Demand or Exchange Rate: Investigating the relationship between India's exports and its determinants

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Introduction

The real exchange rate is often referred to as a measure of international competitiveness. It tells us how much the goods and services in the domestic country can be exchanged for the services and goods in a foreign country. It is also known as the competitiveness index of the currency of any country and there is an inverse relationship between this index and competition. Hence, the lower the value of this indicator in any country, the higher the currency of that country.

According to the International Monetary Fund (IMF), the real exchange rate between two currencies is the nominal exchange rate multiplied by the ratio of prices between the two countries which is the domestic price and foreign price. Hence, the real exchange rate is represented by the following equation:

Real Exchange Rate = Nominal Exchange Rate * Domestic Price/Foreign Price

There is an important relationship between the real exchange rate and net exports within a country. When the real exchange rate is high, the relative price of domestic goods is higher than the relative price of foreign goods. Import is likely in this case because foreign goods are cheaper, in real terms, than domestic goods. Thus, when the real exchange rate is high, imports increase and net exports decrease. Alternatively, when the real exchange rate is low, imports decrease and net exports increase. This relationship helps to show the effects of changes in the real exchange rate on net exports.

As per the Mundell Fleming Model,

$$NX = NX(e, Y, Y*)$$

where NX is net exports, e is the nominal exchange rate (the price of domestic currency in terms of units of the foreign currency), Y is GDP, and Y* is the combined GDP of countries that are foreign trading partners. Higher domestic income (GDP) leads to more spending on imports and hence lower net exports; higher foreign income leads to higher spending by foreigners on the country's exports and thus higher net exports. A higher *e* (more expensive domestic currency in terms of foreign currency, and equivalently less expensive foreign currency in terms of domestic currency) leads to more purchasing of foreign goods due to the lesser cost of acquiring the foreign currency to pay for them, and also leads to less purchasing of the country's exports by foreigners since they find it more costly to acquire the country's currency with which to pay for them; for both reasons, higher *e* leads to lower net exports.

Understanding the impact of currency depreciation on a nation’s trade balance is essential to the implementation of a successful trade policy. In an economic climate where countries are focused on improving their output, often by allowing their currencies to depreciate, this topic has become more important. The standard theory states that these countries should be able to improve output via exports using depreciation as a tool. As prices fall sharply imported goods become more expensive for domestic consumers, while at the same time exports are less expensive for foreign buyers. Thus, the combination of these relative price changes should result in a positive movement in a nation’s trade balance.

Further, the Government of India took its first step on 1 July 1991 towards fully floating currency in the current account when it reduced the value of the rupee. In June 1991 the exchange rate was about Rs 21.1 per US dollar. This exchange rate was fully regulated by the government and can be considered unchanged from the point of view of the free market.

The major exchange rate policies adopted by the government between 1991 and 1994 were as follows: (a) Rupee was reduced by 8 percent on 1 July 1991, (b) Rupee was reduced by 11 percent on 3 July 1991, (c) In March 1992, the rupee was made partially convertible in the trading account, with the introduction of the Liberalized (dual) Exchange Rate Management System, (d) In January 1993, the Foreign Exchange Regulation Act 1973 was amended, (e) The dual exchange rate system of March 1992 unified. The rupee was made fully convertible on the trading account in February 1993, (f) A full conversion of rupee on the current account. Art VIII status of the International Monetary Fund (IMF) was attained in August 1994. In August 1994, the rupee value was 31.3 per US dollar each. Since gaining the freedom of the current account, the rupee almost dropped steadily until 2002 when it breached the 50 rupees on the dollar mark. Since then the two major times where the rupee fell have been the 2008-2009 period and the 2010-2011 period. In between, the rupee showed an opposite trend with fluctuations. On the other hand, since the early 1990s, the real value of exports has been steadily increasing. Hence, the expected relationship between exports and the real exchange rate appears to be obvious from this observation.

Literature Review

In India, studies show both the presence and absence of links between exports and exchange rates. Joshi and Little (1994) found that the price elasticity of demand for export was 3 in the long run and 1.1 in the short run. Srinivasan (1998) found that relative prices were an important export determinant in India. Veeramani (2007) found that due to the appreciation of the real effective exchange rate, the dollar value of India's export goods fell.

Bhagwati and Srinivasan (1975) found evidence suggesting the 1966 devaluation aided export performance. Harinaryana (1983) looked at Indian engineering exports and considered world demand through the real engineering exports of the OECD countries. The paper revealed that in the concerned time period (1960-75), world demand was a major determinant of India's engineering exports. However, relative price (price ratio of India's engineering exports relative to her competitors based on unit value indices) did not have a significant effect on export performance.

However, Ghosh (1990) and Sarkar (1994) reported that Indian exports do not respond to price and that India's export performance was not often led by movements in the exchange rate. These papers did not consider the change in government due to the implementation of liberalization policy in their analysis. Bhattacharyya and Mukherjee (2014) considered the impact on India's export due to the breaks of the trend curve during liberalization policy on India's export. They found that the real effective exchange rate did not influence Indian exports at the consolidated level.

Eichengreen and Gupta (2013) examined (a) whether growth rates and exports differed between commodities, traditional and modern services, and (b) whether the experiences of developing countries differed from developed countries, for the timeline 1980–2000 taking 66 countries. They found that the real exchange rate was an important factor in the growth of exports. Cheung and Sengupta (2013) examined the impact of the real effective exchange rate on the share of exports of non-financial sector firms of India for the years 2000–2010. They found a significant negative impact of currency volatility and currency appreciation on export shares of Indian firms. There are many concerns about the pass-through of currency changes into domestic inflation in developing countries. Goldfajn and Olivares (2001) have noticed higher levels of exchange rate pass-through in many emerging economies. Khundrakpam (2008) examined the relationship between exchange rate and domestic prices for the period 1990–2005. Roy and Pyne (2011) estimated the exchange rate changes to India's export prices.

Data and Methodology

In our paper, we attempt to understand the export function of India over the time period of 1996-2015 on the exchange rate and global demand. We utilize export-share of GDP as a dependent function (represented by *inex*), while for exchange rate and global demand we use real broad effective exchange rate (*rbeer*) and world GDP (*wgdp*) respectively. The calculation of the *rbeer* has happened with a currency basket of 60

countries by the Bank of International Standards with the methodology as prescribed by Klau and Fung (2006). It is not seasonally adjusted and standardized with the index year of 2010. The *wgdp* data comes from the Our World in Data database by World Bank and Maddison (2017)[15], denominated in 2011 US Dollars. To prevent base year concerns, we converted the indexing of the *rbeer* data to 2011. For the export share of GDP of India, exports of goods and services represent the value of all goods and other market services provided to the rest of the world.

On a cursory qualitative analysis of data, we observe some interesting trends in the data. Overall, exports grew as a percentage of GDP in our concerned time period (1996-2015), from 10.4% to 19.8%. World GDP and Real Broad Effective Exchange Rate also grew by 98% and 12.3% respectively. The latter becomes moot, given how India follows a managed-floating system, allowing for institutional intervention in the exchange rate., but still may give us valuable insights.

Table 1

Dataset of India's Exports, World GDP and Real Broad Effective Exchange Rate for 1996-2015

Year	INEX	WGDP	RBEER
1996	10.38516927	54605200000000.00	86.77460191
1997	10.69071732	56772100000000.00	92.12639083

1998	11.01846918	58159500000000.00	89.37387567
1999	11.45206461	60247500000000.00	87.92224665
2000	12.99723631	63100900000000.00	92.0264508
2001	12.55837963	64639200000000.00	93.96528749
2002	14.26438392	66420900000000.00	90.69308415
2003	14.94791386	68894900000000.00	90.54150843
2004	17.85912496	72618200000000.00	91.46678659
2005	19.60524669	76089200000000.00	94.40918782
2006	21.26794142	80202600000000.00	93.58051836
2007	20.79969975	84576500000000.00	99.77180358
2008	24.09735726	87020700000000.00	94.88473583
2009	20.40051937	86750100000000.00	89.5379439
2010	22.40093325	91329700000000.00	99.94003598

2011	24.54041132	94982400000000.00	100
2012	24.53443066	98032300000000.00	93.6979479
2013	25.4308613	101270000000000.00	89.31391165
2014	22.96796301	104720000000000.00	90.68392298
2015	19.81318916	108120000000000.00	97.46735292

We test first the stationarity of the three time-series data vectors. We do this by employing the Augmented-Dicky-Fuller test. The test yields that all the data series are non-stationary at a 1% percent level of significance. We then take the first differences of the three series and observe that now they are stationary.

Figure 1

Trends for Export-GDP ratio of India (*inex)*

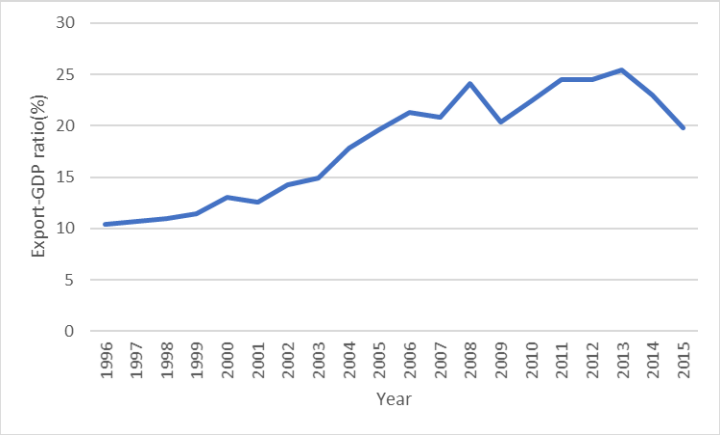

Table 2

Augmented Dickey-Fuller Test for stationarity for *inex*

INEX	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.470	-3.750	-3.000	-2.630

Figure 2

Trends for World GDP in terms of 2011 US Dollars (*wgdp*)

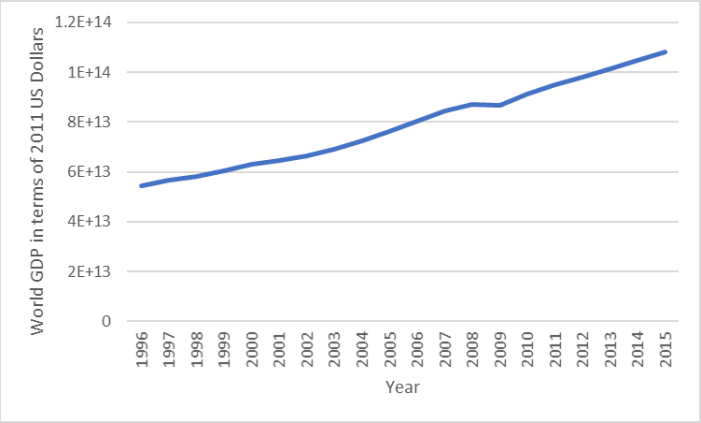

Table 3

Augmented Dickey-Fuller Test for stationarity for *wgdp*

WGDP	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	1.587	-3.750	-3.000	-2.630

Figure 3

Trends for Real Broad Effective Exchange Rate for India (*rbeer*)

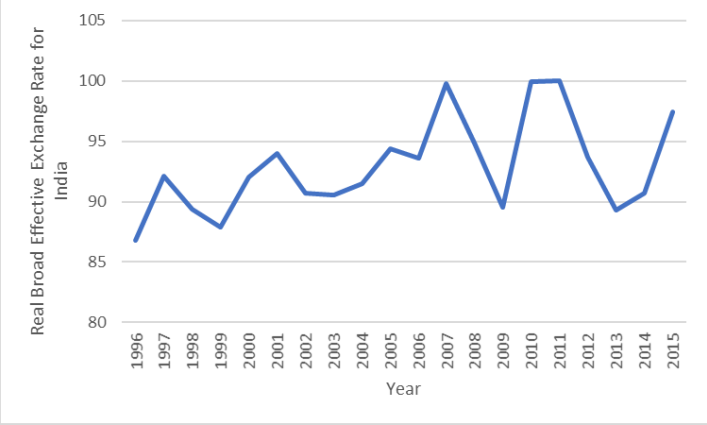

Table 4

Augmented Dickey Fuller for stationarity for *rbeer*

RBEER	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.241	-3.750	-3.000	-2.630

We create first differences and test them for stationarity and can ascertain that the above series are integration of the first order, given that the first differences are stationary at 5% level of significance.

Table 5

Augmented Dickey-Fuller for stationarity for *dinex* (first difference of *inex)*

dinex	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.121	-3.750	-3.000	-2.630

Table 6

Augmented Dickey-Fuller Test for stationarity for *dwgdp* (first difference of *wgdp*)

dwgdp	Test Statistic	1% Critical Vale	5% Critical Value	10% Critical Value
Z(t)	-3.378	-3.750	-3.000	-2.630

Table 7

Augmented Dickey-Fuller for stationarity for *drbeer* (first difference of *rbeer*)

drbeer	Test Statistic	1% Critical Vale	5% Critical Value	10% Critical Value
Z(t)	-4.520	-3.750	-3.000	-2.630

With our initial testing of the data, we can move forward on estimating our relationship through an ordinary-least-squares regression and explore the possibility of a long run cointegration relationship through the Engle-Granger Test.

Results and Analysis

Estimating the OLS relationship with non-stationary forms shows that *wgdp* is a significant determinant of *inex* at 1% and 5% levels of significance, while *rbeer* is significant at 42.1% level. The entire relationship has a multiple regression coefficient of

0.8309 and an adjusted R^2 value of 0.8110, showing a strong relationship between *inex* and the two determinants.

Table 8

Ordinary-Least Squares Regression of *wgdp* and *rbeer* on *inex*

Source	**SS**	**df**	**MS**	Number of obs = 20
Model	442.696261	2	221.348131	F(2, 17) = 41.75
Residual	90.1193799	17	5.30113999	Prob > F = 0.0000
Total	532.815641	19	28.0429285	R-squared = 0.8309
				Adj R-squared = 0.8110
				Root MSE = 2.3024

inex	Coef.	Std. Error	t	P>|t|	[95% Conf. Interval]	
wgdp	2.66e-13	3.54e-14	7.52	0.000	1.92e-13	3.41e-13
rbeer	.1270944	.1541128	0.82	0.421	-.1980553	.4522441
_cons	-14.72406	13.18304	-1.12	0.280	-42.53784	13.08971

We run cointegration tests on the given variables and attempt to capture any long-term cointegrating equations between them. For that, we employ the Engle-Granger Test Method. We calculate the residuals from the above regression and run an ADF test on the residuals to see if there is any stationarity in the residuals, which would be an indication of long-run cointegration. We see that there is no evidence of cointegration equations present in the data over the given time period.

Figure 4

Residual Plot of the OLS regression summarised in Table 5

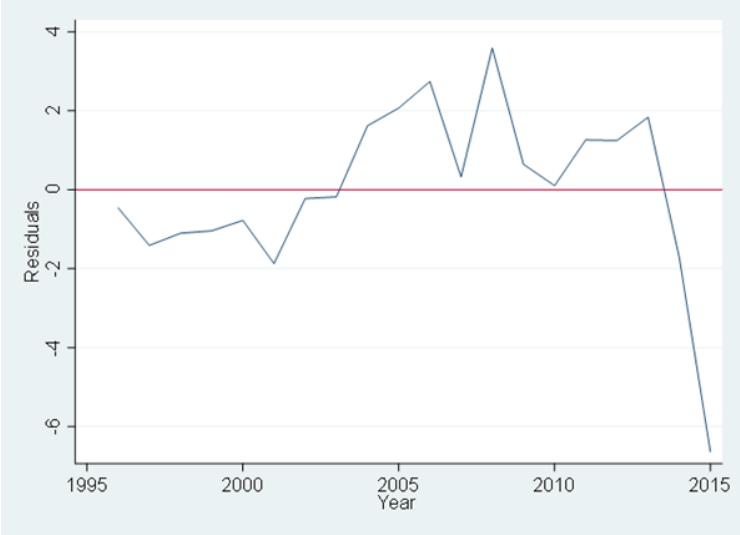

Table 9

Augmented Dickey-Fuller Test for the residuals obtained from OLS (See Table 5)

error	**Test Statistic**	**1% Critical Value**	**5% Critical Value**	**10% Critical Value**
Z(t)	-1.099	-2.660	-1.950	-1.600

We also run the OLS regression of the first differences of all the variables to ensure better results, to prevent the risk of spurious results. In the following regression, we get a weak regression coefficient value of 0.2147. *dwgdp* (first difference of *wgdp*) is significant at 5.3% level of significance, whereas as *drbeer* (first difference of *rbeer*) is only significant at 23.1% level of significance on *dinex (*first difference of *inex)*

Table 10

Ordinary-Least-Squares Regression for *dwgdp* and *drbeer* on *dinex*

Source	**SS**	**df**	**MS**	Number of obs = 19
Model	14.1985779	2	7.09928896	F(2, 16) = 2.19
Residual	51.9198922	16	3.24499326	Prob > F = 0.1446
Total	66.1184701	18	3.67324834	R-squared = 0.2147
				Adj R-squared = 0.1166
				Root MSE = 1.8014

dinex	**Coef.**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**

dwgdp	8.74e-13	4.19e-13	2.08	0.053	-1.47e-14	1.76e-12
drbeer	-.135755	.1089399	-1.25	0.231	-.3666973	.0951872
_cons	-1.889846	1.221815	-1.55	0.141	-4.479977	.7002856

Looking at the export share of GDP, it peaked at 25.4% in 2013 but then dropped for two years to 19.8%. This could be attributed to an increase in the exchange rate. Another reason could be the outpacing of growth rates of GDP and exports, wherein the above two years, India recorded a high GDP growth rate of almost 8%. One may also argue governance changes in this aspect, given the majority victory of the Modi Government, which in hindsight, has not been trade-centric in their policies. However, we postulate that the government transitionary reasons may not appear as swiftly and would be more pronounced in later years (beyond 2015).

The reason for taking world GDP as a representation of global proclivity towards exports and international trade translates into global demand. The global volume of trade would be majorly driven due to global demand hence. In the effective exchange rate variable, there are two representations: narrow and broad. A narrow real effective exchange rate is set up against a comparatively smaller bunch of countries or unions, while a broad one is set up against a more-encompassing set of references. Many papers attempt to establish an export function or an export determination function to attribute different factors that may contribute to the exports of a country. However, our intention is to

understand mainly which factor out of real effective exchange rate and global demand shows a greater correlation with India's export growth. Hence, this paper only attempts to estimate the above-specified regression equation.

Reviewing the real broad effective exchange rate data, we observe great variation during 2008-13. This can be attributed as a consequence of the global financial crisis followed by the Taper Tantrum of the Federal Reserve. The effects were further accentuated due to the minimal intervention done by RBI during this time period.

Post running the proper regression, we observe a significant correlation of world demand with the export share, while the real effective exchange rate is an insignificant contributor. The given variables explain only 21% of export share variation over the time period.

Over the concerned time period, we see global income level to be more strongly correlated with the export share. This could be linked to multiple reasons. Directly, for the ambit of the paper, the exports of India are impacted majorly by the global export demand, which is fueled by global income. Higher global income contributes positively to higher exports of a particular country (Chang, 1948).

One may argue that the global income and export share of the GDP may also have a relationship in lieu of the component situation. However, the share of India's GDP in the global GDP is very less, and hence the effect would be negligible. Moreover, this also enables us to view India's export contribution to GDP as well, so given a common global

level effect that may occur and affect India's GDP likewise, would also allow us to see how much of the effect is transmitted through export share. One may postulate a bidirectional relationship between exchange rate and exports, thus presenting an insignificant correlation in our OLS regression. However, it has been observed that exchange rates are more affected by capital flows rather than traditional trade flows. (Dua and Ranjan, 2010).

Conclusion

In this article we reviewed the theoretical relationship between Indian exports, real broad effective exchange rate and world demand. Time series data vectors for the three variables were checked for stationarity. We then proceeded to construct a model explaining the export function and run an OLS regression. The multiple regression coefficient for the overall relationship is 0.2147.

We use cointegration tests to see if there are any long-term cointegrating equations between the variables. We can see that the data from 1996 to 2015 shows no evidence of the presence of any long-term cointegration equations.

After running the necessary regression, we see a substantial link between global demand and export share, with the real effective exchange rate playing a minor role. Also, the results were shown to be robust to a variety of possible sources of specification error.

Our analysis is partly in tandem with the macroeconomic model designed by Mundell and Fleming which is suggestive of exports being driven by global GDP. Research also tells us that there is a strong relationship between exports and world demand. This has

been attested in the Indian context earlier on. In support of previous literature, Indian exports do not respond to price changes, and India's export performance is not generally influenced by exchange rate fluctuations. Additionally, It has been noticed that capital flows, rather than traditional trade flows, have a greater impact on exchange rates. However, there is theoretical ambiguity when it comes to real effective exchange rate and exports as other studies are of the view that the exchange rate is an imperative component to determine the export function of a country and India portrays a negative relation between the two. Future studies should focus on coming up with a more lucid relationship between the two variables by deploying new techniques.

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