," How Bad Are Twins? Output Costs of Currency and Banking Crises," *Journal of Money, Credit, and Banking*, Volume 37, Number 4, August 2005, 725-752

Jorion, P., "The Exchange-Rate Exposure of U.S Multinationals," *The Journal of Business*, Volume 63, July 1990, 331-345

Lane, Phillips R. and Gian Maria Milesi-Ferretti," The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970–2004," *Journal of International Economics* Volume 73, Issue 2, November 2007, 223–250

Nucci, F. and A.F. Pozzolo," Investment and the Exchange Rate: An Analysis with Firm-Level Panel Data," *European Economic Review,* Volume 45, Issue 2, February 2001, 259–283

Parsley, D. C. and H. A. Popper, "Exchange rate pegs and foreign exchange exposure in East and South East Asia," *Journal of International Money and Finance*, Volume 25, October 2006, 992-1009.

Ranciere, Romain, Aaron Tornell, and Athanasios Vamvakidis, 2010, "Currency Mismatch, Systemic Risk and Growth in Emerging Europe," *Economic Policy,* Volume 25, Number 64, October 2010, 597-658

Shah, Ajay and Ila Patnaik, "Does the Currency Regime Shape Un-hedged Currency Exposure?", *Journal of International Money and Finance*, Volume 29, Issue 5, September 2010, 760–769

Appendix: Industry wise Delta

	Metallurgy		Chemicals		Machinery	
Year	No. of Obs.	Mean Delta	No. of Obs.	Mean Delta	No. of Obs.	Mean Delta
1995	1	1.193451	2	-1.23104	0	
1996	3	0.246302	1	-0.78443	0	
1997	2	0.451515	1	-3.209	1	-4.91349
1998	3	6.388232	3	0.484065	2	-0.65666
1999	7	23.05454	2	-0.27246	1	2.356646
2000	23	4.167277	16	-0.66937	10	0.402342
2001	24	1.949874	19	-3.85829	13	-2.93369
2002	23	2.382144	19	-1.01196	13	2.076542
2003	23	14.47238	19	-0.8049	13	-0.04326
2004	24	2.620868	18	-0.27842	13	-0.47933
2005	26	-0.15865	18	-0.60971	13	0.388311
2006	28	1.214891	18	-1.06772	13	1.084965
2007	28	2.476182	18	-0.44248	13	-1.99512
2008	28	-0.99363	19	-0.63864	13	0.908894
2009	29	2.242941	18	1.002114	13	0.335465
2010	28	0.424274	19	-0.46067	13	0.414132
2011	28	-0.17725	19	-0.80912	14	0.58856

	Electronics		Textiles		Transport Equipment	
Year	No. of Obs.	Mean Delta	No. of Obs.	Mean Delta	No. of Obs.	Mean Delta
1995	1	-0.7937	1	-1.94254	2	-0.50047
1996	1	-1.57033	0		1	0.73694
1997	1	-0.07133	0		1	-0.53021
1998	1	-1.50766	0		2	2.274721
1999	1	-3.23165	0		2	1.668867
2000	2	-1.33594	6	0.007516	5	1.05536
2001	3	-1.53013	7	-0.19214	4	-1.21456
2002	2	-5.35748	8	1.656129	5	-2.46397
2003	2	-2.82955	9	0.766101	5	0.205531
2004	3	-1.00523	9	0.65112	5	0.36083
2005	3	-0.30535	9	0.955959	5	0.735924
2006	3	-0.47062	10	5.943482	5	0.793782
2007	3	-2.13367	10	4.21266	5	1.114788
2008	3	0.32503	10	4.778178	6	1.976183
2009	3	-0.07861	10	4.028325	6	2.83747
2010	3	-0.24076	10	3.813468	6	1.011854
2011	3	-0.2631	11	1.878846	6	0.918411

Appendix: Industry wise Delta

	Plastic and Rubber		Food		Wood and Leather	
Year	No. of Obs.	Mean Delta	No. of Obs.	Mean Delta	No. of Obs.	Mean Delta
1995	2	-0.34225	1	2.035492	2	-0.01309
1996	0		1	1.397972	2	-0.00033
1997	0		1	-3.11366	2	-0.33909
1998	0		2	-1.45705	2	1.196122
1999	0		3	-0.40765	1	-0.79799
2000	10	1.921495	10	2.767622	3	0.72016
2001	10	0.207985	14	-3.12353	3	0.544789
2002	10	1.591208	15	-3.97391	4	0.582204
2003	10	1.365384	16	-0.79257	4	0.029509
2004	11	0.028831	14	-3.15332	4	-0.02858
2005	11	6.273344	17	0.040609	4	0.241882
2006	11	11.77141	18	-0.12447	4	-0.0283
2007	11	1.987754	18	0.692841	4	-0.18301
2008	11	0.601292	18	-0.12431	4	-0.10368
2009	12	0.896686	19	-0.0969	4	0.046268
2010	12	-0.17889	19	-0.97554	4	0.054782
2011	11	0.110759	19	2.280987	4	-1.14883

	Non-Financial Services	
Year	No. of Obs.	Mean Delta
1995	1	-0.00191
1996	0	
1997	0	
1998	1	1.399382
1999	1	-1.45446
2000	12	1.648504
2001	14	10.4001
2002	11	11.07501
2003	9	10.66461
2004	10	7.63747
2005	9	12.61214
2006	7	2.708564
2007	9	2.652988
2008	10	4.093751
2009	12	4.055271
2010	12	3.754429
2011	11	-0.17544

Appendix

Table A

Dependent Variable: PAT Growth	Entire Sample	Manufacturing	Non-Manufacturing
Exchange Rate Volatility	3.2 [31.3]	-2.2 [34.0]	11.1 [50.5]
R-squared	0.002	0.004	0.006
F-statistic	1.45 [0.10]	1.96 [0.00]	0.98 [0.47]
Total Number of Observations	6328	3150	3178

Table B

Dependent Variable: Abs. size of *h1-h2*	Entire Sample	Manufacturing	Non-Manufacturing
Exchange Rate Volatility	-0.012*** [0.002]	-0.012*** [0.003]	-0.012*** [0.003]
R-squared	0.01	0.04	0.01
F-statistic	3.98 [0.00]	3.77 [0.00]	2.47 [0.00]
Total Number of Observations	6506	3214	3292