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Wani, Mr. Nassir Ul Haq and Dhami, Dr. Jasdeep Kaur and Sidana, Dr. Neeru

\*Kardan University, Kabul, Afghanistan and \*\*Lovely Professional University, Punjab, India., CT Institute of Management and Technology, Punjab, India., Lovely Professional University, Punjab, India.

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**Mr. Nassir Ul Haq Wani**

**Professor\* and Doctoral Fellow\*\***

**\*Kardan University, Kabul, Afghanistan and \*\*Lovely Professional  
University, Punjab, India.**

**[nassirtoiba786@gmail.com](mailto:nassirtoiba786@gmail.com)**

**Dr. Jasdeep Kaur Dhani**

**Professor and Director**

**CT Institute of Management and Technology**

**[bawa\\_mangat@yahoo.com](mailto:bawa_mangat@yahoo.com)**

**Dr. Neeru Sidana**

**Assistant Professor**

**Lovely Professional University, Punjab, India.**

**neeru.19830@lpu.co.in**

# INDIA'S TRADE LINKAGE WITH BRCS: AN ECONOMETRIC STUDY

## ***Abstract***

*India has put stress on enhancing trade relations with BRCS (Brazil, Russia, China and South Africa) economies, from the recent past. As a result India's export to BRCS's economies has been momentous. From the modeling exercise of this paper, the price and import elasticities of export flows attract a great deal of attention because of its significant implications on India's export earnings from BRCS. Time series data ranging from 2000-2014 has been taken into consideration and to avoid non-stationarity issue on their level, DF and ADF test have been applied at level and first difference. In connection to the model results, Phillips-Hansen's Fully Modified (FM) Method has been employed to get the estimated value of price and import elasticity of export demand for India. The results advocate that India's export are appreciably prejudiced by BRCS economic growth and are very price competitive in the BRCS market. In other words, the depreciation of Indian rupee will be helpful for expanding India's exports to BRCS.*

*JEL Classification: E21, F43, F59, G18*

*Key Words: BRCS, DF, ADF, FM and India.*

# ***INDIA'S TRADE LINKAGE WITH BRICS: AN ECONOMETRIC STUDY***

## **I INTRODUCTION**

International trade has played an important role in the development of both developed and developing countries because countries are dependent on one another due to uneven distribution of resources. Exports are believed to be the engine of economic growth. A nation can win friends through trade relations and ensure an optimal allocation of the available resources. Following the footprints of economic ascendancy, BRICS (Brazil, Russia, India, China and South Africa) are transcending geographical, historical, and regional differences in order to promote their individual and collective interests at a time when the current economic hardship and declining U.S. hegemony mean greater opportunities for emerging countries in global context. India is not an exception to the rule that export promotion policy is much more superior to inward import substitution policy. This article of faith is not only followed by BRICS (Brazil, Russia, China and South Africa) but by other economies as well for the economic development.

Together, the BRICS account for more than 40 per cent of the global population, nearly 30 per cent of the land mass, and a share in world GDP (in PPP terms) that increased from 16 per cent in 2000 to nearly 35 per cent in 2014, and is expected to rise significantly in the near future. If one compares the GDP in PPP terms for 2010, four economies figure among the G-20 top ten, with China, India, Russia, Brazil, and South Africa in 2nd, 4th, 6th, 8th, and 26th place, respectively. In terms of contribution to growth of PPP-adjusted global GDP of the world, these five economies accounted for 55 per cent during 2000–8, and their contribution is expected to rise in the coming years. However, as per the criterion of GDP at market prices, among the members of the G-20, China holds the 2nd position while Brazil, India, Russia, and South Africa hold the 7th, 9th, 11th, and 19th positions, respectively (BRICS Report, 2012 ).

Since early nineties India took trade liberalization measure as a fundamental part of its economic reforms. India's economy has grown at an impressive pace over the last two decades as a result of wide-ranging structural reforms to open up the economy and make it more competitive. As a result of these economic reforms, there has been considerable degree of trade openness in the country. The share of trade in GDP has significantly increased, but the share in world trade is still very low when compared with China and Russia. Although, India

implemented wide-ranging reforms, opened up the economy, dismantled the old licensing system and introduced competition into a number of sectors that had previously been dominated by public monopolies. This decisive action has helped the Indian economy to narrow the gap in living standards with advanced economies. Supported by further reforms, convergence accelerated in the 2000's as growth averaged over 8 per cent a year, one of the strongest performances in the world. India's share of global output and trade has continued to climb. The Indian economy now ranks third largest in the world, measured in PPP terms. But this does not seem enough. To fully reap the benefits of this demographic dividend and support a return to high growth, India needs to continue to address important obstacles to stronger growth. New bottlenecks to growth have also appeared. Following the 2009 global downturn, the Indian economy enjoyed a recovery, however growth began to fade again in 2011 and new macroeconomic challenges began to emerge. GDP raised by 6½ per cent in 2011-12, the slowest annual growth in almost a decade, and has continued to weaken more recently. The composition of growth has also become less resilient. Capital formation, which underpinned the heady growth prior to the slowdown, has languished while manufacturing, another key engine of growth, has been chronically weak. There is, therefore, a clear need to enhance the volume of trade with the rest of world. BRCS area seems to be a dynamic market for India's exports. BRICS economies have taken initiatives on their own to boost their mutual cooperation and understanding and thus have become very important actors in the globalization process.

In this background, the present paper analyses India's trade linkage with BRCS economies within an econometric framework. In designing commercial policies and studying international trade linkages, very little attention has been given in empirical literature in studying the effect of estimated income and price elasticities for bilateral trade (Resnick and Truman 1973). *In this context, the present paper estimates import and price elasticities of export demand for India.* Reshuffling the economic literature, there exist some analytical and theoretical studies on Indo-BRICS economic relations like that of (Cheng et.al (2007), Wani et.al. (2013) and Hirst and Sincai (2015), but however to the best of knowledge, no modeling exercise has been done so far for trade flows between India and individual BRCS economies. From such modeling exercise, measuring price and import elasticities of export flows to BRCS attracts a great deal of attentions because of its significant implications on India's export earnings from BRCS economies. Exports are considered to play an important role in the

economic development of a country. However measuring the price import and income elasticities of foreign trade, especially in developing countries, has received a great deal of attention because of its substantial implications on trade policy and balance of payments issues. Senhadji and Montenegro (1999) highlighted the prominence of export demand elasticities as follows; demand elasticity is an extent of sensitivity of demand against the changes in price and income. The higher the income elasticity of export demand, the more powerful exports will be as an engine of growth. The higher the price elasticity, the more competitive is the international market for exports of the particular country, and thus a real devaluation will be more successful in promoting the export revenues. The higher the import elasticity, the more powerful exports will be as an engine of export growth. Accordingly, price, import demand and income elasticities of export demand become important for investigating the effects of devaluation on trade balance. Based on this statement, the major aim of this paper is to find the price and import elasticities of aggregate export demand. The next section outlines some recent features of Indo-BRCS trade, highlighting the current trend in trade structure followed by section 3 outlining the determinants of trade flows between India and other BRCS economies and finally section 4 concludes the paper.

## **II FEATURES OF INDO-BRCS TRADE**

Traditionally a supporter of multilateral trade negotiations, India has finally woken from the deep slumber and realized the importance of being in an influential trade bloc of BRICS. The opening up and the dynamism of the Indian economy increasingly give rise to questions about the emergence of a "new key player" in the world economy and henceforth it may be relevant to examine the emergence of India from BRCS point of view.

The BRICS countries (Brazil, Russia, India, China and South Africa) have shared a common experience of rapid and substantive economic change over the last decade. While economic growth has had varied consequences for India's foreign policy, we focus on India-BRCS relations, asking whether economic interdependence could lead to more wide-ranging political cooperation between the India and BRCS. This dyadic interaction is of great geopolitical significance covering all the factors needed to change the outlook of India. The Government of India's welcome moves in supporting the core principles of BRICS reminds us of the promises of the 6 summits held so far. The recently held BRICS sixth summit including Federative Republic of Brazil, the Russian Federation, the Republic of India, the People's

Republic of China and the Republic of South Africa, met in Fortaleza, Brazil, on 15 July 2014. The theme chosen for the discussions was "Inclusive Growth: Sustainable Solutions", in keeping with the inclusive macroeconomic and social policies carried out by the governments and the imperative to address challenges to humankind posed by the need to simultaneously achieve growth, inclusiveness, protection and preservation.

Although there are no free trade agreements in BRICS, but it is expected that IBSA countries can reinforce the economic strength of each other by synergizing their complementarities in areas of industry, services, trade and technology, which, in turn, could create a market of 1.2 billion people, 1.2 trillion dollars of GDP, and foreign trade of 300 billion dollars (De, 2005). The BRICS economies altogether are doing their best to change the dimensions of the world. India has made progress towards participating in regional multilateral arrangements in both the economic and security realms. It has also expressed support for some major principles of multilateral cooperation. BRICs have come together in a political grouping in a way that has far exceeded most expectations. For India, co-operation with the BRCS is more vital in terms of addressing its food and energy security issues, trade and combating terrorism. Engaging China has been one of the significant components of India's foreign policy in recent years, considering that co-operation and negotiations with China is imperative in clearing the mistrust between the two countries. This is where Indo-BRCS offers an effective forum.

If we compare India's trade position vis-à-vis BRCS trade positions in global scenario, we easily comment that China's and Russia's position is much stable and stronger than India. Brazil and South Africa lag behind India in the trade position. In Table 1 we have computed the share of different country/region in overall world exports over the period 2000-14. BRCS collective share in world exports has ranged from 7.02 per cent to 17.88 per cent. On the other hand India's share in global exports ranged from 0.68 per cent to 1.8 per cent. Not only BRCS has surpassed India in global exports, same episode has happened against U.S.A, Japan, European Union and Canada.

**Table 1: World Exports by Region/Country (\$ Billions)**

<b>Year</b>	<b>World</b>	<b>India</b>	<b>Brazil</b>	<b>Russia</b>	<b>China</b>	<b>S.Africa</b>	<b>BRCS</b>	<b>U.S.A</b>	<b>Japan</b>	<b>E.U</b>	<b>Canada</b>
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<b>2000</b>	6163.12	42.35	55.11	103.09	249.2	26.29	433.69	780.33	479.27	781.05	277.42
	(100)	(0.68)	(0.89)	(1.67)	(4.04)	(0.42)	(7.02)	(12.66)	(7.77)	(12.67)	(4.52)
<b>2005</b>	9981.52	100.35	118.52	241.45	761.95	46.99	1168.91	904.33	599.41	1345.82	360.55
	(100)	(1.00)	(1.18)	(2.41)	(7.63)	(0.47)	(10.75)	(9.06)	(6.00)	(13.48)	(3.61)
<b>2006</b>	11663.8	121.2	137.8	301.55	968.93	52.6	1460.88	1037.03	646.42	1499.99	388.17
	(100)	(1.03)	(1.18)	(2.58)	(8.3)	(0.45)	(11.61)	(8.89)	(5.54)	(12.86)	(3.32)
<b>2007</b>	13320.5	145.89	160.64	352.26	1220.06	64.02	1796.98	1162.54	714.32	1757.32	419.88
	(100)	(1.09)	(1.2)	(2.64)	(9.15)	(0.48)	(12.51)	(8.72)	(5.36)	(13.19)	(3.15)
<b>2008</b>	15441.9	181.86	197.94	467.99	1430.69	73.96	2170.58	1299.9	781.41	1928.55	455.63
	(100)	(1.17)	(1.28)	(3.03)	(9.26)	(0.47)	(14.04)	(8.41)	(5.06)	(12.48)	(2.95)
<b>2009</b>	12014.8	176.76	152.99	301.79	1201.65	53.86	1710.29	1056.71	580.71	1600.13	315.17
	(100)	(1.47)	(1.27)	(2.51)	(10.00)	(0.44)	(14.22)	(8.79)	(4.83)	(13.31)	(2.62)
<b>2010</b>	14625.7	220.4	197.35	397.06	1577.76	82.62	2254.79	1278.1	769.77	1795.77	386.58
	(100)	(1.5)	(1.34)	(2.71)	(10.78)	(0.56)	(15.39)	(8.73)	(5.26)	(12.27)	(2.64)
<b>2011</b>	17385.5	301.48	256.03	516.99	1898.39	107.94	2779.35	1481.68	823.18	2241.19	450.43
	(100)	(1.73)	(1.47)	(2.97)	(10.91)	(0.62)	(15.97)	(8.52)	(4.73)	(12.89)	(2.59)
<b>2012</b>	17182.9	289.56	242.58	524.76	2048.78	98.87	2914.99	1544.93	798.56	2250.14	454.09
	(100)	(1.68)	(1.41)	(3.05)	(11.92)	(0.57)	(16.95)	(8.99)	(4.64)	(13.09)	(2.64)
<b>2013</b>	17788.6	336.61	242.17	527.26	2209.01	95.11	3073.55	1577.59	715.09	2326.34	456.6
	(100)	(1.89)	(1.36)	(2.96)	(12.41)	(0.53)	(17.26)	(8.86)	(4.01)	(13.07)	(2.56)
<b>2014</b>	17627	317.54	225.09	497.3	2342.34	90.61	3155.34	1619.74	690.21	2339.71	473.55
	(100)	(1.8)	(1.27)	(2.82)	(13.28)	(0.51)	(17.88)	(9.18)	(3.91)	(13.27)	(2.68)

*Source: Calculations based on data from UNCOMTRADE*

*Figure in parenthesis shows percentage of total world export based on the author's calculation.*

One common feature of India's export pattern is that the industrial countries provide the major market for India's export in the past. Over the period 2012-13, the direction of trade (Exports and Imports of goods) has been presented in table 2. United Arab Emirates has remained on priority list in export market and China has proved as an import hub for India. Out of the BRCS, only China could make it to the list and others are missing on top 10 economic radar of India. Classifying the countries rank-wise in export structure, India has exported to U.A.E (36317 Mn \$, followed by U.S.A (36 155Mn \$), Singapore (13 619 Mn \$), China (13 535 Mn \$), Hong Kong (12 279 Mn \$), Netherlands (10 565Mn \$), Saudi Arabia (9 786 Mn \$), United Kingdom (8 613n \$), Germany (7 246) and Japan (6 100 Mn \$) respectively.

**Table 2: Selected Data on Merchandise Trade: Major Trade Partners - India - 2012-2013**  
(Million US\$)

Countries	Import	Countries	Export
China	52 248	China	13 535



Germany	14 326	Germany	7 246
Indonesia	14 879	Hong Kong	12 279
Iraq	19 247	Japan	6 100
Kuwait	16 588	Netherlands	10 565
Qatar	15 693	Saudi Arabia	9 786
Saudi Arabia	33 998	Singapore	13 619
Switzerland	32 167	United Arab Emirates	36 317
United Arab Emirates	39 138	United Kingdom	8 613
United States of America	25 205	United States of America	36 155

Source: Ministry of Commerce & Industry, Export Import Data Bank.

The import pattern depicts some new actors into the trade play as China continues to be the ruler of imports for India. India imports from U.A.E (39138 Mn \$), followed by Saudi Arabia (33998 Mn \$), Switzerland (32167 Mn \$), United States of America (25205 Mn \$), Iraq (19247Mn \$), Qatar (15693 Mn \$), Kuwait (16588 Mn \$), Indonesia (14879 Mn \$) and Germany (14326 Mn \$). It is quite clear that Gulf countries emerge as the major destinations for Indian imports.

**Table 3: Selected Data on Merchandise Trade: BRCS Countries - India - 2000/2013**  
(Million US\$)

	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013
	<b>Import</b>									
<b>Brazil</b>	-	893	992	950	1186	3438	3549	4271	4826	5045
<b>Russia</b>	518	2022	2409	2478	4328	3567	3600	4764	4532	5324
<b>China</b>	1502	10869	17475	27146	32497	30824	43480	55314	52248	73245
<b>S.Africa</b>	1022	2472	2470	3605	5514	5675	7141	10972	8888	9456
	<b>Export</b>									
<b>Brazil</b>	-	1091	1449	2526	2651	2414	4024	5770	6049	6111
<b>Russia</b>	889	733	904	941	1096	981	1689	1778	2296	2418
<b>China</b>	831	6759	8322	10871	9354	11618	15483	18077	13535	16416
<b>S.Africa</b>	311	1527	2242	2661	1980	2059	3912	4731	5107	5722

Source: Ministry of Commerce and Industry, Export Import Data Bank.

The growing importance of trade of India with BRCS group of countries is quite momentous and speaks high. The trends in trade between India and BRCS countries (Brazil, Russia, China and South Africa) provide strong insights and implications for India. From table 3, it is clear that China ranks first in terms of exports and imports market. With the passage of time, the strong degree of coherence in terms of trade between Indo-BRCS is increasing.

Year/Country	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
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Brazil	9.19	9.44	12.2	13.15	19.21	11.81	14.03	19.03	22.00	19.91	25.04
Russia	40.92	6.87	6.89	6.39	6.44	6.39	5.32	6.68	7.65	7.88	7.77
China	35.15	69.99	63.82	65.70	59.67	68.72	66.68	59.02	52.58	53.49	47.11
S.Africa	14.72	13.68	17.07	14.74	14.66	12.99	13.95	15.25	17.75	18.71	20.06
BRCS(Total)	100	100	100	100	100	100	100	100	100	100	100

**Table 4: BRCS Country in India's total export to BRCS (%)**

*Source: Calculations based on data from UNCOMTRADE*

In table 4, we provide the share of individual BRCS country in India's total exports to BRICS region during 2000-2014. From this table it is clear that China accounts for major share in India's exports to BRCS throughout the period. In 2000 Russia was important destination for Indian exports accounting 40.92 per cent, but the strategies of Chinese market attracted Indian export flow. After China, Brazil is in a race to become a hub of exports of India followed by South Africa. If analysed year wise Brazil and South Africa are consistently making up to the expectations of the export demand, as China has slumped from 66.68 per cent in 2010 to 47.11 per cent in 2014.

### **III DETERMINANTS OF EXPORT FLOWS FROM INDIA TO BRCS**

#### **A: Theoretical Background**

Following the comparative advantage principle, each country is likely to export those goods which can be produced at relatively low costs. The returns from trade depend on enhancing domestic production, ensuring international standards and exploring new markets for exports. The export performance of a country is determined by many factors, which can be categorized in terms of demand and supply side determinants. The demand side factors include capacity of the trading partners, the prices of exportable goods, the prices of competing/substitute goods in the world market and the exchange rate etc. However the political and social factors also play a very crucial role in this regards. The supply side factors include domestic productive capacity, exchange rate, relative prices (prices of exports relative to prices of competing goods), wage rate and import of inputs etc. On the demand side, the world price and world income have an important role in explaining export performance, whereas on the supply side, the domestic productive capacity and the availability of inputs are important.

Developing economies, when compared with other developed economies like USA, UK, Canada etc. have limited access to international financial markets, exports play a vital role in the

growth process by spawning the scarce foreign exchange necessary to finance their imports of energy and investment goods, both of which are crucial in capital formation. Lewis in 1980 stated that if developed world gets knotted, the effect will be on the advance track of developing world unless the latter find a auxiliary engine of growth. However Riedel in 1984 defied the idea of Lewis by disagreeing that developing economies can endure the slowdown by engaging in price competition. A million dollar question arises as how the developing world can safeguard from the brunt of developed world. In this regard, (Faini et.al, 1992) empirically proved Riedel's reasoning false. Riedel's arguments suffer from the misleading notion of composition of reasoning in the sense that a country alone can increase its market power through a real devaluation but all countries can't. A central constituent in this disagreement is the size of the price, income and import elasticities of developing country's export demand. If import and income elasticity of the export demand is higher, exports will be definitely as the powerhouse of growth (Goldstein and Khan, 1978) and if price elasticity is higher, the more competitive is the international market for exports of the particular country, and thus the more successful will a real devaluation be on promoting export revenues.

Conventionally, the empirical analysis of trade flows has been carried out through partial-equilibrium models based on the hypothesis of imperfect substitution between foreign and domestic goods. The main assumption of the model is that, in a simple two-country world, each country produces a single tradable good that is an imperfect substitute for the good produced in the other country (Goldstein and Khan, 1985). The most widely used (and simple) procedure for estimating aggregate export and import demand functions in this context is based on the Marshallian demand function. The model can be extended to a n-country world, in which the symmetry between the import demand and the export demand equations disappears. The country's total imports face competition only from domestic producers, whereas the country's exports will face competition not only from domestic producers in the importing region, but also from "third country" exporters to that region. Thus, normally it is assumed that the dominant relative price competition occurs among exporters. Consequently, the relative-price term that typically appears is the ratio of the export price to competitor's export prices adjusted for the exchange rate. Therefore, a typical function for aggregate exports can be written as follows:

$$X_d = F(Y_+^* P_x/S \times P^* ) \quad (\text{I})$$

where  $X_d$  is the volume of exports demanded by foreigners,  $Y^*$  is the world economic activity in constant prices,  $P_x$  is the price of exports,  $P_x$  are the foreign competitor's prices in the country's export markets, and  $S$  is the nominal exchange rate in units of foreign currency per unit of home currency. Therefore, the relative price term  $(P_x/S \times P^*)$  can be viewed as the terms of trade or the real exchange rate.

In a similar way, the demand for imports can be specified as follows:

$$M_d = f(Y_{(+)}, P_{M(-)}/P) \quad (\text{II})$$

where  $M_d$  is the volume of imports demanded by the domestic residents,  $Y$  is the domestic economic activity in constant prices,  $P_M$  is the price of imports in domestic currency, and  $P$  is the price of the products that are domestic substitutes to this country's imports.

Numerous empirical studies on exports are available, following different estimation approaches and methodologies. Most of these studies have relied on single equation models, incorporating both the demand and supply side determinants of exports mixed together. This approach has often led to misleading results due to the aggregation of different classes of variables. The robust and precise estimates can be obtained only if the demand and supply side equations are carefully specified with appropriate variables. Khan and Night (1988) have employed the Two Stage Least Square (2SLS) to examine the relationship between import of inputs and export performance for a sample of thirty four developing countries, using time series data over the period 1971-80. Reidel (1988) used the simultaneous equations approach to examine the demand and supply side determinants of exports quarterly time series data over the period 1972-1984. Funk and Holly (1992) have employed the Full Information Maximum Likelihood method to estimate the demand and supply side export functions for three different categories of exports i.e., the total manufactured exports, mechanical engineering and motor vehicle exports of the West Germany. The quarterly time series data was applied over the period 1961-1987. Muscatelli, et al. (1992) have employed the Modified OLS to examine the determinants of the Hong Kong's exports, using quarterly time series data over the period 1972-1984. Reidel, et al. (1988) have examined also the determinants of exports of Hong Kong to test the small country hypothesis, using quarterly time series data ranging from 1977:1 to 1984:4. Muscatelli, et al. (1995) analyzed the determinants of exports of the newly industrialized Asian economies, including Hong Kong, Korea, Taiwan, Singapore, Malaysia and Thailand, using a time series data over the period 1967-1987 and employed the Full Information Maximum

Likelihood method for estimation. In Indian perspective, Roy (2007) studied the demand and supply factors in the determination of India's disaggregated manufactured exports by employing a simultaneous exports error-correction approach covering the period from 1960-2000. The study provides an insight about the vitality of demand as well as supply effects in the determination of India's disaggregated exports except textiles and garments.

Keeping in view the above discussion, it is evident that studies regarding the determinants of exports follow different methodologies to achieve desired results. Although some methodologies are not comprehensive enough, suffer from estimation weaknesses. In contrast, there are only few international studies that have followed comprehensive approach in specification of both demand and supply side. The present paper is intended to fill up the gaps in specification and estimation. We develop a model based on Armington approach (1969) equation framework and test the demand of export function for export partners of India which include Brazil, Russia China and South Africa. The estimates so obtained are likely to be more consistent and reliable.

## **B: Model Specification and Methodology**

The foreign trade models are specific by different researchers following different approaches. However there is a universal consent in literature about the empirical form of demand for and supply functions of exports. The standard approaches are the "imperfect substitute model" and the "Armington Approach". Imperfect substitute model assumes that neither imports nor exports are perfect substitutes of domestic goods. Keeping this in view, the consumers in the trading partners' economies are assumed to maximize their utility subject to budget constraint. The resulting demand function depends on the level of income in the economies concerned, the price of exports and price of substitute goods in the world market. The specification of supply-side export equation is also straightforward within the 'imperfect substitute model'. The producers in the domestic economy are assumed to maximize their profits subject to cost constraint. This yields export supply function, depending on the productive capacity and relative prices i.e. foreign prices of exports relative to the domestic prices of exportable goods (Goldstein and Khan, 1985). Armington approach is a popular specification. It is a disaggregate model which distinguishes commodities by country of origin with import demand determined in a separable two-step procedure. The Armington approach permits the

calculation of cross-price elasticities between imports from all sources using estimates of the aggregate price elasticity of demand for imports, a single elasticity of substitution and trade shares. Although, the main focus of this paper is to estimate the import and price elasticities of export demand for India against BRCS, and hence the supply side determinants are beyond the scope of the paper and thus imperfect substitute model will not be employed (Equation I and II support the model). To achieve the results, Armington based approach is employed.

### **C: The Export Demand Model**

The economic interdependence between India and BRCS countries stems from the idea of international trade linkage system. According to Waelbroeck (1976) and Sawyer (1979), international trade linkage provides a platform for economies to rejuvenate the flow of their trade to their utmost potential. In order to identify the determinants of trade flows between India and the BRCS countries, the explanation of bilateral trade is divided into two steps. The first is the allocation of expenditure between domestic goods and imports at BRCS country level. The second is the distribution of commodities according to their geographical origin. This advancement allows one to summarize from the simultaneous explanation of the volume of trade and its origin and concentrate only on the latter (Armington, 1969). In other words, the specification of demand functions in foreign trade first determines total demand among competing sources of supply (Winter, 1984). Thus it is assumed in this study that total import demand in each BRCS country are the India's respective exports to BRCS countries and thus allocation decision will be considered in the model. The modeling exercise employed in this paper is same as (Sarkar, 2009) has used for assessing the India's trade linkage with ASEAN economies.

In order to specify the model, we consider India's export to jth BRCS country as a demand function of jth BRCS country, so that it may be called the import function of jth BRCS country for India's exports. Thus, it can be seen as an allocation model that explains India's exports to jth BRCS country as a function of imports of buyer country and India's unit value of exports relative to domestic price level of buyer country (Ranuzzi, 1981). The specification of bilateral export demand function is as follows:

$$\mathbf{X_j} = \mathbf{a} + \mathbf{b M_j} + \mathbf{c (UVX / PY_j)} + \mathbf{U_j} \quad \text{( III)}$$

Where,  $j = 1, 2, 3$  and  $4$  (four BRCS countries namely Brazil, Russia, China and South Africa).

$X_j$  = Exports of India to  $j$ th BRCS country in US \$ million at constant price.

$M_j$  = Aggregate imports of  $j$ th BRCS country in US \$ million at constant price.

$UVX$  = India's indices of unit value of exports in US\$ terms (2000=100).

$PY_j$  = GDP deflator of  $j$ th BRCS country in US \$ terms (2000=100).

$U_j$  = Error term.

Here, the assumptions are

- (i)  $b$  is positive implying higher world imports of  $j$ th BRCS country would increase India's exports to that country and lower imports would decrease India's exports to that country.
- (ii)  $C$  is negative implying India's higher export prices relative to domestic price of  $j$ th BRCS country would decrease India's exports to that country and vice-versa.

To get a direct measure of elasticity, the final form of equation to be estimated has been assumed in log- linear form of equation (III) in real term:

$$\text{Log } (X_j/UVX) = \mu + \alpha \text{ Log } (M_j/PY_j) + \beta \text{ Log } (UVX/PY_j) + V_{ij} \quad (\text{IV})$$

Where

$\alpha$ : Elasticity of India's export to  $J$ th BRCS country with respect to total imports of that country.

$\beta$ : Elasticity of India's exports to  $j$ th BRCS country with respect to India's unit value index of exports relative to domestic price level in that country (to represent cost of production of buyer country).

#### **D. Database, Methodology and Data Analysis.**

The time series data required for the estimation are based on bilateral exports of India to individual BRCS country, the aggregate imports of individual BRCS country, unit value of

exports of India, GDP deflator of individual BRCS country, and the exchange rate of five countries (Brazil, Russia, India, China and South Africa). The data on former two variables has been collected from Uncomtrade. The series of unit value index of exports, exchange rates and GDP deflator with base at 2000 have been taken from World development indicators- World Bank Database. All data on quantity variables are measured in million US dollars. The sample period ranges from 2000-2014.

The most general method of estimating single equation is ordinary least squares (OLS) method. However, application of OLS to a time series data, might lead to spurious regression results if the data series are found to be non-stationary (Dickey and Fuller, 1979). In maximum of the cases, time series data suffers from the problem of non-stationarity. A series is said to be (weakly or covariance) stationary if the mean and auto-covariances of the series do not depend on time. Any series that is not stationary is said to be non-stationary. In our study, we are also employing time series data, thus the pre-requisite condition is to check the stationarity of the data, and for the same procedure we have tested unit root test for all the variables, namely India's bilateral exports to individual BRCS country, India's relative export price and import bill of BRCS country individually. The total number of variables is twelve.

Table 5 depicts the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) statistics for testing the unit root hypothesis together with the associated critical values. It is clear from the table 5 that for all the twelve variables in the study, neither DF nor ADF statistics accept the stationarity in data. The unit root hypothesis cannot be rejected for all the variables at conventional significance levels. To put into simpler words, all the variables under study are non-stationary on their respective levels. Therefore, the application of OLS (Ordinary Least Square) method to the regression model will give spurious (non-sense) relationship. As a result equation (IV) will be estimated by employing fully modified OLS method proposed by Phillips-Hansen's (FM) technique. Phillips and Hansen (1990) proposed an estimator technique which employs a semi-parametric correction to eliminate the problems caused by the long run correlation between the co-integrating equation and stochastic regressor's innovations. The resulting Fully Modified OLS (FMOLS) estimator is asymptotically unbiased and has fully efficient mixture normal asymptotic allowing for standard Wald tests using asymptotic Chi-square statistical inference. The FMOLS estimator employs preliminary estimates of the symmetric and one-sided long run covariance matrices of the residuals. The condition for



applying FM technique is that the dependent variable and the independent variables are integrated of order one, i.e. they have unit roots.

**TABLE 5: UNIT ROOT TEST FOR VARIABLES IN LEVEL**

**Dickey-Fuller statistics and Augmented Dickey-Fuller Statistics**

India's Exports	Bilateral Real Exports (Xj/UVX)		Real Imports of buyer country(Mj/PYj)		India's relative export price Index(UVX/PYj)	
	DF	ADF	DF	ADF	DF	ADF
Brazil	-0.678	-0.890	-1.072	-1.014	-1.364	-1.460
Russia	-2.225	-3.553	-1.559	-1.694	-1.966	-2.054
China	-2.153	-3.473*	-1.250	-2.043	-1.899	-1.337
S.Africa	-0.874	-1.163	-0.916	-0.411	-2.755	-4.195

95 per cent critical value for the ADF statistics=2.768

Source: Data collected from UNCOMTRADE

Notes: 1. All variables are expressed in natural logarithm.

2. Unit root tests have been performed using E-Views 7.0.

In order to apply the FM technique, the testing procedure as described in the above section, the basic need is to determine whether all variables employed in the model are I (1), i.e. integrated of order one. The testing tools to check the unit root are Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests. The results obtained by applying these tests to the series of data set for all the variables in their first difference have been presented in Table 6 as follows.

**TABLE 6: UNIT ROOT TEST FOR VARIABLES IN FIRST DIFFERENCE**

**Dickey-Fuller statistics and Augmented Dickey-Fuller Statistics**

India's Exports	Bilateral Real Exports (Xj/UVX)		Real Imports of buyer country(Mj/PYj)		India's relative export price Index(UVX/PYj)	
	DF	ADF	DF	ADF	DF	ADF
Brazil	-5.943	-5.696	-3.646	-3.571	-3.770	-3.654
Russia	-1.680	-1.613	-3.464	-3.306	-4.348	-4.354
China	-2.745	-2.590	-2.828	-2.761	-2.194	-2.166
S.Africa	-4.396	-4.257	-1.727	-2.059	-4.624	-5.859

95 per cent critical value for the ADF statistics=2.876

Source: Data collected from UNCOMTRADE

Notes: 1. All variables are expressed in natural logarithm.

2. Unit root tests have been performed using E-Views 7.0

From table 6, the unit root tests confirm that all the series employed are integrated of order one, i.e. I (1). Therefore the necessary condition for Phillip's –Hansen FM technique is satisfied. Thus we can proceed to perform the regression analysis.

### E. Regression Results.

The regression results of FM estimates for the regression model (Equation IV) are presented in table 7 by employing the E-Views 7.0 software package. The study period covered is from 2000-2014. The results portrayed in table 7 depict that the two regressand (Independent variables) bear the expected sign as is clear from the economic literature. The coefficient of real import for each BRCS (Brazil, Russia, China and S.Africa) country has been found to be statistically significant at 1 per cent level for all the four cases (BRCS). Furthermore, India's export price relative to domestic price of BRCS country bears expected negative sign with statistical significance at 1 per cent level in all the four cases. Although the variables in the regression equation (IV) are measured in logarithm, the corresponding coefficient gives the direct measure of elasticity of India's export with respect to price and imports. In case of India's export to Brazil, it has been found to be elastic with respect to both India's export price and total imports of the buyer country. However, the import elasticity is greater than price elasticity.

**TABLE 7: PHILLIPS HANSEN FULLY MODIFIED ESTIMATES**

<b>Dependent Variables</b>	<b>Coefficient of independent variables</b>		
<b>India's real exports to jth BRCS country(Xj/UVX)</b>	<b>Real import bill of jth BRCS country(Mj/PYj)</b>	<b>India's export price relative to domestic price of jth BRCS country (UVX/PYj)</b>	<b>Intercept (C)</b>
<b>Exports to Brazil</b>	0.983 (1.751)	1.647 (2.125)	-2.180 (-2.399)
<b>Exports to Russia</b>	0.232 (0.813)	-3.735 (-5.496)	-0.604 (-2.583)
<b>Exports to China</b>	0.762	-0.034	-1.735

	(2.832)	(0.098)	(3.470)
<b>Exports to S.Africa</b>	0.284	1.366	-1.133
	(2.418)	(3.470)	(-5.118)

Notes: 1. All variables are measured in natural logarithm.

2. The value in the parenthesis below each coefficient gives estimated (t) ratio for the corresponding coefficient.

3. \* denotes the respective coefficient is significant at 1 per cent level.

In case of exports to Russia, India's exports have been found to be elastic with reference to price and inelastic with reference to import elasticity. Same trend like that of Russia is seen in China as well. Furthermore, India's exports have been found to be elastic with reference to price and import in case of South Africa.

The elasticity of exports with respect to BRCS import in all of the cases doesn't exceed unity. The elasticity of India's export with respect to Brazils import has been found to be highest. The lowest one has been observed in case of India's exports to Russia. The estimated activity elasticity reveals that a one percentage point increase in BRCS import leads to 0.983 percentage point increase in the demand for India's exports to Brazil, 0.762 percentage point increase in the demand for India's exports to China, 0.284 percentage point increase in the demand for India's exports to South Africa and 0.232 percentage point increase in the demand for India's exports to Russia. The relative price elasticities for three out of four BRCS countries exceed unity. The highest one has been found in case of India's export to South Africa, while the lowest has been found in case of India's export to China. The estimated price elasticity reveals that a one percentage point increase in India's relative export price would lead to 3.735 percentage point decrease in the demand for India's exports to Russia and 0.034 percentage point decrease in the demand for India's exports to China. Furthermore, the estimated price elasticity reveals that a one percentage point increase in India's relative export price would lead to 1.647 percentage point increase in the demand for India's exports to Brazil and 1.366 percentage point decrease in the demand for India's exports to China.

#### **IV. CONCLUSION AND POLICY IMPLICATIONS**

Since the inception of the idea of BRIC by Jim O' Neill in 2001, followed by the joining of South Africa in 2009, thus completing the BRICS, these countries realized their economic

weight to be the game changers for the world by making it bi-polar. In the same flows, India realized the truth of gaining economic mass and has put emphasis on these economies namely BRCS (Brazil, Russia, China and South Africa). Exports to these countries have increased significantly since 2005, but financial crises of 2008 put a worrisome note on the trade flow. But somehow, India managed its growth path. At this decisive juncture, policymakers have to be very vigilant to safeguard India's economy.

The objective of this paper is to find the determinants of India's export flows to Individual BRCS countries. The consideration of individual countries in this study shows that there exist significant differences in export demand elasticities in the BRCS countries with different stages of their economic development when explaining their behaviour as importers from a common trade partner, India. Taking results of the model into consideration, it can be said that the results are up to mark in terms of significance and sign of the explanatory variables. Further, the result of this study reveals valuable insight for policy designers. The important implication excavated from the study is that the expenditure effect on India's export to BRCS has been found to be positive. To put into simpler words, the demand for India's exports is influenced positively by the growth of the BRCS country.

In order to formulate a commercial or exchange rate policy one major concern for policymakers is the responsiveness of export flows to changes in prices. This question is of utmost importance in Indian context, as there is not a single preferential trade agreement between the BRICS except IBSA. The study has clearly depicted that India's export is competitive in BRCS market. Thus it is the need of the hour between the BRICS countries to sign the preferential trade agreements and that would ultimately escalate its volume of trade with the region.

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