

Exchange Rate Pass through and Pricing to the Market at Individual Product Level: Evidence from India

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Abstract This paper investigates the degree of responsiveness of exchange rate with respect to prices of top 10 imported commodities. To test the hypothesis, we use monthly and quarterly dataset for the period from 2002 to 2014 and for four countries namely, US, UK, India and China. We use Autoregressive Distributive Lag model (ARDL) to measure the degree of responsiveness. We find the results both in long run and short run, and the corresponding degrees of responsiveness of commodities. We measure the degree of responsiveness of commodity prices into the import index and found that Non-ferrous metal shows a high degree of responsiveness followed by metallic tools, metals etc. whereas, organic chemical, machinery electrical, plastic etc. shows a negative sign. In long run, almost every commodity shows a high degree of responsiveness in comparison with short run results. The paper also attempts to recommend some policy implications based on the literature.

Keywords: *imported goods, ARDL, degree of responsiveness*

Cite This Article: Anup Tiwari, and Rajesh Acharya H, "Exchange Rate Pass through and Pricing to the Market at Individual Product Level: Evidence from India." *Journal of Finance and Economics*, vol. 4, no. 6 (2016): 191-198. doi: 10.12691/jfe-4-6-4.

1. Introduction

It is known that real exchange rates exhibit large and persistent departures from purchasing power parity Betts & Devereux [1] and the explanation relies on the existence of non-traded goods. However, there are number of evidences which have established the fact that oscillation in real exchange rate is attributed to failure in law of one price among goods traded internationally A.E Biondo [2]. Since the mid-1980s, many studies have shown extensive work on pricing-to-market in traded goods industries. After a long phase of debate over the law of one price and convergence across countries, studies on exchange rate pass-through started emphasizing on industrial organization and the role of price discrimination across geographically different product markets. Though, exchange rate pass-through has been of interest for a long time, it has evolved considerably over time because of firms tend to set prices in local currencies of sale, and firms do not adjust prices of their products to movements in the exchange rate. A simple characterization of these findings would be that prices of most goods seem to demonstrate 'local currency price stability' (i.e. prices are set in the currency of the buyers and do not adjust at high frequencies), whereas, real exchange rate movements are driven primarily by fluctuations in the nominal exchange rate.

Because the term exchange rate pass through have evolved considerably over the decades. There are significant literatures on the concept of exchange rate pass through. Studies has been done on effect of exchange rate

pass through by Patra and Patnaik [3], Bahmani-Oskooee and Mlixli [4], Nag and Upadhya [8] etc. Studies have also been conducted in developed countries by Anderton [10], Campa and Goldberg [11], Campa et al. (2005), Gagnon and Ihrig [12], Hahn [13], Ihrig et al. [15] and McCarthy [16] and some studies in emerging market economies such as Choudhri and Hakura [14], Frankel et al. [17] and Mihajek et al. [18]. There have been studies focusing on the relationship between exchange rate pass through and import price index. Yelana [19] explains that there is decline in pass through changes in exchange rate and Choudhri [14] shows that there is incomplete exchange rate pass through into import price. These studies measuring the relationship between exchange rate pass through and import prices index via CPI using data from developed and emerging market economies. It is perhaps surprising that there is little and no empirical evidence focusing on the exchange rate pass through and pricing to market at the individual product level. By the product level we mean, the goods that are imported from developed and emerging economies. This study looks into pass through effect at individual product level and degree of responsiveness of commodities in import index.

There are insignificant amount of studies focusing on this kind of relationship (relation would be of two type; complete and incomplete or may be zero because exporter would not adjust the prices of its product with the exchange rate in the same proportion therefore pricing to market is high) at the commodities level. Patra and Patnaik [3], Bahmani-Oskooee and Mlixli [4] find some evidence on the inverse relation between the exchange rate pass through and the pricing to market at product level.

Further, Mlivi (1992) assess an effect of changes in effective exchange rate of least developed country on their trade balance. Both of these paper appealed to show the individual product specific exchange rate pass through information but Patra and Patnaik paper emphasis insignificant empirical evidence on the product level pass through. However, this paper is meant to present the exchange rate pass through and pricing to market degree of responsiveness on top 10 imported products¹. As per our understanding, none of the paper so far have studied the significance of Product level pass through effect on the import index. This paper looks for the outcome of the same by measuring high or low degree of responsiveness of product prices on import index.

To sum up, the idea of this study is to look for extent of relationship between exchange rate pass through and pricing to market at individual product level. The relation could be several type such as complete, and pricing to market is low or incomplete, and exchange rate pass through may be zero and pricing to market is high. This relation can be measured by looking at the degree of responsiveness. Therefore, we use Autoregressive Distributed Lag (ARDL)² model to measure the degree of responsiveness.

Using the ARDL model, we find that pass through is 53 percent in the case of nonferrous metal, 87 percent in the case of organic chemicals etc. in the short run (see appendix Table 2). For the commodities, where the real exchange coefficient is more than 1 shows that one percent increase in exchange rate would lead to an more than one percent increase in the prices, hence show a high degree of responsiveness. More explanation of the results are provided in the section 5.

The remainder of the paper is organized as follows: Section 2 we explain some definition and relation, Section 3 we present data collection and description, section 4 we show model and methodology, section 5 we describe an analysis of the data and presentation of the result, section 6 describe the summary and discussion of the researcher's findings, implications for practice, and recommendations for future research, and section 7 contains a references.

2. Definition and Relation

Eric Fisher [7] define exchange rate pass through as the relationship between the foreign currency prices and domestic currency prices. In general, Exchange rate pass through refer to the degree of sensitivity of import price with one percent change in exchange rate in the destination country currency. In the similar term, Pricing to market (PTM) refers to the pricing behavior of the export country firm with the change in exchange rate in importing country in term of importing country currency. The term PTM was explained by Krugman with reference to European automobile industry. He describe that increase in US dollar with respect to European currency was the reason that for US started importing product from Europe. In order to maintain the export price in market,

the European firms started adjusting the prices against US dollar. This phenomenon of adjusted export prices by the foreign firms is known as PTM.

In the similar way, Exchange rate pass through is considered to be complete or full when exporter adjust the prices of its product by the same proportion with change in the exchange rate and hence there is perfect pricing to market. Inversely, Exchange rate pass through is considered to be incomplete when the exporters adjust the prices of its product in its own currency by smaller proportion than the change in the exchange rate and hence pricing to market is low.

There have been evidence which shows that PTM is responsible for a greater movement in exchange rate. Such as Betts and Devereux [1] theoretically study the relationship and concluded that "A simple quantitative exercise based on the estimated degree of PTM in international trade shows that the increase in exchange rate variability arising from PTM may be very large." Similarly, Degree of sensitivity is associated with the degree of openness of an economy. Degree of openness is an important determinant of exchange rate pass through. There is direct relationship between the exchange rate and degree of openness. Suppose, If a country is open for trade, then there is large movement in the exchange rate pass through if country regulation is not stringent. The fluctuation in exchange rate is being brought via import price which then further bring changes in consumer price index (CPI). In this study, we use CPI as one of the independent variable in the model in order to measure the degree of responsiveness. We use Autoregressive Distributed Lag (ARDL) in order to measure the relation between exchange rate pass through and pricing to the market at top 10 imported goods.

3. Data Description

Data has been collected from the Bloomberg for the period from 2002 to 2014 and for the countries US, UK, China and India. For analyzing the pass through effect on pricing to market, the data has been collected for the list of imported goods;

(1) Mineral including Mineral Fuels, Mineral Oils and Products Of Their Distillation; Bituminous Substances; Mineral Waxes, (2) Metal and stones including: Natural Or Cultured Pearls, Precious Or Semiprecious Stones, Pre. Metals, Clad With Pre. Metal and Artcls Thereof; Imit. Jewelry; Coin, (3) Machinery including: Nuclear Reactors, Boilers, Machinery and Mechanical Appliances; Parts Thereof, (4) Electrical Appliances including: Electrical Machinery and Equipment and Parts Thereof; Sound Recorders and Reproducers, Television Image and Sound Recorders and Reproducers, and Parts, (5) Organic Chemicals, (6) Plastic and Articles Thereof, (7) Animal Or Vegetable Fats and Oils and Their Cleavage Products; Pre. Edible Fats; Animal Or Vegetable Waxex, (8) Iron and Steel, (9) Ores, Slag and Ash, (10) Ships, Boats and Floating Structures.

We take US, UK and China as a trading partner with India. Trading partners are major exporter to India in some or the other imported goods mentioned above. China majorly exports electric machinery, organic chemicals,

¹ It comprises 80 percent of India top 50 imported products for the year 2013-14.

² Elaborate in section 4.

iron and steel etc to India, UK top 10 exported products to India are non ferrous metal, non metallic mineral manufacture, power generating machinery and equipment, metalliferous ores and metal scrap, general industrial machinery and equipment etc. US exports are machinery and equipment, ores and metal scraps, machinery, engineering goods, and other professional instruments other than electronics, non-ferrous metals and chemicals.

The import prices of all the commodities and for all the countries have been collected from Bloomberg at monthly and quarterly frequency. For India, WPI is collected from Press Information Bureau of India, Real and Nominal GDP from India Central Statistical Organization, and real and nominal exchange rate from Bank of International Settlement (BIS). For China, Real and Nominal GDP are collected from National Bureau of Statistics of China, and WPI is from People's Bank of China. For US, CPI and WPI is collected from Bureau of Labor Statistics, and Nominal and Real GDP from Bureau of Economic Analysis. For UK, Nominal and Real GDP, CPI and WPI is collected from UK Office of National Statistics. All the data would be secondary in nature.

For the purpose of examining the hypotheses, we consider two dependent variables; imports and export price of individual commodities, and independent variable are trading countries macro factors which are as; Gross Domestic Product (GDP) also known as foreign income, domestic wholesale price index, foreign wholesale price index, exchange rate of trading partner (which is US, UK and China) in Indian rupee currency. We compare the import index and import price of commodities in order to get the degree of responsiveness in import index. All the analysis has been done in short run and long run.

4. Model and Methodology

In this section, we present the methodology to address the hypotheses. In first model, we use log-log model where dependent variable is export price of individual products and in second, we use ARDL and dependent variable is import price of products. Independent variables are same in both models.

Model 1: Export Price of Individual level goods as a dependent variable and other factor as independent

$$P_{xt} = \beta_0 + \beta_1 ER_{xt} + \beta_2 FWP_{xt} + \beta_3 DWP_{mt} + \beta_4 GDP_{ft} + \epsilon_{xt}$$

where, P_{xt} is the basket of exported price of all Individual level goods for time period 2002-14, β_0 is the intercept term, ER_{xt} is the exchange rate of trading partner currency in rupees, FWP_{xt} is the index of foreign wholesale price index in foreign currency, DWP_{mt} is the index of domestic wholesale price index in domestic currency, GDP_{ft} is the foreign income and ϵ_{xt} is the error term.

Model 1 is log-log model, where coefficient β_1 measures the direct effect of exchange rate changes on the export prices of individuals goods measured in rupees. If exchange rate pass through is defined in terms of Indian currency then we can derive the proportion of exchange rate pass through by $(1 - \beta_1)$ for example if $\beta_1 = 0$ then the

changes in the exchange rate are fully passed on to the prices of exports i.e pass through is 1.

Model 2: ARDL Model in which Import Price of Individual level goods as a dependent variable and other factor as independent variable:

$$P_{mt} = \alpha_0 + \alpha_1 ER_{mt} + \alpha_2 FWP_{mt} + \alpha_3 DWP_{mt} + \alpha_4 GDP_{mt} + \alpha_5 P_{mt-1} + \epsilon_{mt}$$

Where, P_{mt} is the basket of imported price of Individual level goods, α_0 is the intercept term, ER_{mt} is the exchange rate of India in rupees currency, FWP_{mt} is the index of foreign wholesale price index in Indian currency, DWP_{mt} is the index of domestic wholesale price index in domestic currency, GDP_{mt} is the domestic income and P_{mt-1} is the lag value of imported price of individual goods.

ARDL is the standard least square regression which have both dependent and independent variable in lag form as a regressors Greene [5]. This model can also be use to test for co integration, and estimate long and short run dynamics even when the variable are of different nature i.e stationary and non stationary time series Pesaran and Shin [6]. The model is "autoregressive", such that independent variable is explained by lagged values of itself. It also has a "distributed lag" component, in the form of successive lags of the explanatory variables.

Autoregressive Distributed Lag ARDL (1,0) is used in second model which takes 1 period lag of dependent variable i.e α_5 in model 2- lagged valve of import prices of product. Coefficient α_1 measures the extent of pass through directly. If $\alpha_1 = 1$ represents full pass through because the import price of individual level goods expressed in rupees fully reflect the changes in the exchange rate and if $\alpha_1 = 0$ represents pass through is zero which shows that country has sufficient market power in import market and exchange rate pass through is incomplete. In this paper, results has been explained by using only model 2 because the extent of pass through is being explained fairly by the import prices of commodities rather than export prices of commodities.

In both the models, all variables are in natural log form because taking the natural log of all the variables enables us to separate the exchange rate from the foreign prices Dholakia and Saradhi (2000).

5. Results

We estimate the model for each import price commodities for the period 2002-2014. As a preliminary diagnostic check we test for stationarity of the variables. We use Portmanteau (Q) statistic which performs a white noise test for time series. The test is based on the fact that the Q statistics should be large and probability should be small for no autocorrelation. As shown in Table 1, we can say that the import price of commodities does not have autocorrelation. Only machine tools and electric machinery are found to be stationery because of small Portmanteau (Q) statistic and large probability. In order to eliminate the autocorrelation we use ARDL model. ARDL model is appropriate to deal with stationery issues and whenever there is co-integrating relationship among your variables Pesaran and Shin [6].

Table 1. Unit root test for stationery

Commodities	Portmanteau (Q) statistic	Prob> chi2(40)
Non metallic Minerals	52.78	0.09
Non Ferrous Metals	64.20	0.01
Metalliferous ores and metal	53.62	0.07
Manufacture of Metals	54.12	0.07
Machine Tools	9.07	1.00
Machinery Ex Electricals	42.43	0.37
Electrical Machinery	10.09	1.00
Organic Chemicals	47.90	0.18
Artificial Resins and Plastic material	55.27	0.05
Essential Oil and Cosmetics	65.28	0.01
Iron And Steel	57.29	0.04

Table 2. Exchange rate pass through into import prices (Short run)

	Non metallic Minerals	Non Ferrous Metals	Metallic ferrous ores	Manufacture of Metals	Machine Tools	Machinery Electricals
Coefficient of Real exchange rate- India	1.35* (0.77)	0.53 (0.56)	1.54 (1.43)	1.53** (0.75)	3.74** (1.81)	1.33 (1.14)
No. of Observations	120	127	120	120	127	120
R Squared	0.62	0.78	0.4	0.64	0.15	0.46

	Electrical Machinery	Organic Chemicals	Artificial Resins and Plastic	Essential Oil & Cosmetic	Iron & Steel
Coefficient of Real exchange rate- India	2.61 (1.58)	0.87 (2.15)	0.64 (1.01)	1.09** (0.48)	0.56 (1.08)
No. of Observations	120	120	120	120	127
R Squared	0.17	0.3	0.59	0.81	0.53

* p<.05; ** p<.01; *** p<.001.

Note: We used monthly level price data for all the top commodities imported by India for the period 2003-2014. All the import prices, exchange rate, CPI and WPI are in natural log. All the specifications in the table are control for log of WPI India, log of WPI of rest of the country, log of India exchange rate and their respective one period lag prices. WPI of the rest of the country is the average of US,UK and China WPI after taking the log of their respective WPI.

In the subsequent tables we use ARDL model. Table 2 shows the effect of exchange rate pass through into imports price of commodities in short run. For the commodities where pass through is less than one shows that with one percent increase in exchange rate would lead to less than 1 percentage increase in prices i.e low degree of responsiveness. Such as Pass through for nonferrous metal is 53 percent and 87 percent for organic chemicals. For commodities, where the real exchange rate coefficient is more than 1 shows that the one percent increase in exchange rate would lead to a more than one percent increase in the prices, i.e a high degree of responsiveness. Such as Pass through is highest for machine tools followed by electric machinery and manufacturing of metal. And also the coefficient for non-metallic minerals, metals, machine tools, and oils & cosmetics are significant at 1 and 5 percent.

Similarly, the similar commodities is analyzed for the long run. Table 3 explains the same. All the commodities have a real exchange rate coefficient more than 1. The degree of exchange rate pass through is highest for electric machinery and machine tools which then followed by non-metallic minerals. This shows that with one percent increase in exchange rate there would be more than one

percent increase in prices. Inversely, the degree of exchange rate pass through is lowest for Non-ferrous metal. For commodities like metallic ferrous ore, machine tools are significant at 10 percent and show a high degree of response in prices as compared to other commodities. And non- metallic minerals, and metal are significant at 1 percent.

In order to check the consistency of the results, we reciprocate the similar analysis with the ARDL model using the quarterly data. The next two tables (4 and 5) show the short and long run analysis about the effect of real exchange rate on prices of commodities using the quarterly data.

Table 4 shows short run result. In this scenario, the degree of responsiveness is more than one for all the commodities. Thus making the short run results stronger in comparison with the short run results using the monthly data. Degree of exchange rate pass through is more than 1 and highest for machine tools, manufacturing of metal followed by Non-ferrous metal. Similarly, level of significance is high for metal, machine tool, non-ferrous metals and machinery. And also these commodities have higher degree of response as compared other commodities.

Table 3. Exchange rate pass through into import prices (Long run)

	Non metallic Minerals	Non Ferrous Metals	Metallic ferrous ores	Manufacture of Metals	Machine Tools	Machinery Electricals
Coefficient of Real exchange rate- India	2.65*** (0.96)	1.36* (0.79)	3.13* (1.74)	2.42*** (0.89)	3.10* (1.87)	3.10** (1.52)
No. of Observations	119	126	119	119	126	119
R Squared	0.43	0.56	0.16	0.51	0.13	0.15

	Electrical Machinery	Organic Chemicals	Artificial Resins and Plastic	Essential Oil & Cosmetic	Iron & Steel
Coefficient of Real exchange rate- India	2.49 (1.64)	2.21 (2.58)	2.06 (1.36)	1.68*** (0.5)	1.63 (1.5)
No. of Observations	119	119	119	119	126
R Squared	0.15	0.033	0.31	0.78	0.15

* p<.05; ** p<.01; *** p<.001.

Note: We used monthly level price data for all the top commodities imported by India for the period 2003-2014. All the import prices, exchange rate, CPI and WPI are in natural log. All the specifications in the table are control for log of WPI India, log of WPI of rest of the country, log of India exchange rate and their respective four period lag prices. WPI of the rest of the country is the average of US,UK and China WPI after taking the log of their respective WPI.

Table 4. Exchange rate pass through into import prices (Short run)

	Non metallic Minerals	Non Ferrous Metals	Metallic ferrous Ores	Manufacture of Metals	Machine Tools	Machinery Electricals
Coefficient of Real exchange rate- India	3.14* (1.6)	3.71*** (1.32)	2.89 (1.79)	3.97*** (1.18)	4.36*** (0.76)	3.27 (2.38)
No. of Observations	39	39	39	39	39	39
R Squared	0.5	0.61	0.53	0.72	0.87	0.29

	Electrical Machinery	Organic Chemicals	Artificial Resins & Plastic	Essential Oil & Cosmetic	Iron & Steel
Coefficient of Real exchange rate- India	2.85*** (0.53)	1.88 (1.31)	1.71 (2.38)	1.63** (0.65)	1.98 (1.94)
No. of Observations	39	39	39	39	39
R Squared	0.92	0.58	0.39	0.89	0.41

* p<.05; ** p<.01; *** p<.001

Note: We used quarterly level price data for all the top commodities imported by India for the period 2003-2014. All the import prices, exchange rate, Import Index, CPI and WPI are in natural log. All the specifications in the table are control for log of WPI India, log of WPI of rest of the country, log of Import Index, log of India exchange rate and their respective one period lag prices. WPI of the rest of the country is the average of US,UK and China WPI after taking the log of their respective WPI. Import Index included only in quarterly analysis for testing due to unavailability of data at monthly level.

Similarly, [Table 5](#) shows long run results of exchange rate pass through using quarterly dataset. In this table the result are almost tantamount or atleast in some commodities less responsive in comparison with the long run results obtained using the monthly dataset. The degree of responsiveness for Machine tools is highest which then followed by metals, non metallic minerals, electrical machinery etc. Whereas, pass through is 40 percent for organic chemical and negative for artificial design and plastic. The coefficient is significant for machine tools and electric machinery. While comparing the same result at monthly level, we can say that although organic chemical

and artificial design are not statistically significant but degree of response for some commodities is higher as compared to similar commodities at quarterly level. Magnitude has increased in the long run and thus the individual product has more impact on import index in long run than in the short run.

The import index is effected mostly by the prices of imported commodities. It would be really interesting to look and understand the degree of responsiveness of individual commodity prices into the import index. [Table 6](#) and [Table 7](#) shows the short and long run results over the same.

Table 5. Exchange rate pass through into import prices (Long run)

	Non metallic Minerals	Non Ferrous Metals	Metallic ferrous Ores	Manufacture of Metals	Machine Tools	Machinery Electricals
Coefficient of Real exchange rate- India	2.78 (2.29)	2.02 (1.58)	1.74 (2.12)	2.91* (1.69)	4.35*** (0.94)	2.1 (3.36)
No. of Observations	31	31	31	31	31	31
R Squared	0.44	0.59	0.56	0.48	0.81	0.19

	Electrical Machinery	Organic Chemicals	Artificial Resins & Plastic	Essential Oil & Cosmetic	Iron & Steel
Coefficient of Real exchange rate- India	2.34*** (0.8)	0.4 (1.87)	-1.81 (3.48)	1.55 (0.92)	1.84 (2.55)
No. of Observations	31	31	31	31	31
R Squared	0.83	0.59	0.38	0.85	0.36

* p<.05; ** p<.01; *** p<.001.

Note: We used quarterly level price data for all the top commodities imported by India for the period 2003-2014. All the import prices, exchange rate, Import Index, CPI and WPI are in natural log. All the specifications in the table are control for log of WPI India, log of WPI of rest of the country, log of Import Index, log of India exchange rate and their respective four period lag prices. WPI of the rest of the country is the average of US,UK and China WPI after taking the log of their respective WPI.

Table 6. Impact of Individual product on the Import Index (Short run)

	Non metallic Minerals	Non Ferrous Metals	Metallic ferrous Ores	Manufacture of Metals	Machine Tools	Machinery Electricals
Coefficient of Import Index	0.002 (0.09)	0.1 (0.07)	0.025 (0.09)	0.081 (0.06)	0.076* (0.04)	-0.0011 (0.13)
No. of Observations	39	39	39	39	39	39
R Squared	0.5	0.61	0.53	0.72	0.87	0.29

	Electrical Machinery	Organic Chemicals	Artificial Resins & Plastic	Essential Oil & Cosmetic	Iron & Steel
Coefficient of Import Index	0.045 (0.03)	-0.03 (0.07)	-0.064 (0.12)	-0.0095 (0.03)	0.0018 (0.1)
No. of Observations	39	39	39	39	39
R Squared	0.92	0.58	0.39	0.89	0.41

* p<.05; ** p<.01; *** p<.001.

Note: We used quarterly level price data for all the top commodities imported by India for the period 2003-2014. All the import prices, exchange rate, Import Index, CPI and WPI are in natural log. All the specifications in the table are control for log of WPI India, log of WPI of rest of the country, log of Import Index, log of India exchange rate and their respective one period lag prices. WPI of the rest of the country is the average of US,UK and China WPI after taking the log of their respective WPI. Import Index included only in quarterly analysis for testing the proportional share of individual product on the Import Index.

Table 6 shows the short run results. Here the degree of responsive is represented as with one percent change in commodities prices led to a more or less than one percent change in import index. Following the same method, Non-ferrous metal shows a high degree of responsiveness followed by metallic tools, metals etc. Whereas, organic chemical, machinery electrical, plastic etc. shows a negative sign represent that they have least or no effect on the import price index. We can also say that import index has been affected mostly by Non-ferrous metal among the group of 11 commodities and then followed by metallic tools, metals.

Similarly, Table 7 shows the degree of responsiveness of commodity prices into the import index in long

run. Electricity shows a high degree of responsiveness followed by iron & steel, metallic orers etc. in the long run. Almost every commodity shows a high degree of responsiveness in comparison with the short run results.

By comparing results in the short and long run, the degree of responsiveness for machinery, manufacturing of metals, machine tools remains highest in short and long run compared with other commodities. Moreover, the degree of responsiveness of commodity prices into the import index was highest for electricity and machinery. Magnitude is greater in the long run because of that individual product has more impact on import index in the long run than in the short run.

Table 7. Impact of Individual product on the Import Index (Long run)

	Non metallic Minerals	Non Ferrous Metals	Metallic ferrous Ores	Manufacture of Metals	Machine Tools	Machinery Electricals
Coefficient of Import Index	0.23* (0.12)	0.23** (0.09)	0.26** (0.11)	0.14 (0.1)	0.019 (0.05)	0.32* (0.18)
No. of Observations	31	31	31	31	31	31
R Squared	0.44	0.59	0.56	0.48	0.81	0.19

	Electrical Machinery	Organic Chemicals	Artificial Resins & Plastic	Essential Oil & Cosmetic	Iron & Steel
Coefficient of Import Index	0.10** (0.04)	0.19** (0.09)	0.26 (0.16)	0.084* (0.05)	0.31** (0.13)
No. of Observations	31	31	31	31	31
R Squared	0.83	0.59	0.38	0.85	0.36

* p<.05; ** p<.01; *** p<.001.

Note: We used quarterly level price data for all the top commodities imported by India for the period 2003-2014. All the import prices, exchange rate, Import Index, CPI and WPI are in natural log. All the specifications in the table are control for log of WPI India, log of WPI of rest of the country, log of Import Index, log of India exchange rate and their respective four period lag prices. WPI of the rest of the country is the average of US,UK and China WPI after taking the log of their respective WPI.

6. Conclusion

The central concern of this paper is to study the relationship between exchange rate pass through and pricing to market at individual product level. In particular, we use the ARDL models to measure the degree of responsiveness of exchange rate with the change in import price of commodities. We have also scrutinized the Impact of prices of commodities on the Import Index.

We use data for import prices, exchange rate, etc and data is collected at monthly and quarterly frequency from Bloomberg. The analysis is carried out for the short as well as long run. For short run and long run, all regression equations are control for macroeconomic factors, and the lagged prices of commodities. WPI is the average of US,UK and China.

The results show that the degree of responsiveness of commodities are much higher in the long run, whereas, result using quarterly data are relatively better than the results obtained using monthly dataset. Long run results using quarterly data show a decrease in degree of responsiveness for commodities such as organic chemicals and plastics etc. For commodities such as oil and cosmetic, iron and steel have less degree of responsiveness in real exchange rate as compared to results in short run using quarterly data. The degree of responsiveness for machinery, manufacturing of metals, machine tools show a consistent rise in short and long run compared with other commodities.

Finally we measure the degree of responsiveness of commodity prices in the import index and found that Non-ferrous metal shows a high degree of responsiveness followed by metallic tools, metals etc, whereas, organic chemical, machinery electrical, plastic etc show an negative sign. In long run, almost every commodity shows a high degree of responsiveness in comparison with the short run results.

It is relevant to look the exchange rate pass through issue from policy implication point of view because it would be necessary for the policy maker to access to what extend the inflation in a country is affected by exchange rate. If the pass through is large like in the case of long run results which would show constraint on the effectiveness of monetary policy and require an exclusive focus on the exchange rate Billmeier & Bonato [21]. In order to reduce the exchange rate pass through, inflation targeting regime is one of the best measure and also credible monetary policy reduce the exchange rate pass through. For future research, we would like to explore the relative importance of these factors in determining the pass through to CPI. In nutshell we summarize that, import prices of top imported commodities bring larger fluctuation in exchange rate not only because commodities have 80 percent share in total imports (2013-14) but also the commodities magnitude is high with high degree of responsiveness on exchange rate and import index.

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