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Determinants of India's Manufactured Exports to South and North: A Gravity Model Analysis

Suresh K G
IBS Business School, Dehradun, India.
Email: sureshkg2020@gmail.com

Neeraj Aswal
Faculty of Science and Technology, ICFAI University,
Dehradun, India. Email: n.rajdd@gmail.com

ABSTRACT: We have analysed the determinants of India's manufactured exports to its southern (developing countries) and northern (developed countries) markets. We employed an augmented gravity model to examine the determinants of India's exports. The analysis shows that India's exports to south and north is explained by the new trade theory variables like total GDP, GDP similarity and the difference in percapita income as an indicator of Heckschor-Ohlin theory of trade. However the distance is more negatively affecting India's exports to north than the southern market as the proximity to southern market is helping India's exports to grow in south.

Keywords: South-South trade; South-North trade; Gravity model.
JEL Classifications: F1; F14

1. Introduction

The traditional world trade pattern; exporting primary products by developing countries and manufactured goods by developed countries is being replaced by a more complex pattern in world trade, which is commonly known as the "new Geography of trade" (UNIDO 2006). In the new geography of international trade, "South (developing countries) is gradually moving from the periphery of global trade to the centre..... South as a producer, trader and consumer in global markets" (UNCTAD 2004); where the role of developing countries became strong on a north-north as well as south-south basis[1] (Puri 2007). The reason for the emergence of this pattern is the development of China, East Asian countries and India. Combined with this, the low level of economic growth in developed countries and the resultant decline in the demand for primary products, since it moves away from the raw material based industrial production structure to service based economic structure made the trade between developing countries attractive. Trade among developing countries.... "Can shield against a decline in demand of developed countries for primary commodity exports, as well as provide an opportunity for export diversification away from a narrow dependence on primary commodities "(TDR 2005). Lewis (1980) indicated the need for improving the trade between developing countries as he expected the slowing down of growth in developed countries may negatively affect the growth in developing countries. He suggested that the trade among developing countries can stimulate the growth in developing countries by using trade as an engine of growth.

The Trade and development report (TDR 2005) lists three striking features of the new geography of trade in the post 1980 global trade data; (i) a dramatic increase in the value of manufactured exports from developing countries, (ii) a rising share of developing countries in world trade and (iii) a strong increase of South-South trade in both primary commodities and manufactures. Asian Development Outlook (2011) lists the following three reasons for the rapid growth of developing countries role in world trade; "(1) strong economic growth in emerging economies, the rates of which were above the

[1] North-north refers to trade among developed countries and south-south refers to trade among developing countries (TDR 2005)

world average; (2) the rise of fragmented production and trade networks; and (3) the progressive dismantling of trade barriers".

The economic growth in developing countries have changed the weights of global economy also, since the share of South's GDP (as given in ADB outlook 2011 based on WDI data) in the World GDP has increased from 27.8% in 1990-91 to 41.3% in 2009. For the developing Asian countries, the respective shares are 13.1% and 25.7%. The share of China's GDP has tripled over this period as it was 3.7% in 1990-91 against 12.6% in 2009. India's share has increased from 3% to 5.2%.

As per the UNCTAD trade data base, the share of developing countries in the world trade has increased from near about 20% in 1970 about 42% in 2010 against a fall in the share of developed countries from 76% to 54% during the same period. But the developing countries in Asia accounts for about 33% of the world trade in 2010 against 8.42% in 1970. The respective figures for African developing countries are 4.98% and 3.31% respectively; indicating a decline in the share of developing African countries in the world trade. The South-south trade is following a "hub and spoke" pattern; developing Asian countries (including intra Asian trade) accounted for over 85% of the South-South trade in 2005 (UNCTAD (2008)). Athukorala (2011) has observed that developing Asia accounts for about 80.3% of the South-South trade in 2009 against 84.2% in 1990-91. For the other regions in south such as Africa and Latin America excluding Mexico account for about 2.6% and 9.9% respectively. Out of developing Asia, regional concentration of trade is very discernible since China accounts for about 51% of exports and 56% of imports in 2009. The northeast Asia (covering China and South Korea) and South East Asia accounted for about 66.5% and 25.6% of the total South-south trade in Asia respectively. Another emerging country -India accounted for only 6.1% of the exports and 8.5% of imports in South –South trade in Asia. As Athukorala pointed out more than 50% of the South-South trade is with China. China has 51.8% share in south-south exports in 2009 (against 40% in 1991) and 56% share in south-south imports in 2009 (against 45.6% in 1991).

Does the growth of south-south trade make the northern markets less important for southern countries? The traditional trade theories advocate trade between dissimilar economies, since it increases the welfare gains from trade. "Despite already low levels of protection in the North, the market shares of these countries and the associated potential for technology spill- over suggest that further liberalisation by the North would generate substantial gains in the South even without significant liberalisation by the South" (Kowalski and Shepherd, 2006).

In this paper we are analysing the exports of India with south and north using the augmented gravity model. The contribution of our study are; this is the first study analysing the exports determinants of India with the South and North on a comparative perspective, secondly, we have considered the nonstationarity features of variables in Gravity model which has not considered in any study in Indian context.

2. India's Trade With South and North

As pointed out earlier, one of the reasons for the emergence of South-South trade is the growth of India, China and the East Asian countries. Among these, India is a prominent player in the changing global economic scenario since it registered high rate of economic growth over the last several years.
Since independence, India's foreign trade has shown remarkable performance in absolute terms. The exports of India have grown at a rate of 0.22% during the 1950's and about 3.58% during the 1960's. In the seventies, the annual export growth was remarkable with about 17%. With the introduction of liberalization policies in 1980's, the economy has registered a much higher rate of growth in the second half of the 1980's. The post reform period shows different growth performance. But after 2002, the exports sector has shown a rapid growth rate (Veeramani, 2007). According to the WTO trade profile 2011, India occupies 20th position in merchandise exports. In terms of the economic growth, exports and imports growth, India is a leading country in the world after China in the recent period (Qureshi and Wan, 2008).

The share of India in the world merchandise exports is also improving over the period after a fall in the first three decades of post independent period. The figure was 2.21% in 1948, but it went down to 0.5% in 1983 and in the post liberalization period the share has improved and it is more than 1.32% in 2009 as per the WTO data. Direction wise, exports data indicates that the Indian exports

structure is matching with the global changes in trade pattern, as against the dependence on developed economies in the pre-reform period, the exports markets are shifting towards the developing countries. The share of developed countries in the exports of India was more than 65% in 1962 and it decreased to 39% in 2009. By the same time the share of South (developing countries) has increased significantly.

Among the developed countries India's exports share to European Union (EU) was 36% in 1962 and it came down to 23% in 1991 and in 2010 the share is about 18%. Similarly for Euro Area the share increased from 7.39% in 1962 to 13.65% in 2010. But this share reached more than 17% in the late 1990s. Country wise USA had 17% share in 1962 and in 2010 it is about 12%, after reaching more than 23% in 1999.

Even though the development of India is considered as an important reason for the emergence of South-south trade, despite the fact that India's share in south-south trade improves, the share of India in South-south exports and imports are 6.1% and 8.7% respectively,…….. much less than China (with 51.8% and 50.6% respectively for exports and imports as per Athukorala 2011). But the share of India in South-South exports and import have increased in the post 1991 period, since the respective figures were 2.4% and 2.6% in 1991. South-South exports constitute 58.2% of India's nonfuel exports in 2009 against 25.2% in 1990-91. In absolute terms the exports increased from $4.4 billion in 1991-92 to $88.9 billion in 2009. The share on Indian exports to the developing Asia (ASEAN plus East Asia) increased from 3% in 1962 to 24% in 2010. The respective share was 9% in 1991. Among the developing countries India's exports to China is 9.40% in 2010 against 0.01% in 1977. Regarding the commodity composition, around 82% of India's exports to developed countries were manufactured goods and the respective figure for developing countries were 57.6%.

3. Methodology

Following Krugman and Helpman (1985) we set the following gravity model for the study. The equation for OLS estimation is as;

$$RX_{ijt} = \beta_i + \beta_2 \ln TGDP_{ijt} + \beta_3 SGDP_{ijt} + \beta_4 DPIC_{ijt} + \beta_5 RER_{ijt} + \beta_6 Dis_{ij} + \beta_7 CL_{ij} + \beta_8 CB_{ij} + \beta_9 CC_{ij} + \beta_{10} RTA_{ij} + \varepsilon$$

For the north the model is modified as

$$RX_{ijt} = \beta_i + \beta_2 \ln TGDP_{ijt} + \beta_3 SGDP_{ijt} + \beta_4 DPIC_{ijt} + \beta_5 RER_{ijt} + \beta_6 Dis_{ij} + \beta_7 CL_{ij} + \beta_8 EU + \varepsilon$$

For considering the specific effects we have added the fixed effect (αij) and time effects(αt) in the above model.

Where;

RXijt is the real exports, SGDPij- GDP similarity between country I and j, DPICij-Difference in per capita income between country i and j, ERij-Real exchange rate between the currencies of country I and j, Disij-Distance between the capital cities of country i and j, CLij-common language dummy, CB-ij-common border, CCij-common colony, RTAij-Dummy variable to indicate the presence of trade agreements between country i and j.

Based on the share in Indian export pie we have selected 32 countries in the south and 32 countries in the north for the analysis. The annual data span for the period 1992 to 2012. Countries included in the south panel are Algeria, Angola, Bangladesh, Brazil, Brunei, Chile, China, Columbia, Egypt, Hong Kong, Indonesia, Iran, Kenya, South Korea Kuwait, Malaysia, Mauritius, Mexico, Nepal, Nigeria, Pakistan, Peru, Philippines, Qatar, Saudi Arabia, Singapore, South Africa, Sri Lanka, Thailand, Turkey, UAE and Vietnam.

For the north panel we considered Australia, Austria, Bermuda, Bulgaria, Canada, Denmark, Finland, France, Japan, Iceland, Belgium, Luxemburg, Cypress, Estonia, Germany, Greece, Ireland, Israel, Italy, Latvia, Lithuania, Malta, Netherlands, NewZealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, U.S.A, and United Kingdom. We have considered Belgium and Luxemburg as one country.

TGDP is the sum of GDPs of country and j at time period t. As per the new trade theory the TGDP is positively related to the exports.

SGDP-Similarity of GDP index is calculated as
GDP similarity index=

$$SGDP_{ijt} = \ln\left[1 - \left(\frac{GDP_{it}}{SGDP_{it} + SGDP_{jt}}\right)^2 + \left(\frac{GDP_{jt}}{SGDP_{it} + SGDP_{jt}}\right)^2\right] \quad .$$

Breuss and Egger (1999), Egger (2000), Baltagi et al. (2003), Stack (2009) and Stack and Pentecost(2011) among other used GDP similarity in their Gravity models. This is following the observation by Krugman and Helpman (1987) that the trade between countries is better explained by the similarity in their level of development rather than the factor endowment differences. The value of SGDP is a fraction and it varies from 0 to 0.5, where 0 indicates perfect similarity and 0.5 indicates extreme divergence, however since we are using the log form of the data the figure will be always negative.

DPCIij-Difference in per capita income is a measure of the factor endowment differences between country i and j. DPCI is calculated as

$$DPCI_{ijt} = \ln\left(\frac{GDP_{it}}{N_{it}}\right) - \ln\left(\frac{GDP_{jit}}{N_{it}}\right)$$

Percapita income is used as a proxy for factor endowment and the difference between percapita incomes considered as factor income difference (following Kaldor (1963)).The DPCI is used by Helpman (1987), Baltagi et al(2003), Stack(2009) and Stack and Pentecost(2011). If both countries have same factor endowment the value of DPCI will be 0 and any divergence from 0 indicates the difference in factor endowment.

RERij- real exchange rate is the nominal bilateral exchange rate between country I and j deflated by the ratio of the price indices of country I and j. Bilateral exchange rate is computed as the ration between the exchange rate of i^{th} countries currency with the US dollar with the j^{th} countries currency's exchange rate with US dollar.

$$RER_{ijt} = \frac{R_{iUSt}}{R_{jUSt}}\frac{P_{it}}{P_{jt}}$$

RiUS-nominal exchange rate of ith countries currency with US dollar at time t, RjUS-Nominal exchange rate of jth countries currency with US dollar at time t. Pit/Pjt-Ratio of price levels of country i and j. The coefficient of RER is expected to be positive since economic theory predicts positive relationship between currency depreciation and exports.

As a first step we examined the nonstationary characteristics of the time variant variables in gravity model using the panel unit root test and the cointegration between the variables were examined using Patroni (1999) panel cointegration technique. We use the least squire dummy variable (LSDV) regression to estimate the above mentioned model with fixed effect to account for the possible endogeneity between the specific effects and error term. However for considering the possible endogeneity between exports variable (dependent variable) and the TGDP, SGDP etc we can't rely on the LSDV estimation. Since the time variant variables are shown to be cointegrated we use the Dynamic OLS (DOLS) suggested by Mark and Sul (2003). Mark and Sul (2003) suggest to add two lead and two lags of the first difference of the time variant independent variables to allow the error term to correlate between the lead and lags of the differenced independent variables. Considering fixed effect in DOLS makes it Dynamic Least Squire Dummy Variable model (DLSDV). We have used a two stage least square estimation proves for this. As a first stage we included the time invariant variables in the model taking two lags and two leads of the first difference of the independent variables. In second stage with full model we substituted the coefficients estimated from the first stage regression.

Another extension of gravity model estimation technique is considering the non-stationary characteristics of the Gravity variables.

The real exports data of India to its trading partners is collected from the *UNCOMTRADE* database provided by WITS. The nominal data is deflated with the Wholesale price index of India

(base year 2005) to get the real exports. GDP data of India and its trading partners at 2005 US dollar are taken from the *World development Indicators (WDI)* database of World Bank. Percapita income data of India and its trading partners at 2005 US dollar prices are also collected from WDI. Exchange rate of Indian currency with US dollar and its trading partner's currency with US dollar is collected from *UNCTAD stat* database provided by UNCTAD.

4. Estimation Results

Table 1 provides the panel unit root rest results of the study variables at level form and at first difference. We use the Schwarz information criterion (SIC) to choose the optimum lag for the panel unit root test. The L.L.C (Levin-Lin-Chu test) test and the IPS (Im-Pesaran-Shin) panel unit root test results provide evidences of first order integration of the study variables of both south panel and north panel.

Table 1. Panel unit root results for South panel

		Level form		First differenced	
Test name	Variables	Constant	Constant and trend	Constant	Constant and trend
LLC	TGDP	1.72	-0.19	-7.91***	-5.82****
IPS	TGDP	9.65	2.08	-7.01***	-3.41****
LLC	Exports	1.35	2.61	-11.27***	-7.53***
IPS	exports	5.49	-3.14	-13.17***	-9.40***
LLC	SGDP	1.08	0.56	-6.44***	-4.46***
IPS	SGDP	6.69	0.37	-9.24***	-6.42***
LLC	DPCI	0.15	0.71	-6.25***	-4.20***
IPS	DPCI	6.03	-0.24	-8.75***	-5.25***
LLC	E.R	-2.29**	-98	-9.77***	-10.26***
IPS	E.R	-1.08	-0.74	-12.70***	-10.04***
*** ,** and * indicates significance at 1%,5% and 10% respectively					

Panel unit root results of the study variable for North

		Level form		First differenced	
Test name	Variables	Constant	Constant and trend	Constant	Constant and trend
LLC	TGDP	-1.15	0.02	-13.11***	-11.74***
IPS	TGDP	6.48	1.50	-12.12***	-8.87***
LLC	Exports	-2.19**	0.73	-7.16***	-6.95***
IPS	exports	2.24	1.25	-11.04***	-8.25***
LLC	SGDP	14.65	3.88	-9.67***	-11.58***
IPS	SGDP	-19.08***	9.21	-8.44***	-10.84***
LLC	DPCI	11.91	3.25	-8.28***	-8.70***
IPS	DPCI	16.08	8.75	-8.19***	-9.08***
LLC	E.R	7.22	11.95	-20.94***	-11.91***
IPS	E.R	4.79	6.49	17.54***	-11.25***
*** ,** and * indicates significance at 1%,5% and 10% respectively					

Since the variables are integrated at first order we use the Padroni (1999) cointegration test to examine the long term relationship between the variables. Table 2 provides the results of Padroni cointegration test results. The panel PP and Panel ADF test results provides evidences of long term relationship between the variables in both North and South panel. Padroni(1999) mentions that panel PP and panel ADF test are more powerful in case of $N>T$[2] .In our sample the N=32 and T=21, therefore based on the panel ADF and panel PP test we proceed with the conclusion that the variables are cointegrated.[3]

[2] N-number of cross sections, T –number of years in each cross section.

[3] We use the Johanson fisher panel cointegration test to further verify our conclusion. We find evidences of cointegration relationship between the variables in Johanson Fisher cointegration test.

Table 2. Pedroni residual based cointegration results for panel south

	Model with only constant		Model with constant and trend	
Test type	Statistic	P value	Statistic	P value
Within dimension				
Panel v-Statistic	1.840635	0.0328	0.281623	0.3891
Panel rho-Statistic	-0.822172	0.2055	0.417368	0.6618
Panel PP-Statistic	-7.425816	0.0000	-9.126831	0.0000
Panel ADF-Statistic	-7.132281	0.0000	-10.23245	0.0000
Between-dimension				
Group rho-Statistic	2.656919	0.9961	4.203464	1.0000
Group PP-Statistic	-7.557181	0.0000	-10.84091	0.0000
Group ADF-Statistic	-7.491246	0.0000	-9.270054	0.0000

Pedroni residual based cointegration test results for North panel

	Model with only contant		Model with constant and intercept	
Within-dimension				
Test type	Statistic	P value	Statistic	P value
Panel v-Statistic	-0.906554	0.8177	-3.643822	0.9999
Panel rho-Statistic	-0.539407	0.2948	1.032256	0.8490
Panel PP-Statistic	-10.91013	0.0000	-19.89496	0.0000
Panel ADF-Statistic	-11.63426	0.0000	-13.42401	0.0000
between-dimension				
Group rho-Statistic	2.071590	0.9808	3.481687	0.9998
Group PP-Statistic	-14.25630	0.0000	-31.74356	0.0000
Group ADF-Statistic	-10.86043	0.0000	-13.19892	0.0000

The results of the estimated model are given in the following table 3. We provide results for the dynamic OLS (DOLS), Dynamic least squire dummy variable model (DLSDV) and the corresponding static versions of DOLS and DLSDV.

For the south model Total GDP, SGDP, DPCI, Real exchange rate, common language, common border and common colony are significant in DOLS. The estimated coefficient for the new trade theory variables; TGDP is at 0.92 and same for SGDP is at 0.40. The DPIC coefficient is estimated at 0.24 and for real exchange rate it is 0.05. All these coefficients are found to be significant. Regarding the distance and dummy variables; the distance coefficient is estimated at -0.89, common language coefficient is 0.24, common colony coefficient is estimated at 0.91 and for common border the coefficient is -0.95. The expected sign of common border coefficient has a positive sign, but the negative coefficient is reported in few studies. Kabir and Salim (2010) found negative coefficient for BIMSTEC panel including India. Kirkpatrick and Watanabe (2005) and Baier et al., 2007 also find negative coefficients for common border.

Dynamic Least Squire dummy variable model (DSLDV) estimated coefficients more than the DOLS coefficients. But the coefficients are significant at 10%. The same is found in other studies*; inter alia*, Stack and Pentecost (2011). The estimated coefficient for TGDP is 1.80; SGDP is at 1.18 and for DPCI 0.62, while the real exchange rate is not significant. Further the DSLDV controls the endogeneity between the specific effects and the error term apart from the exports and time variant independent variables. The significant TGDP and SGDP variables support the new trade theory that product differentiation and economic size of trading partners are significant in India's trade with south. The significant DPCI coefficient with positive sign supports the Hechchor-Ohlin theory that difference in factor endowment is causing trade between India and other southern countries.

The results for the north are provided in table 2. The DOLS estimation results indicated that the TGDP coefficient is 1.14, SGDP coefficient as 0.82, DPCI at 0.60 and for Exchange rate at 0.15. All are significant at conventional level of significance. The distance and dummy variables coefficients are estimated at -2.53 for distance, Common language at 2.21. As seen in the south model the DLSDV estimated coefficients is more than what the DOLS estimated. The TGDP coefficient is at 1.63, SGDP is at 1.44, DPCI at 1.19 and all the three are significant at conventional level of significance. The real exchange rate is not found significant. The results support the New trade theory since both the new

trade theory variables are significant. The positive and significant DPCI coefficient supports the Hekchor Ohlin theory and rejects the Linder hypothesis.

Table 3. Gravity model estimation results for panel South

	DOLS	DLSDV	POLS	LSDV
TGDP	0.92(0.17)***	1.80(0.18)***	1.77(0.10)***	1.86(0.26)***
SGDP	0.40(0.08)***	1.18(0.65)*	0.39(0.06)***	0.61(0.59)
DPCI	0.24(0.05)***	0.62(0.34)*	0.12(0.04)***	0.43(0.27)
ER	0.05(0.01)***	0.12(0.13)	0.01(0.01)	0.16(0.10)
DIS	-0.89(0.07)***		-0.89(0.07)***	
EL	0.24(0.09)**		0.24(0.09)**	
CC	0.91(0.08)***		0.91(0.08)***	
CB	-0.95(0.16)***		-0.95(0.16)***	
RTA	0.004(0.10)	0.14(0.20)	0.004(0.10)	0.15(0.20)
_CONS	-8.38(1.43)***	-16.04(3.72)***	-8.38(1.43)***	-16.04(3.73)***
Gravity model estimation results for panel North				
	DOLS	DLSDV	POLS	LSDV
TGDP	1.14(0.03)***	1.63(0.53)***	1.05(0.19)	1.66(0.36)***
SGDP	0.82(0.12)***	1.44(0.82)*	0.81(0.06)***	1.30(0.55)**
DPCI	0.60(0.14)***	1.19(0.54)**	0.37(0.12)***	1.03(0.51)*
ER	0.15(0.06)**	0.48(0.45)	0.27(0.05)**	0.60(0.38)
DIS	-2.53(.24)***		-2.53(0.24)***	
CL	2.21(0.17)***		2.21(0.17)***	
Eu	0.21(0.18)		0.23(0.23)***	-0.03(0.19)
CONS	38.11(1.93)***		38.12(1.93)***	-6.56(6.58)
*** indicates significance at 1% level, ** shows significance at 5% and * indicates significance at 10%				

5. Conclusion

We have examined the determinants of India's exports to developing countries (south) and developed countries (North). We have used a panel of selected 32 countries for south and 32 countries for the north. We have considered the non-stationary characteristics and endogeneity between exports and other independent variables by using DOLS estimation using two stage least squire. Our results indicates that India's trade with south and north is supported by the New trade theory variables; Total GDP and Similarity and the Hekchor-Ohlin theory variable; DPCI. But the coefficients for TGDP for South estimation are more than that for the northern counterpart. The TGDP coefficient for south is 1.80 while that of north is 1.59. Another striking feature we found is that the distance coefficient is -2.53 for the North while for the south it is just -0.89. Distance parameter indicates the transportation cost or transaction cost in trade.

Our results indicate India's transaction cost to south is less compare to the north and this causes the trade growth towards the south. India's trade with north is further supported by the common language dummy; whose coefficient is more than 2 and this indicates that the advantage for India in northern market is the English as common language. But in south's estimation the language coefficient is small and this indicates the language advantage is not much with the southern countries.

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