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Real Effective Exchange Rate and Manufacturing Sector Performance: Evidence from Indian firms

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Real Effective Exchange Rate and Manufacturing Sector Performance: Evidence from Indian firms[1]

Abstract

We explore the impact of Real Exchange Rate changes on the performance of Indian manufacturing firms over the period 2000-2012. Our empirical analysis shows that real exchange rate movements have a significant impact on Indian firms' performance through the cost as well as the revenue channel. The impact depends upon the share of imports & exports along with the degree of market power as reflected in the time varying firm level mark up. However, presence of overvaluation negates the beneficial effects of exchange rate appreciation operating through the lower input cost channel. The same cannot be said about the 'price competitiveness' effect working through the export channel.

JEL Classifications: F1, F4

Keywords*: Real Exchange Rate, Manufacturing Performance, Mark up*

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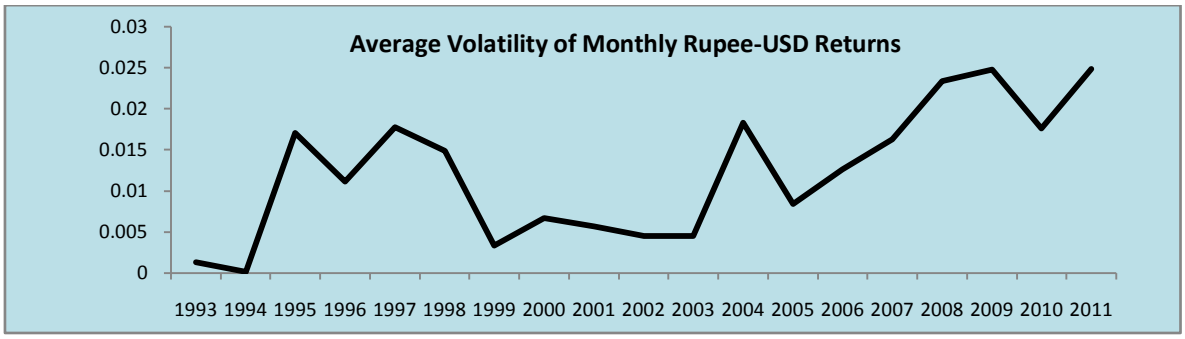
I. Introduction

International economics has long been concerned with the effects of exchange rate movements on the real economy. The topic continues to attract theoretical as well as empirical researchers alike. This paper contributes to the large body of empirical literature looking at the impact real exchange rate on firm level performance by using a newly compiled dataset of around 300 Indian manufacturing firms. We find several interesting results with regards to the importance of real exchange rate movements in influencing the performance of Indian manufacturing firms. The results and their implications are discussed in detail below.

India presents a unique case for studying the impact of exchange rate movements. Prior to the Balance of Payments crisis in 1991, Indian Rupee was pegged to a basket of currencies dominated by the US Dollar. The external payment crisis of 1991 forced the Reserve Bank of India (RBI) to implement a set of market oriented financial sector reforms and a paradigm shift from fixed to market-based exchange rate regime in March 1993.[2] Institution of Current Account convertibility in August 1994 and gradual liberalization of Capital Account along with other trade and financial liberalization measures meant a rise in total turnover in the foreign exchange market by more than 150% from USD 73.2 billion in 1996 to USD 130 billion in 2002-03 and further to USD 1100 billion in 2011-12[3]. A direct outcome of these changes has been a rise in the volatility of Indian Rupee. Figure 1 plots annual volatility of monthly Rupee-USD log returns to illustrate this point.

Figure 1



In this backdrop, RBI exchange rate management policy has aimed at maintaining orderly conditions in the foreign exchange market by eliminating lumpy demand and supply and preventing speculative attacks, without setting a specific exchange rate target. RBI has used a combination of tools including sales and purchase of currency in both the spot and the forward segments of the foreign exchange market, adjustment of domestic liquidity through the use of Bank Rate, CRR, Repo rate etc. and monetary sterilization through specialized instruments[4]. An

[2] See the Special edition of RBI's *Reports on Currency and Finance*, Vol. III (2005-06) for detailed discussion on the evolution of India's foreign exchange market. (Link: http://rbidocs.rbi.org.in/rdocs/content/PDFs/89704.pdf) See Sengupta and Sengupta (2012) for a discussion on India's Capital Account Management between 1990-2011.

[3] Table A in Appendix presents the growth in the size of foreign exchange market in India over time.

[4] For instance, RBI resorted to a net purchase of 5.4 billion USD between April-August 1997 to reduce the acute upward pressure on Rupee resulting from buoyant capital inflows and sluggish import demand. Then, as Rupee weakened in the last week of August, partly in response to the East Asian financial crisis, RBI sold foreign exchange worth 978 million USD to strengthen the Rupee. Again, a surge in capital inflows

interesting feature of RBI's intervention during this period has been asymmetry during episodes of appreciation and depreciation.

Figure 2

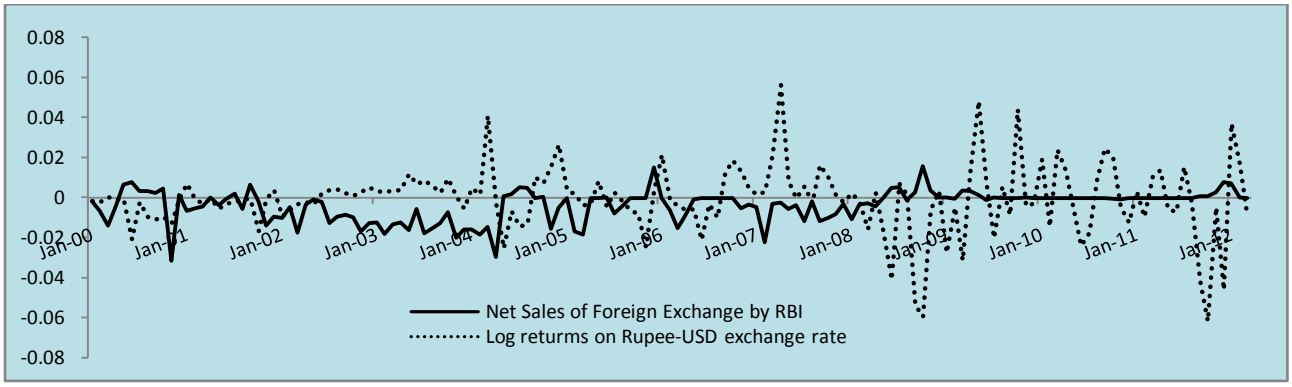


Figure 2 plots Net Sales of Foreign Exchange Assets by RBI as a percentage of total turn-over in the foreign exchange market[5] along with monthly log returns on Rupee – USD exchange rate[6]. One can see that RBI has been intervening actively in the foreign exchange market during episodes of Rupee appreciation by purchasing foreign exchange while following a hands-off approach during episodes of Rupee depreciation. Underlying this asymmetry has been the notion that an appreciated Rupee would hurt exporters through a loss in cost competitiveness and by corollary, adversely affect India's growth performance. Empirical evidence on the impact of exchange rate on the performance of Indian firms is however non-existent[7]. Present paper tries to fill this important gap in the literature.

Exchange rate movements could affect firm performance through a number of channels, such as the cost of imported inputs relative to other factors of production, price of exports relative to foreign competitors or the cost of external borrowing. Although the impact on firm performance is only one component determining how exchange rate changes affect aggregate economic growth, it can be an important and significant determinant of the same. Our paper looks at the short term and long term effect of real exchange rate change on firm performance using data on roughly 300 Indian firms. An important advantage of using firm level panel data is that it allows us to control for unobservable firm level effects. Although unmeasured, these individual idiosyncrasies reflect important characteristics of a firm, which are likely to influence its response to exchange rate movements. We use time varying firm specific mark-ups along with firm and industry specific dummies to capture heterogeneity in firm's response to exchange rate changes.

Main findings of the paper are that real exchange rate changes affect long term and short term firm level performance through cost as well as revenue channels but the impact is more pronounced for firms with smaller market power. The results hold true for various alternative measures of firm performance such as output growth, sales growth, income growth and growth in

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starting 2004 forced RBI to purchase foreign exchange in order to ward off the upward pressure on Rupee. This time around RBI's intervention was sterilized using *Market Stabilization Scheme* bonds issued specifically for this purpose.

[5] Negative net sales implies net purchase of foreign exchange by RBI

[6] Positive return implies appreciation of Rupee.

[7] Recent paper by Rajeswari Sengupta (2012) being the only exception.

market capitalization. Real exchange rate appreciation benefits firms with higher dependence on imported inputs through a lower variable cost while it hurts the firms with a greater dependence on exports through lower `price` competitiveness. The effect is more pronounced for firms with lower market power. Another interesting finding of our paper is that overvaluation in exchange rate negates the beneficial effect of exchange rate appreciation through the `cost` channel even though it does not significantly affect the impact through the revenue channel. This highlights another channel through which an overvalued exchange rate can adversely affect a country's growth performance.

The paper is organized as follows – Section 2 provides a brief review of the literature. Section 3 describes the dataset in detail. Section 4 lays the empirical methodology and presents our results. Section 5 concludes.

II. Literature Review

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 its 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 variables such as investment or employment (e.g. Goldberg (1993), Campa and Goldberg (1995, 1999), Nucci and Pozzollo (2001), Demir (2010)). While this paper is most closely related to the last strand of literature, most of the existing papers in this literature look at developed 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.

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 including firm level export and import shares and firm level mark ups.

III. Data

Our primary source of data is the PROWESS database compiled by the Centre for Monitoring Indian Economy. The original database contains financial performance of over 27,000 companies. Out of these we include 250 manufacturing firms listed on the Bombay Stock Exchange (BSE) and included in the BSE 500 index over the period 2000-2012. Firms included under the BSE 500 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. Since our focus is on manufacturing firms, we only include those in our sample. We also check our sample for potential outliers. One firm for which data appeared obviously misreported was removed from the sample.

To check how well our sample captures fluctuations in aggregate data we plot change in output growth and investment in the sample and aggregate data in the figures below. Our sample manages to capture broad trends in aggregate data reasonably well. After rising steadily between 2004 and 2007, output growth and investment declined in the aftermath of the 2008 crisis. While the output growth recovered quickly before slowing down for a second time 2010, investment maintained a sustained downward trend after 2008.

Figure 3

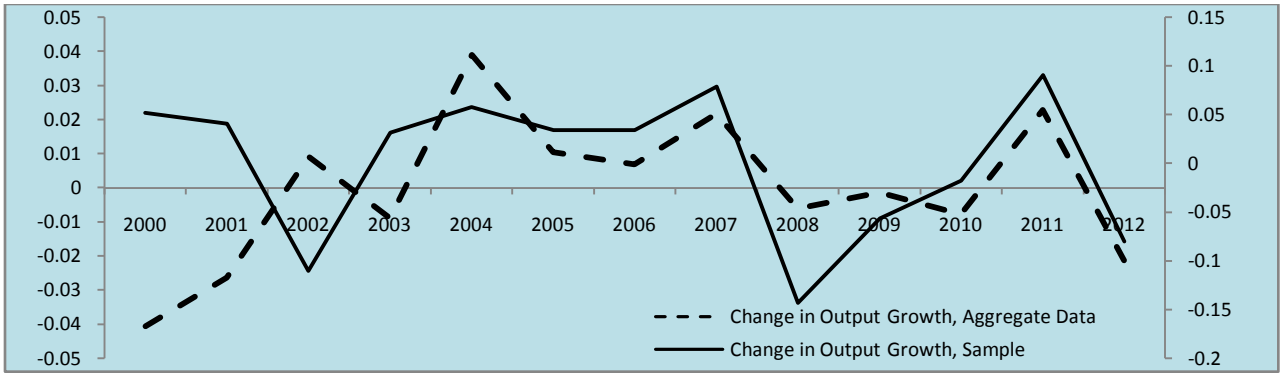
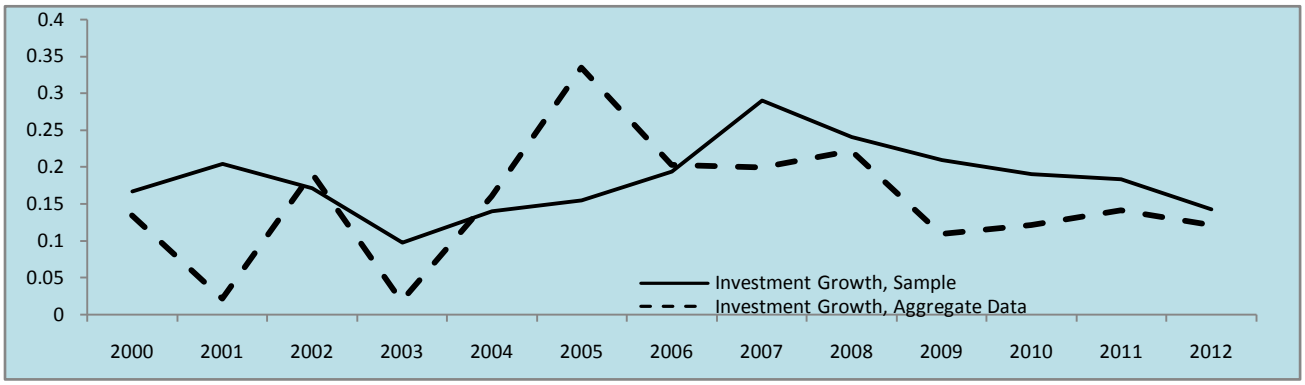
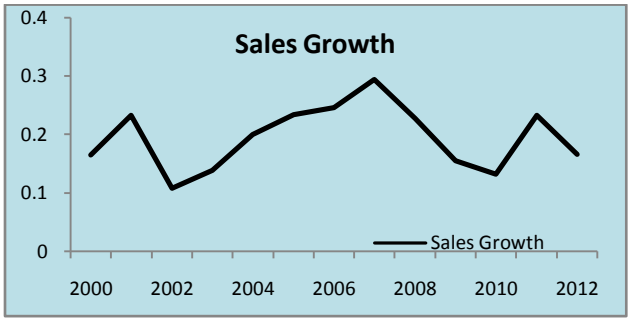


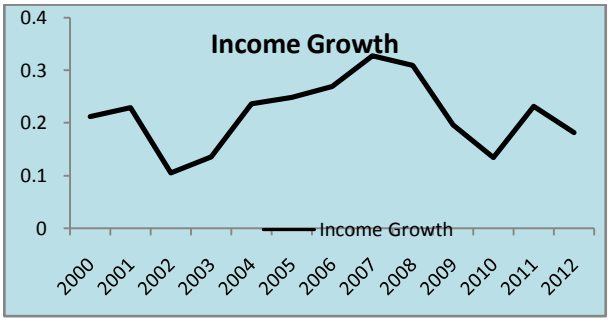
Figure 4

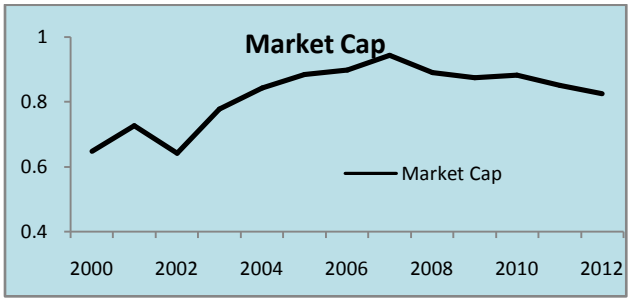


Plots of average sales growth, income growth and market capitalization present a similar picture. There is an increase in sales, income and market capitalization between 2004 and 2007 followed by a downturn in 2008 due to global financial crisis that originated in the US.

Figure 5







Text table 1 provides industry wise composition of our sample along with key characteristics such as output growth and trade shares. The first column gives the total number of observations for each sector in the entire sample followed by the share of each industry in total output in the second column. Metal and metal products constitute the largest percentage in terms of the number of observations followed by Chemicals and Food. Refinery constitutes the single largest sector in terms of its share of output followed by Metal products and Food.

The last two columns give industry wise average share of exports in total sales and share of imports in total intermediate inputs in year 2012 – both, indicating the trade orientation of each sector. In terms of trade orientation, Refinery has the largest share of exports in total sales as well as the largest share of imports in intermediate inputs. Transport equipment has the smallest degree of trade orientation as measured by the sum of export and import shares. As discussed above, shares of exports and imports have an important bearing on the impact of exchange rate movement on firm's performance. Data appendix gives year wise export and import shares for each of these industries. A larger share of exports in total revenue implies that an increase in price competitiveness following currency depreciation is likely to boost revenues, income as well as expected future profits of the firm. Similarly, the larger is the share of imported inputs in total cost, the greater is the increase in cost of production and the decline in current and future profits after exchange rate depreciation. The empirical model that follows incorporates firm specific export and import shares.

Text Table 1

Industry	No. of Obs.	Share in Output (%)	Average Export Share	Average Import Share
Metal & Metal Products	496	8.7	0.19	0.32
Chemicals	342	1.7	0.098	0.34
Machinery	243	2.7	0.10	0.18
Electronics	54	0.65	0.06	0.13
Textiles	179	1.1	0.22	0.22
Transport Equipment	95	3.9	0.07	0.05
Plastic & Rubber	207	0.63	0.16	0.19
Food	323	3.7	0.08	0.11
Wood & Leather	72	0.16	0.06	0.15
Refinery	126	41.6	0.33	0.74
All industries	1716	100	0.19	0.25

IV. Empirical Methodology

Our baseline specification includes the standard output growth equation augmented with real exchange rate change interacted with time varying import and export shares of each firm. Equation 1 presents our base line specification:

$$\Delta y_{t,i} = \beta_1 \Delta l_{t,i} + \beta_2 \Delta k_{t,i} + \beta_3 \Delta ulc_{t,i} + \beta_4 \alpha_{t-1,i} \Delta e_t + \beta_5 \eta_{t-1,i} \Delta e_t + b' Z_{t,i} + \tau_t + \upsilon_{t,i} \quad (1)$$

$\Delta y_{t,i}$ is the growth rate of output of firm i defined as the difference in log of output. $\Delta l_{t,i}$ is the growth rate of labor while $\Delta k_{t,i}$ is the growth rate of capital i.e. investment[8]. Δulc is the growth rate of unit labor cost used as a proxy for productivity growth[9]. The first three variables on the right hand side can be derived easily from the basic Cobb-Douglas production function.

To this basic specification we add two terms capturing the impact of real exchange rate movements. The first term $\alpha_{t-1,i} \Delta e_t$ is the product of log difference in annual average *BI S* real effective rate index (REER from now on) of Rupee, Δe_t [10] and $\alpha_{t-1,i}$ - lagged share of imports in intermediate inputs. Firms with a higher share of imported inputs are likely to benefit more from Rupee appreciation on account of reduced variable cost. One therefore expects the coefficient on this term to be positive. Using similar logic, one would expect the coefficient on $\eta_{t-1,i} \Delta e_t$ - product of lagged export share and real exchange rate change - to be negative. Use of lagged import and export shares is done to avoid endogeneity bias induced by the possible correlation of these shares with the exchange rate. $Z_{t,i}$ is a set of industry specific and size dummies. In

[8] Growth rate of labor is calculated as the change in log of total number of workers employed while investment is calculated as the log difference in Gross Fixed Assets (this includes land and plant and equipment for production)
[9] Unit labor cost is calculated as the ratio of total worker emoluments and output.
[10] REER index is defined so that an increase denotes appreciation of Rupee.

addition, we use year dummies τ_t to account for year specific effects. We use random effects estimator to estimate our model as suggested by Haussmann's specification test. To check the robustness of our results we replace output growth with sales growth.

Table 1 below presents the results of this exercise. Starting with the key variables, we find labor and investment growth to be positively correlated with output and sales growth and unit labor cost growth to be negatively correlated with the same. All the coefficients are significant at 1 percent and have theoretically correct sign. Next we look at the coefficients on the two exchange rate terms. Once again, coefficients on both the terms have theoretically expected signs but the coefficient on real exchange rate interacted with the share of imports appears statistically insignificant. Overall, it appears that the `price competitiveness` effect of exchange rate appreciation operating through the revenue channel is stronger than the `cost` effect operating through lower price of imported inputs. This result is in contrast with studies like Nucci & Pozzolo (2001) that find a significant impact of both import and export channels on firm level investment. An important determinant of firm's response to exchange rate movements is their market power. Firms with a lower degree of market power are likely to experience greater impact of exchange rate movement on their output growth as compared to the firms with a higher degree of market power. Controlling for differences in trade orientation, the more significant effects of exchange rate changes in low-markup industries may arise because producers in high markup industries are more able to absorb shocks to their overall profitability than are producers in low-markup industries. Consequently, the link between changes in exchange rates and producer profitability and output growth is weaker in high-markup firms. We explore this relationship in the next section.

Market Power

Dornbusch (1987) Nucci (2001), Goldberg (1999) show that impact of exchange rate movement on firm's investment growth is inversely related to the degree of their market power. Assuming that the exchange rate changes are permanent and uncorrelated over time, they show that the impact of exchange rate changes on the marginal profitability (and hence investment growth) of firms depends upon their external trade orientation and the size of markups reflecting their market power. Following their insight we include a measure of market power in our extended model[11]. Following Domowitz, Hubbard and Petersen (1986) we define firm's markup as –

$$AMKP = \frac{\text{sales} + \text{change in inventories}}{\text{payroll} + \text{cost of materials}} \quad (2)$$

In the absence of data on marginal cost of production, the measure given in equation (2) is commonly used in empirical literature to capture firm and industry specific markups. PROWESS data set provides information on sales, inventories, worker's compensation and intermediate inputs for each firm; allowing us to calculate time varying firm specific mark ups. Text Table 2 presents industry wise average mark ups.

[11] In the absence of data for calculating distinct markups for sales in domestic and foreign markets we assume that the markups for the domestic and foreign sales are the same and are equal to the average markup calculated below.

Text Table 2

Industry	Average Mark up
Metal & Metal Products	4.15
Chemicals	5.5
Machinery	2.5
Electronics	3.3
Textiles	6.1
Transport Equipment	1.9
Plastic & Rubber	1.8
Food	4.4
Wood & Leather	2.7
Refinery	4.4

In order to capture the effect of market power on the relationship between firm's performance and exchange rate changes, we multiply the reciprocal of lagged mark up, $mkp_{i,t-1}^{-1}$, with the two exchange rate terms ($\alpha_{i,t-1} \times \Delta e_t$ & $\eta_{i,t-1} \times \Delta e_t$) in our baseline specification. Table 2 presents the results from this exercise. Introduction of mark ups makes coefficients on both the exchange rate terms significant with theoretically expected signs. The estimated coefficient of the interacting variables $\alpha_{i,t-1}, \Delta e_t$ and $mkp_{i,t-1}^{-1}$ is positive, suggesting that for a given share of imported inputs in total costs and a constant path of currency depreciation, lower price-cost margins are associated with a larger reduction in output, income and sales. Opposite is of course true in case of a currency appreciation. On the revenue side the coefficient on $\eta_{i,t-1} \times \Delta e_t \times mkp_{i,t-1}^{-1}$ is negative indicating that the effect of exchange rate depreciation on output and income is positive and increases with the exposure to export markets; on the contrary, it decreases with the market power of the firm, as measured by $mkp_{i,t-1}^{-1}$. Coefficients on other variables remain same as before.

Overall the results so far confirm the predictions of economic theory. However, we have assumed that exchange rate elasticity is homogenous across sectors. It is likely that the impact of exchange rate movements varies across sectors depending upon differences in the degree of import penetration in the domestic market, substitutability of imported inputs etc. Given the sample size, it is not possible at this stage for us to estimate separate regressions for each sector. In its place we try to incorporate industry dummies in our model to capture parameter heterogeneity. Next section provides the details of this exercise.

Asymmetric Effects of Appreciation and Depreciation

It is possible that appreciation and depreciation of exchange rate affect the firms differently. It may happen, for example, that the depreciation of Rupee has a much stronger effect on firm's output growth through the channel of higher import costs as compared to Rupee appreciation. This could be the case when firms are dependent on external borrowings to finance imports which become scarcer to get during episodes of real depreciation. This has important policy

implications for the government. To test this hypothesis we multiply the two exchange rate terms with dummies for appreciation and depreciation separately. Results from this exercise are presented in Table 3. Two key results emerge out of this exercise – i. Depreciation of Rupee has a much stronger impact on firm level output growth through the import cost channel as compared to appreciation. In fact, Rupee appreciation does not provide a significant boost to firm's output growth through lower cost of imported inputs even though there is a strong adverse impact of Rupee depreciation on firm's output through the higher import cost channel. As suggested above, this would be expected if firms are dependent upon external borrowing to finance their imports. ii) Looking at the revenue channel, both appreciation and depreciation affect firm's performance significantly though the adverse impact of appreciation on output growth through the revenue channel is much bigger in size. This clearly has important implications for government policy. Overall, Rupee appreciation is likely to hurt economic growth through the revenue channel without giving additional benefit through the cost channel. On the other hand, Rupee depreciation has a strong adverse impact on growth through the cost channel but a relatively weak positive impact through revenue channel. Real appreciation is likely to have an overall adverse impact on output growth since it has no significant beneficial impact through the cost channel to offset the adverse impact occurring through the revenue channel. Real depreciation on the other hand does provide benefits through the revenue channel but the overall impact on growth will depend upon the strength of the offsetting cost channel.

Exchange Rate and Overvaluation

One aspect of firm performance in the face of exchange rate change is the degree of exchange rate misalignment. If exchange rate is overvalued to begin with then currency appreciation is likely to affect firm performance adversely while depreciation is likely to prove beneficial. We test this implication by incorporating a measure of exchange rate overvaluation in our baseline model. Exchange rate overvaluation is defined as deviation from the Hodrik-Prescott filtered trend. We define overvaluation dummy that takes a value of one whenever the actual REER is above trend. To incorporate overvaluation in our model we multiply exchange rate terms with the overvaluation dummy and include them in our model. Table 4 presents the results from this exercise.

As we can see, the two overvaluation terms are negative though only first term with import elasticity is significant. The remaining variables maintain their original signs and significance. These results can be interpreted as follows – exchange rate depreciation (appreciation) affects firm's performance through `cost` as well as `revenue` channels and these effects vary with the degree of international trade integration as measured by export and import shares and the degree of market power measured by the inverse of mark up. The impact also varies depending upon whether the exchange rate is overvalued. In particular, the positive impact of an exchange rate appreciation through the cost channel is almost fully reversed when the exchange rate is overvalued. In other words, firms with significant dependence on imported inputs benefit from an exchange rate appreciation but only when exchange rate is not overvalued. On the revenue side, exchange rate depreciation benefits exporters but the benefit does not show a significant change in case of an overvaluation (the sign is negative, however, indicating a greater gain in `cost` competitiveness under overvalued exchange rate).

Exchange Rate Regime

Impact of exchange rate regime on growth is theoretically ambiguous. While a peg provides greater certainty regarding the value of foreign currency denominated transactions and policy regime which, in turn, is likely to promote productivity growth and trade (both conducive to faster output growth); the loss of flexibility under a peg leaves the economy less resilient to external shocks. That can encourage protectionist behavior, price distortions and misallocation of resources in the economy thereby having an adverse impact on growth.

It is therefore interesting to ask whether exchange rate regime has an impact on the relationship between output growth and exchange rate. To accomplish this we use a dummy variable to capture pegged exchange r ate regime. In this we take the help of Shah et al (2011). Using a linear regression model and Perron & Bai (2003) methodology extended to a more general *maximum likelihood* setting they identify structural breaks in eleven Asian economies including India over the period 1991-2009. Based on their analysis the period between 1999 and 2003 saw Rupee being tightly pegged to the USD[12]. We therefore create a dummy for the pegged exchange rate regime that takes a value of 1 during the years 2 000-2003 and zero otherwise. Multiplying this dummy with the two exchange rate terms allows us to capture the impact of exchange rate regime on the relationship between exchange rate changes and output growth. Table 5 provides the results from this exercise.

Firm Collateral

Firm's ability to borrow externally can potentially help it in managing the impact of exchange rate movements better. We therefore split our sample in to firms with low collateral and high collateral and estimate the model for output growth separately on each. Collateral is measured as the ratio of net fixed assets to total assets. We divide firms in to low versus high collateral sample based on their average net fixed assets as a percentage of total fixed assets. Table 6 presents the results from this exercise. While the signs of coefficients on import and export elasticity terms remain unchanged they are not statistically significant for high collateral firms. In fact when we replace output growth with sales growth, coefficients on the two terms change signs for the high collateral firms though they are statistically insignificant. Overall, the ability to borrow externally as captured by the ratio of net fixed asset to total assets does seem to help firms manage exchange rate movements better.

Firm level controls

We include additional firm level control variables that are likely to influence output growth. These are i. share of firm's foreign currency borrowing in total liabilities and ii. firm's efficiency in capital utilization measured by ratio of sales to total assets, the underlying hypothesis being that more efficient firms are likely to grow faster and handle unfavorable exchange rate movements better. Including these additional variables does not affect out main results. Further, none of the additional variables significantly affects output growth[13].

[12] In a regression of Rupee on USD, British Pound, Japanese Yen and Euro; USD has a coefficient of 0.98 with the R^2 of 0.97 indicating that the Rupee was closely tracking USD during this period.

[13] Only the share of foreign currency borrowing appears as significant in the equation for sales growth

In the end we conduct a couple of robustness checks to test the sensitivity of our results. First, we replace Real Effective Exchange rate with Nominal Effective Exchange rate. Next we divide output with wholesale price index to calculate real output growth. Tables 8 and 9 present the results from these checks. Our results remain unchanged with these changes.

Conclusion

This paper lays out stylized facts regarding the impact of Real Exchange Rate change on firm level performance using data on 500 Indian firms. We find a significant effect of real exchange rate movement on firm's performance through the cost as well as the revenue channel. The impact depends upon the share of imports and exports along with the degree of market power as reflected in the time varying firm level mark up. Appreciation and depreciation have asymmetric impact of firm's output and sales growth. Appreciation has a much stronger impact through the export (revenue) channel while depreciation has a stronger impact through the import (cost) channel. Presence of overvaluation negates the beneficial effects of exchange rate appreciation operating through the lower input cost channel though the same cannot be said about the 'price competitiveness' effect working through the export channel. Flexibility of exchange rate does not affect the relationship between exchange rate and firm level performance. Amongst the firm characteristics, ability to borrow externally (measured by the share of net fixed assets to total assets) significantly affects firms' ability to manage the effect of exchange rate movements. Controlling for other firm level variables such as the share of foreign currency borrowings and efficiency of capital use leaves the main results unchanged. These results remain robust to alternative choices of exchange rate and output growth measures.

For policy makers trying to assess the impact of exchange rate movements on real economy these results provide various important insights. First, they help to identify the factors affecting the vulnerability of Indian firms to exchange rate shocks. Second, the asymmetric effect of appreciation and depreciation – with cost channel relatively weak and statistically insignificant during episodes of appreciation – indicates that real appreciation is likely to have an overall negative impact on firm's growth performance. Aggregate impact in case of real depreciation is however ambiguous.

One drawback of the current study is that it only focuses on publicly listed firms which are likely to be larger in size and have access to finance. It is possible that non-listed firms, which are smaller in size and have poorer access to outside finance, are affected more severely by exchange rate changes. It is equally possible that smaller firms respond to greater competitive pressure by lowering their mark up while bigger firms with greater market power reduce their volume of sales while maintaining their profit margins. These questions provide fruitful areas of future research.

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Table [1] Benchmark Model (REER)

Dependent Variable:	Output Growth	Sales Growth
$\alpha_{i,t-1} \times \Delta e_t \times mkp_{i,t-1}^{-1}$	2.14* [1.1]	1.8* [0.99]
$\eta_{i,t-1} \times \Delta e_t \times mkp_{i,t-1}^{-1}$	-0.2*** [0.05]	-0.18*** [0.05]
Unit Labor Cost Growth	-0.59*** [0.05]	-0.57*** [0.05]
Labor Growth	0.30*** [0.05]	0.29*** [0.05]
Investment	0.24*** [0.03]	0.23*** [0.03]
y2000,…, y2012 (time dummies)	Wald test: 66.9 (12, 0.00)	Wald test: 70.3 (12, 0.00)
d1,…..d5 (firm size dummy)	Wald test: 13.0 (5,0.02)	Wald test: 42.7 (5,0.00)
No. of Observations	1716	1716
R-sq	0.72	0.73

Table [2] Asymmetric Effects of REER change

Dependent Variable:	Output Growth	Sales Growth
$\alpha_{i,t-1} \times \Delta e_t \times mkp^{-1} \times$ Appreciation Dummy	0.48 [0.61]	0.40 [0.58]
$\alpha_{i,t-1} \times \Delta e_t \times mkp^{-1} \times$ Depreciation Dummy	3.3*** [1.0]	2.7*** [0.99]
$\eta_{i,t-1} \times \Delta e_t \times mkp^{-1} \times$ Appreciation Dummy	-1.1** [0.5]	-0.6 [0.5]
$\eta_{i,t-1} \times \Delta e_t \times mkp^{-1} \times$ Depreciation Dummy	-0.3*** [0.05]	-0.2*** [0.05]
Unit Labor Cost Growth	-0.59*** [0.047]	-0.58*** [0.04]
Labor Growth	0.30*** [0.05]	0.3*** [0.05]
Investment	0.24*** [0.03]	0.24*** [0.03]
No of Observations	1716	1716
R-sq	0.72	0.73

Table [3] Overvaluation and Effects of REER change

Dependent Variable:	Output Growth	Sales Growth
$\alpha_{i,t-1} \times \Delta e_t \times mkp^{-1}$	3.35*** [0.74]	2.8*** [0.96]
$\alpha_{i,t-1} \times \Delta e_t \times mkp^{-1} \times$ Overvaluation Dummy	-2.9*** [1.0]	-2.45*** [0.98]
$\eta_{i,t-1} \times \Delta e_t \times mkp^{-1}$	-0.3*** [0.09]	-0.23*** [0.05]
$\eta_{i,t-1} \times \Delta e_t \times mkp^{-1} \times$ Overvaluation Dummy	-0.95 [0.55]	-0.54 [0.55]
Unit Labor Cost Growth	-0.59*** [0.04]	-0.58*** [0.047]
Labor Growth	0.3*** [0.05]	0.29*** [0.05]
Investment	0.24*** [0.03]	0.24*** [0.03]
No of Observations	1716	1716
R-sq	0.73	0.73

Table [4] Exchange Rate Regime and Effects of REER change

Dependent Variable:	Output Growth	Sales Growth
$\alpha_{i,t-1} \times \Delta e_t \times mkp^{-1}$	2.1* [1.1]	2.8*** [0.96]
$\alpha_{i,t-1} \times \Delta e_t \times mkp^{-1} \times$ Peg Dummy	-0.01 [10]	-2.45*** [0.98]
$\eta_{i,t-1} \times \Delta e_t \times mkp^{-1}$	-0.20*** [0.06]	-0.23*** [0.05]
$\eta_{i,t-1} \times \Delta e_t \times mkp^{-1} \times$ Peg Dummy	-2.3 [7.1]	-0.54 [0.55]
Unit Labor Cost Growth	-0.59*** [0.05]	-0.58*** [0.047]
Labor Growth	0.3*** [0.05]	0.29*** [0.05]
Investment	0.24*** [0.03]	0.24*** [0.03]
No of Observations	1716	1716
R-sq	0.72	0.73

Table [5] REER Change and Collateral

Dependent Variable:	Output Growth		Sales Growth	
	Low Collateral	High Collateral	Low Collateral	High Collateral
$\alpha_{i,t-1} \times \Delta e_t \times mkp^{-1}$	3.6*** [0.82]	0.69 [0.57]	3.02*** [0.76]	-0.57 [0.91]
$\eta_{i,t-1} \times \Delta e_t \times mkp^{-1}$	-0.3*** [0.04]	-0.8 [0.7]	-0.2*** [0.03]	1.2 [0.8]
Unit Labor Cost Growth	-0.61*** [0.06]	-0.55*** [0.06]	-0.6*** [0.06]	-0.45*** [0.068]
Labor Growth	0.3*** [0.07]	0.26*** [0.05]	0.31*** [0.71]	0.21*** [0.07]
Investment	0.22*** [0.03]	0.30*** [0.05]	0.22*** [0.03]	0.29*** [0.05]
No of Observations	855	861	855	529
R-sq	0.77	0.61	0.78	0.67

Table 6 Adding Firm Level Control Variables

Dependent Variable:	Output Growth	Sales Growth
$\alpha_{i,t-1} \times \Delta e_t \times mkp_{i,t-1}^{-1}$	2.0* [1.1]	1.7* [1.0]
$\eta_{i,t-1} \times \Delta e_t \times mkp_{i,t-1}^{-1}$	-0.2*** [0.05]	-0.18*** [0.05]
Unit Labor Cost Growth	-0.55*** [0.05]	-0.53*** [0.05]
Labor Growth	0.28*** [0.05]	0.27*** [0.05]
Investment	0.23*** [0.03]	0.23*** [0.03]
Efficiency of Capital Use	-0.00 [0.00]	-0.01 [0.00]
Foreign Currency Borrowing	0.00 [0.00]	0.00*** [0.00]
No. of Observations	1533	1533
R-sq	0.67	0.68

Table 7 Robustness Test 1 – Using NEER instead of REER

Dependent Variable:	Output Growth	Sales Growth
$\alpha_{i,t-1} \times \Delta e_t \times mkp_{i,t-1}^{-1}$	2.8** [1.0]	2.5** [1.0]
$\eta_{i,t-1} \times \Delta e_t \times mkp_{i,t-1}^{-1}$	-0.5*** [0.13]	-0.48*** [0.1]
Unit Labor Cost Growth	-0.59*** [0.05]	-0.58*** [0.05]
Labor Growth	0.30*** [0.05]	0.29*** [0.05]
Investment	0.26*** [0.03]	0.26*** [0.03]
No. of Observations	1716	1716
R-sq	0.72	0.72

Table 8 Robustness Test 2 – Using Real Output Growth

Dependent Variable:	Output Growth	Sales Growth
$\alpha_{i,t-1} \times \Delta e_t \times mkp_{i,t-1}^{-1}$	2.1* [1.0]	1.8* [1.0]
$\eta_{i,t-1} \times \Delta e_t \times mkp_{i,t-1}^{-1}$	-0.2*** [0.05]	-0.18*** [0.05]
Unit Labor Cost Growth	-0.59*** [0.05]	-0.58*** [0.05]
Labor Growth	0.30*** [0.05]	0.30*** [0.05]
Investment	0.24*** [0.03]	0.24*** [0.03]
No. of Observations	1716	1716
R-sq	0.72	0.72

Appendix I

Table A

Year	Total Turnover In Foreign Exchange Market[14] (Billions of USD)	Balance of Payments Size (Billions of USD)	Foreign Currency Assets of RBI (Billions of USD)
1996	73.2	88.3	2.84
2002	130	133.5	30
2011	1175	1014	163.3

*Note: Data on Turnover in Foreign Exchange Market, Balance of Payments and Foreign Currency Assets of RBI are from RBI's *Handbook of Statistics* and *Database on Indian Economy*

[14] Total Turnover in the foreign exchange market is defined as the sum of total sales and purchase in the foreign exchange market

Data Appendix

	Metal & Metal Products		Chemicals		Machinery	
Year	No. of Obs.	Export Share	No. of Obs.	Export Share	No. of Obs.	Export Share
19 95	23	7.43087	19	8.636316	12	7.3525
1996	24	8.945833	19	7.060526	12	6.465833
1997	25	13.886	19	6.762105	13	5.894615
1998	26	15.56077	19	7.305263	13	9.573846
1999	26	15.39538	19	6.696842	13	9.042308
2000	26	17.96731	19	7.501053	13	8.860769
2001	26	16.53385	19	7.423158	13	9.556923
2002	26	19.88769	19	7.693158	13	9.780769
2003	27	22.56926	19	8.49	14	10.45786
2004	28	20.40643	19	11.16421	14	10.30643
2005	29	23.50103	19	11.23053	14	10.83714
2006	30	23.52967	19	11.60579	14	12.08071
2007	30	25.254	19	11.88474	14	12.79571
2008	30	24.71667	19	11.01632	14	12.39286
2009	30	27.152	19	11.84895	14	15.82214
2010	30	22.93133	19	11.00316	14	11.74214
2011	30	21.286	19	13.36737	14	9.372857
2012	30	22.78867	19	16.77053	15	9.25

	Electronics		Textiles		Transport Equipment	
Year	No. of Obs.	Export Share	No. of Obs.	Export Share	No. of Obs.	Export Share
1995	3	0.983333	8	18.01625	5	6.912
1996	3	0.75	8	18.5475	5	6.612
1997	3	4.203333	8	18.82875	5	5.24
1998	3	1.31	8	19.12	5	7.688
1999	3	0.643333	10	18.867	5	6.34
2000	3	1.65	10	19.625	5	4.472
2001	3	1.43	10	19.198	5	5.032
2002	3	3.203333	10	17.416	5	2.97
2003	3	5.73	10	17.237	5	2.71
2004	3	6.58	10	18.295	5	3.704
2005	3	8.57	10	20.75	5	5.208
2006	3	9.686667	11	24.11364	5	6.098
2007	3	14.35333	11	26.16182	5	6.186
2008	3	10.02333	11	23.84818	6	9.178333
2009	3	12.09333	11	25.77	6	11.59333
2010	3	9.593333	11	22.84	6	9.861667
2011	3	8.726667	11	25.34182	6	10.50167
2012	3	9.296667	11	30.55364	6	11.91

Data Appendix

	Plastic & Rubber		Food		Wood and Wood products	
Year	No. of Obs.	Export Share	No. of Obs.	Export Share	No. of Obs.	Export Share
1995	11	10.50455	15	6.189333	4	5.605
1996	11	14.34909	15	5.941333	4	5.4325
1997	11	14.76182	14	5.303571	4	3.635
1998	11	13.77455	15	5.642667	4	3.8425
1999	11	14.56545	16	3.61375	4	3.36
2000	11	11.83455	16	5.735625	4	6.035
2001	11	11.48182	16	6.409375	4	6.1625
2002	11	13.17455	18	8.148333	4	5.5925
2003	11	19.30636	18	6.687778	4	8.7475
2004	12	17.12	20	7.1955	4	8.1925
2005	12	24.2425	20	7.0035	4	8.905
2006	12	23.1	20	9.725	4	7.2675
2007	12	20.2225	20	9.924	4	7.815
2008	12	17.4225	20	11.9515	4	5.66
2009	12	17.18583	20	10.388	4	5.28
2010	12	15.7925	20	9.1285	4	6.215
2011	12	19.89833	20	12.419	4	7.015
2012	12	19.24417	20	12.521	4	6.375

	Refinery	
Year	No. of Obs.	Export Share
1995	7	6.47
1996	7	10.56143
1997	7	15.04
1998	7	12.04857
1999	7	12.70857
2000	7	14.11571
2001	7	17.91286
2002	7	17.95857
2003	7	15.84
2004	7	17.56571
2005	7	9.4
2006	7	12.44286
2007	7	82.57857
2008	7	282.3129
2009	7	18.46
2010	7	17.20857
2011	7	19.08857
2012	7	21.52429

Data Appendix

	Metal & Metal Products		Chemicals		Machinery	
Year	No. of Obs.	Import Share	No. of Obs.	Import Share	No. of Obs.	Import Share
1995	1	0.347096	3	0.288642	0	
1996	4	0.111544	1	0.149148	0	
1997	3	0.046968	1	0.471344	1	0.61018
1998	4	0.168944	3	0.272724	2	0.258015
1999	8	0.219132	2	0.165985	2	0.081752
2000	26	0.23576	16	0.306278	10	0.174563
2001	26	0.232181	19	0.331415	13	0.167274
2002	25	0.254923	19	0.307	13	0.200814
2003	27	0.26003	19	0.308872	14	0.175841
2004	28	0.277648	19	0.358061	14	0.180494
2005	29	0.305542	19	0.367454	13	0.181313
2006	30	0.361356	19	0.367645	14	0.164723
2007	30	0.388411	19	0.362334	14	0.181491
2008	30	0.401417	19	0.357704	14	0.16555
2009	30	0.386012	19	0.366934	14	0.18844
2010	30	0.39467	19	0.374815	14	0.1927
2011	30	0.381674	19	0.358595	14	0.200287
2012	30	0.322057	19	0.342358	15	0.205723

	Electronics		Textiles		Transport Equipment	
Year	No. of Obs.	Import Share	No. of Obs.	Import Share	No. of Obs.	Import Share
1995	1	0.133438	1	0.768686	2	0.131438
1996	1	0.14602	1	0	1	0.078125
1997	1	0.187841	0		1	0.118596
1998	1	0.179804	0		2	0.094367
1999	1	0.174313	1	0	2	0.11433
2000	2	0.092148	9	0.221314	5	0.094238
2001	3	0.114715	10	0.222011	5	0.083875
2002	3	0.13745	10	0.261223	5	0.062388
2003	3	0.108981	10	0.239405	5	0.044413
2004	3	0.091036	10	0.253545	5	0.025417
2005	3	0.103227	10	0.242409	5	0.022907
2006	3	0.128687	11	0.215826	5	0.025517
2007	3	0.138608	11	0.207469	5	0.032686
2008	3	0.13665	11	0.215623	6	0.032686
2009	3	0.151577	11	0.211831	6	0.042037
2010	3	0.138128	11	0.224045	6	0.045982
2011	3	0.12535	11	0.23196	6	0.052179
2012	3	0.146562	11	0.150448	6	0.053768

	Plastic & Rubber		Food		Wood & Leather	
Year	No. of Obs.	Import Share	No. of Obs.	Import Share	No. of Obs.	Import Share
1995	2	0.244163	2	0.002426	2	0.121006
1996	0		2	0.003601	2	0.169745
1997	0		1	0.299921	2	0.163896
1998	0		2	0.270029	2	0.136869
1999	0		3	0.456127	1	0.129984
2000	10	0.14814	14	0.143555	3	0.098504
2001	11	0.116721	16	0.110612	4	0.025501
2002	11	0.118594	18	0.122985	4	0.103772
2003	11	0.121694	18	0.158346	4	0.183648
2004	12	0.146482	19	0.091108	4	0.186784
2005	12	0.133606	20	0.136062	4	0.202055
2006	12	0.189579	20	0.114621	4	0.194431
2007	12	0.187479	20	0.056319	4	0.220255
2008	12	0.229338	20	0.073578	4	0.151939
2009	12	0.269176	20	0.105147	4	0.113833
2010	12	0.298094	20	0.145092	4	0.11206
2011	12	0.26238	20	0.127712	4	0.186814
2012	12	0.238557	20	0.080612	4	0.197416

	Refinery	
Year	No. of Obs.	Import Share
1995	1	0.662757
1996	0	
1997	3	0.634877
1998	3	0.600693
1999	2	0.776341
2000	6	0.546234
2001	7	0.612385
2002	7	0.674155
2003	7	0.6478
2004	7	0.654542
2005	7	0.657031
2006	7	0.711801
2007	7	0.847603
2008	7	0.859851
2009	7	0.865249
2010	7	0.848079
2011	7	0.844807
2012	7	0.874939

Data Appendix: Industry wise Mark up

Year	Metal & Metal Products	Chemicals	Machinery	Electronics	Textiles
1995	5.415884	14.47784		3.724858	2.737957
1996	4.445882	1.992688		3.104789	
1997	4.444195	2.093218	1.311608	3.781608	
1998	3.367592	19.83407	1.870405	1.520067	
1999	6.388566	14.50659	2.161132	1.553383	83.22222
2000	4.82576	4.981748	2.100582	2.766418	29.34611
2001	5.09554	4.82171	1.87755	2.762832	13.77176
2002	4.837991	4.524545	2.123173	2.997136	1.920567
2003	5.163119	4.093712	2.532928	3.281051	1.879488
2004	3.561073	3.642587	2.762286	3.13514	1.846162
2005	3.615861	3.786572	2.084306	3.704995	1.7091
2006	3.715862	3.85252	2.882957	3.642037	3.467725
2007	4.618814	3.843702	3.568263	3.531003	3.125389
2008	4.08193	4.41957	2.725413	3.257943	3.3286
2009	2.980573	4.832998	2.542066	3.783577	2.933927
2010	3.072627	4.016918	2.14546	3.36525	3.223653
2011	3.159331	3.770135	2.062894	3.171747	2.971541
2012	5.04174	15.23572	2.921514	3.418303	6.993098

Year	Transport Equipment	Plastic & Rubber	Food	Wood & Leather	Refinery
1995	1.451258	2.30705	1.956928	2.057867	3.869051
1996	1.488523		1.821715	2.539685	
1997	1.473942		2.226304	2.669143	3.107339
1998	1.455544		1.502422	2.148863	4.128691
1999	1.46359		2.293963	3.215929	3.196501
2000	1.509205	1.983309	4.526507	2.745523	19.85362
2001	7.337798	1.960459	6.443097	7.313276	3.220181
2002	1.571255	1.984644	3.770671	2.612242	2.978689
2003	1.623538	1.865767	4.345221	2.301486	2.948979
2004	1.64992	1.844025	3.545158	2.245034	3.049032
2005	1.579022	1.712137	3.391248	2.111581	11.5752
2006	1.560629	1.695994	5.057708	2.225174	5.784865
2007	1.532357	2.376881	5.230585	2.129065	1.735328
2008	1.521928	1.896187	4.25881	2.250771	1.753056
2009	1.481282	1.775381	4.69664	2.266315	1.86226
2010	1.542225	1.695651	4.406339	2.496356	1.904733
2011	1.495997	1.902685	3.887086	2.176501	1.954769
2012	1.480769	1.775732	4.875761	2.312003	1.83245