

India and trade blocs: A gravity model analysis

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Abstract. *This paper analyses the trading relationship of India with major trade blocs which includes EU, NAFTA and ASEAN whether the trade flow indeed affected by the GDP (Income), Distance, tariff and per capita GDP by using gravity model on the panel data from the period of 1991 to 2017. The panel data is examined by the Multi-level mixed effect model with linear regression and ML method of estimation is used for estimating the model. The study will attempt to examine the trade bloc which has significant trade with India as per the gravity model is a concern. The study found that the distance negatively affecting the trade flow for EU and NAFTA which is as per theoretically expectations while in case of ASEAN its positively affecting the trade flow which is not as per theoretical expectations, However the coefficient is not significant. GDP is negatively and insignificantly affecting the trade flow between India and ASEAN and NAFTA whereas GDP is negatively and significantly affecting the trade flow between India and EU.*

Keywords: EU, NAFTA, Economic Integration, ASEAN, Gravity Model, Trade.

JEL Classification: F16, F100, F120, F140, F150.

1. Introduction

Gravity model is a well established model to study India's trade patterns with the developed trade bloc's viz., EU, NAFTA, and ASEAN and the present study is using it to find out the trade bloc which has significant trade with India as per the model. Tinbergen (1962) and Poyhonen (1963) first apply the gravity equation for the analysis of international trade flows. At the outset, gravity model predicts why trade blocs emerge for countries that are close with reference to developed status with respect to GDP, preferences and technology and close geographical proximity helps (Zarzos, 2003). Trade blocs are mainly based on similar production function and preferences captured by the similar GDP of the member countries i.e. similar level of GDP facilitate more trade between the member countries and small distance between the member countries is a bonus which further leads to increase in the trade. Trade blocs are based on the economic arguments of trade creating and trade diverting which leads to the welfare gains for the union or trade blocs along with these arguments they also based on the geopolitical factors that can play an important role in the formation of regional groupings and the formation of trade blocs. So, geography provides an encouraging factor for the integration of the economies. As geographic distance and GDP both are core variables of the gravity model. Gravity model predicts that trade would be high facilitated by policy to reduce distance and tariff. Trade blocs are also about the reduction or no tariff rate between the member countries. So, based on the somehow same preferences gravity model can predicts the trade blocs.

Countries within trade blocs also have some advantages of greater competitiveness, bargaining power and many other advantages with that translates into maintenance or enhancement of their higher developed status and economic development (Doss and Cabalu, 2000). As India is not a part of the developed blocs, therefore it would be at unfavorable placed as the distance would be higher and the gravity-based trade association with the developed countries would be lower. At the same time, given the geographical distance, India recently has increasingly relied on globalization and imports of capital and intermediate goods that can bring in similarly with respect to technology and preferences and such increased developed status India. The assumption is: such closeness of GDP can predict gravity model based higher trade flows with developed countries and with the developed trade blocs as well. The other assumption that distance is the proxy of the transportation cost along with the various other costs of doing trade with the countries and distance has a negative relationship with the trade association.

India is doing trade with almost all major countries in the world and also has a bilateral trade relationship with the individual countries and a focus can be on gravity model to study India's trade association with individual developed countries, India's major trading partners. In the present paper, on the other hand, an attempt has been made with the help of gravity model to find out the significant trade with these trade blocs. This is because, major advanced countries especially in the Europe, North America and South East Asia operate through trade blocs and India's closeness to trade blocs would further enhance

relationship with the developed countries within the trade blocs via various trade related agreements especially with the ASEAN members. Different countries within each trade bloc could be specializing in different specialized tasks, products and industries; trade blocs are base of such industrial differentiation that also underpins increased intra-firm trade – an advanced status of trade. India's closeness to trade blocs would inform on such closeness to industrial differentiation – that defines advanced preferences and technological choices.

When a country indulged in a trade bloc establishment it has many advantages which mainly includes economies of scale, foreign direct investment, competition, market efficiency and trade effects, The market size of India will increase and will also leads to increase in the efficiency of the Indian firms as it increase the competition with the joining of the trade blocs. India membership with the trade blocs will also leads to the attendant trade expansion and barrier reductions which further induce economic growth in India and the expansion of trade. The export of the India will also increase if India will become the member of the trade blocs. There will be increase in the export of the labor intensive goods and increase the employment and output with the membership of trade blocs with India (Fukase and Martin, 2016).

Since 1991, when massive economic reforms were implemented in India this resulted an increase in share of trade of India with the ASEAN countries as well as NAFTA member's countries along with some others countries as well. An increasing trend of growth in the formation of regional integration and regional integration agreements (RIAs) in all over the world has been observed since 1980s and each trade bloc members has its own priorities and objectives and have different degrees of regional integration. The emergence of international trade blocs mainly started with the creation of the European Economic Area (EEA) in 1957 and after the enactment of the Maastricht Treaty in 1993. In the Asia this has emerged with the ASEAN's creation in 1967. MERCOSUR, also came into existence after the signed by major economies of the South America (Argentina, Brazil, Paraguay, and Uruguay) in March 1991. In North America it has emerged mainly after the free trade agreement between Canada and United States in 1988 and with the establishment of NAFTA in 1994. In the Africa in started after the formation of Economic Community of West African States (ECOWAS) and many others trade blocs (Sickert, 1995). With the formation of SAARC on 8th December 1985 India had also joined the league of Trade blocs. India various regional trading arrangements (RTAs), such as FTAs, Preferential Trade Agreements (PTAs), etc. with many countries around the world, however how much these agreements are beneficial for India it is a matter of concern given the competitiveness of India as compare to the partners. India has signed multiple free trade and economic partnership agreements with some major trade blocs especially with the south east economies like Japan, South Korea, and ASEAN countries.

So, many Indians studies have used the gravity model to predict the trade between India and different countries at the individual level and also with the individual trade bloc trade.

The study regarding the chronology of trade between India and EU since the seventies has been analyzed by Bhattacharya (2005) his area of analysis consists of broad parameters viz. Level of tariff barriers on India's exports, level of NTBs to India's exports, revealed comparative advantage (RCA) and tariff equivalents (TEs) of India's major export with the EU. By using the gravity model Bhattacharyya and Banerjee (2006) try to find out the important factor in determining India's direction of trade. Bhattacharyya and Mandal (2014) apply the gravity model at all HS 6-digit codes for trade between India and ASEAN and found that intermediate goods will be more affected (both adversely and favorably for India) than final goods under the scenario of a Free Trade Agreement (FTA). So, previous studies on India mainly focus on the bilateral trade between India and partner countries, India and EU studies on trade, India and ASEAN studies regarding the trade in particular product code. They focus on the bilateral trade of India with Individual trade bloc, direction of trade, and many others aspects of trade, but they wouldn't focus on the comparative analysis of the trade between India and developed trade blocs on the basis of the gravity model. The present paper collaborate three main trade blocs and find the trade pattern of India with these blocs on the basis of the gravity model as previous studies didn't focus on this objective. The study will attempt to examine the trade bloc out of the three developed trade blocs which has significant trade with India as per the gravity model is concern.

Nachane and Lakshmi (1997) also analyzed the likely consequences on India due to the formation of two regional trading bloc's viz. EC and the NAFTA on the basis of gravity model and found that European community has strong trade creating effects, whereas North America Free trade Agreement was strictly limited. As from the above studies we can say that they attain their objectives by using the gravity model, however there is difference in the model on the basis of the independent variable taken into consideration except the core variables. In this present paper we took the feasible and adequate gravity model variables along with other suitable variables for both India and developed trade blocs as independent variable and trade value between the two as dependent variable keeping into the concern of the multicollinearity problem in the model. The existing studies of India regarding the bilateral trade especially who have used the gravity model have different objectives to attain like to find the direction of trade, trade creating and trade diverting effects, etc., however this paper have somehow different objectives to attain which as per review are not able to achieve by the existing studies. So, in this paper we estimate the gravity model results for India and EU, India and ASEAN and India and NAFTA at Individual level and then compare all the coefficients of the independent variable so that we able to find that with which trade bloc India have significant trade and the pattern of India trade with these trade blocs. Multi-level mixed-effect model with linear regression and ML method of estimation is utilized for the estimation of the result in the present study. This paper does not taken into accounts all the member countries for analysis from EU and ASEAN. It took only those members countries among the trade blocs with which India have a significant trade at a country level on the basis of the trade value.

As we know that there are different approaches to study trade patterns between the countries or trade blocs. These approaches starts from *Mercantilism* to Smith's *Absolute Advantage*, later replaced by the more formidable theory of comparative advantage by Ricardo, the twentieth century saw the propagation of revolutionary ideas by Hecksher and Ohlin which proposed that based on the factor endowment and Factor intensities affect trade between countries and explain the trade pattern. This theory has ignore several other influences such as transport costs, economies of scale, external economies etc., which too exert influence on the cost of production and also on the trade. The HO theory investigates the pattern of international trade in a static sense which is not valid in a current dynamic economic system. The theory overlooks the role played by product differentiation in international trade. The gravity model has become known model for empirical foreign trade analysis. The model has been widely used for flows such as migration, foreign direct investment, and more especially to international trade flows. Gravity model incorporated the distance variable as transport cost involved in the trade, greater distance implies higher cost of trade and also a set of dummies incorporating some type of institutional characteristics common to specific flows.

When we apply gravity model, it is often extended by taking in concern several other qualitative variables such as language, tariffs, colonial history etc. Earlier model of international trade like Hecksher and Ohlin did not incorporated it in the model. Anderson (1979) derive the gravity equation from a model by assuming product differentiation. He was the first person who gave a theoretical basis to the gravity equation and provided it as one of the demand-side models. Bergstrand (1985, 1989) in his couple of papers revealed about the gravity equations and also explored the theoretical determination of bilateral trade on the basis of monopolistic competition models. Helpman (1987) specify the gravity model as according to the increasing returns to scale in the framework of differentiated product. Deardorff (1995) has proven the gravity equation that it has been characterizes by many models in the trade and it can be justified from the regards various standard trade theories. Eaton and Kortum (1997), and Deardorff (1998) derived the Gravity model from a Ricardian, and Heckscher-Ohlin framework respectively, whereas Helpman and Krugman (1985) derived it on the basis of the "New International Trade Theory" framework. So, the essence of the earlier models of international trade also incorporated in the gravity model under some assumption and some conditions. Frankel, Stein and Wei (1995) used the gravity model to examine bilateral trade patterns in the world and took land and sea routes as a measure of distance. So this paper will analyze the variables which are included in the model viz., Trade flow, GDP of the host country and GDP of the partner country, distance between the countries and other gravity model variables incorporated in the model.

2. Gravity model

This present paper specifies a gravity model that is based on the Tinbergen (1962) and Linneman (1966) bilateral model of trade. The gravity equation is a simple empirical

model for analyzing bilateral trade flows between geographical entities (Batra, 2006). The basic form of gravity model explains that bilateral trade (T_{ij}) is directly proportional to the product of GDP_i and GDP_j , i.e. size of the economy and inversely related to the distance between them.

$$\text{Log}(T_{ij}) = \alpha + \beta_1 \log(GDP_i \times GDP_j) + \beta_2 \log(GDP/pop_i \times GDP/pop_j) + \beta_3 \log(Dist_{ij})$$

Apart from the basic core gravity model variables which are included in the model there are other variables or you can say factors which can impact trade flows and thus results the addition of dummy variables to the basic form of the model and this new model is considered as augmented gravity model.

2.1. Augmented gravity model

In this augmented model we also include the dummy variables along with the primary variables. The equation of the model is as follows:

$$\text{Log}(T_{ij}) = \alpha + \beta_1 \log(Y_i Y_j) + \beta_2 \log(PCI_i PCI_j) + \beta_3 \log(D_{ij}) + \beta_4 (Border_{ij}) + \beta_5 (Lang_{ij}) + \beta_6 (RTA) + \beta_7 (Col) + \gamma_1 (landlocked) + \gamma_2 (Island) + \gamma_3 (tariff) + \gamma_4 (Exchange Rate_{ij})$$

Where i and j denote countries and T_{ij} denotes the value of bilateral trade between i and j . Y represent the GDP and (Pop) represent the population. Distance (D_{ij}) is the distance between country i and country j . (PCI_i) denotes the Per Capita Income of the reporting country (PCI_j) denotes the Per Capita Income of the Partner trade bloc, $Border_{ij}$ and $Lang_{ij}$, represent a dummy of border and common language respectively.

Col represents the *Colonial links* which is also a dummy variable represent the relation of trade during the colonial period which is expected to ease of doing trade. *Landlocked* represent the number of landlocked countries in the pair of the gravity model and (RTA) denotes Regional trading arrangements as countries among the pairs often enter into regional trading agreements to facilitate bilateral trade.

A typical gravity model revealed that bilateral trade flows between a pair of countries is depend mainly on their economic size, geographical distance, populations, and some qualitative factors also such as, common language, membership in RTAs etc. Gravity models hypothesize that country's production and its supply capacity has represent by the exporting Country's income while an importing country's income represents the country's purchasing power or its absorption capacity. Various trade resistant factors such as transportation costs and tariffs should be negatively related to trade flows.

So, the present paper deals mainly with India's merchandise trade with the developed trade blocs which mainly include NAFTA, EU, and ASEAN member countries of the Trade blocs over the period from 1991 to 2017. This study are based on the gravity model on the basis of this model we will predict the trade flow of India with the developed trade blocs. The model which we apply, the various variables which are taken into account, the specification of the model are given in the below section.

3. Model specification and data

This paper seeks to find whether the trade flow indeed effected by the Income, Geographical Distance in case of India and trade blocs from the time period of 1991 to 2017. In this study, the gravity model is specified and re-parameterized into a time series and cross-sectional framework.

We have time-series data for the trade flow (Import +Export) and cross-section data for the distance which we assume as a proxy of transportation costs and time in the trade. We also assume that transport cost to be an increasing function of distance keeping in concern the importance of geographical distance in bilateral trade flows.

The model takes the functional form:

$$\log TV_{rpt} = \beta_0 + \beta_1 (\log GDP_{rt} \times \log GDP_{pt}) + \beta_2 \log distance + \beta_3 \log pcGDP_{rt} + \beta_4 \log pcGDP_{pt} + \beta_5 \text{Tariff}_{rpt} + \varepsilon_{rpt} \quad (1)$$

TF_{rpt} (trade flows) represents total trade values (imports + exports) between country r (Host country) and p (partner country). The GDP and per capita GDP variables are stated in thousands of current US dollars. The variable GDP_{rt} represents the GDP of the reporter country and the variable GDP_{pt} represents the GDP of the partner country, which also implies the economic size which facilitates the trade as per the gravity model. Per capita Income also has a positive link with the trade. With the specification of Per capita GDP as independent variable it can explore the link between a country's trade and its stage of economic development. The GDP and per capita GDP coefficients of the model are expected to have a positive sign as trade, economic size, and income has direct relation among them. The coefficient beta on economic size (β_1) i.e. β_1 is the coefficient of combined GDP i.e. the product of GDP_{rt} and GDP_{pt} . The $distance_{rp}$ variable captures the trade distance in Km between the trading country pairs. The distance variable has a negative relation with the trade between the two countries as per the gravity model. The coefficient β_2 represent the coefficient of distance variables which likely to be negative due to the negative relationship between the trade and distance as detailed mention in the above gravity model section. The variable $pcGDP_{rt}$ represents the per capita income of the reporter country and the variable $pcGDP_{pt}$ represents the per capita income of the partner country. Where, tariff_{rpt} represents the tariff between the reporter country and the partner country.

The coefficient of per capita income levels (β_3 and β_4) i.e. β_3 is the coefficient of the per capita income of reporting country whereas β_4 is the coefficient of the per capita income of the partner country. The tariff also includes an explanatory variable due to the reason that trade depends on the rate of tariff. Export of the reporting country depends on the tariff applied by the partner country and export of the partner country depends on the tariff applied by the reporting country. The tariff variable can be proxied by dummy variables indicating the presence of preferential trading arrangements as in the basic gravity equation. The coefficient β_5 represents the effect of the tariff on the trade volume. All the explanatory and the dependent variables are expressed in log form and hence their

coefficient interpretation is one of constant elasticity. Whereas at the end the ε_{rpt} is the stochastic term which is log-normally distributed error term in our model. We take distance as a proxy variable which will represent the cost of trade i.e. transport cost between the two countries. There are several reasons to include of distance as an explanatory variable as it can be use as proxy for transport costs. Synchronization costs and Cultural differences also results with the increase in the distance as it can impede trade (Batra, 2006).

The traditional approach of estimation of gravity model has the problem of significant biases as it estimate the log-linearized equation by Ordinary Least Squares (OLS) and the other problem of unable to use observations with zero (Silva and Tenreyro, 2006). So the maximum likelihood method of estimation is usually used for the estimation of the result. Maximum Likelihood (ML) is the method of estimation of the paper. Preliminary data analysis is employed to ensure that the Multi-level mixed-effect model with linear regression and ML method of estimation is appropriate for estimating the model. This estimation is done for the trade blocs which include ASEAN, EU, and NAFTA. First, we apply this regression method to estimate the results regarding the gravity model variables between India and ASEAN. Data which we used for the estimation of the results between India and ASEAN is based on the assumption that Singapore, Malaysia, Indonesia, and Thailand the main members of ASEAN represent the ASEAN. The selection of these countries is based on their size of the economy i.e. GDP as we know Indonesia, Singapore, Malaysia, Thailand, Vietnam, Philippines and Myanmar are the major economy of the ASEAN and also due to the unavailability of India's data with some ASEAN members. Similar is the case with the other trade bloc which is EU whose estimation result acquire with this similar method of estimation as used for ASEAN. So, data which we used for the estimation of the results between India and EU are based on the assumption that Germany, Italy, UK, France, Netherlands, Belgium and Spain which are the main members of EU represent the EU. As we know Germany, France, UK, Italy, Netherlands, Belgium and Spain is the major economy of the EU in terms of GDP is a concern. In this study, we consider UK still as a member of the EU. As far as NAFTA is a concern we regress upon the data on the variables mention in the model and estimate the result of the gravity model.

So we first study the trading relationship between India and ASEAN i.e. the whole scenario of the trade, Free trade agreements between the two and other important issues and then interpret the actual result of the gravity model. The analysis has been performed for a few major countries within the trade blocs like only seven major countries of the EU and ASEAN and all three countries of NAFTA. The results of only these countries namely, France, Germany, UK, Italy, Netherlands, Belgium and Spain from the EU bloc and Indonesia, Thailand, Malaysia, Singapore, Vietnam, Philippines and Myanmar from the ASEAN bloc and the USA, Mexico, and Canada from NAFTA are reported. So, countries which we have taken into the account for various trade blocs their result will represent the result with the blocs. However, countries which are not included because data for sufficient periods is not available for some member countries and others have not

much trade with India. There are many types of gravity equations were given by various economists to evaluate the effects of different variables like GDP, distance, etc. Gravity models have been augmented with various quantitative and qualitative variables which either facilitate or restrict trade. This study uses a gravity model to analyze the trade flows between India and different trade blocs which is EU, ASEAN, and NAFTA. We use Multi-level mixed effect technique in STATA package to obtain results of the mentioned model in equation (1).

We collected the panel data for bilateral trade flow (exports and imports) and FDI inflow for the selected group of countries from the period of 1991 to 2017. Given our focus on the trade blocs, we centered our country selection around the seven major economies of ASEAN, seven major economies of EU and all NAFTA member countries. Data on GDP for India and the EU, ASEAN and NAFTA economies were obtained from the World Bank Development Database through the WDI data query (<https://dvddata.worldbank.org/data-query>). Data on export and import has been taken from the Direction of Trade Statistics, IMF. The data for distance is taken from Centre D'etudes Prospectives et D'informations Internationales. The Data on the tariff (AHS weighted average) i.e. effectively Applied is taken from the WITS. Since the models estimate trade flows from 1991 to 2017. Data for per capita GDP has also taken from the World Bank database. All trade volume figures which has been used for the estimation are in millions of US dollars. While both GDP and per capita GDP figures are stated in PPP (constant 2011 US \$) terms. Missing value of the variable is treated as zero values. The data on trade flow (Import and Export), Distance, GDP and per capita GDP are converted to natural log form. The data for this analysis is unbalanced and the period for this analysis is from 1991 to 2017.

4. Empirical results

In 2017, India total value of exports is US\$ 294,364 million and the total value of imports is US\$ 444,052 million. United States, United Arab Emirates, Hong Kong, China, Singapore, Germany and UK are among the major export partners of India. US with a total export of US\$ 46,018 million (15.6%) is the top exporter of India. Whereas China, United States, United Arab Emirates, Saudi Arabia, Switzerland, Indonesia are among the major import partners of India. Indonesia, Thailand, Singapore, Malaysia, Philippines, Myanmar and Vietnam are the major economies of the ASEAN in terms of economic size. These countries also have a significant trade with India in 2017. Germany, France, United Kingdom, Italy, Netherlands, Belgium and Spain are the major economies of the EU in terms of GDP and these economies also have significant trade with India in 2017.

As per the Direction of trade statistics IMF (2018) India -ASEAN share of total trade grew from 1.94 billion US\$ in 1991 to 80.74 billion US\$ in 2017 and India-EU total trade grew from 11.18 billion US\$ in 1991 to 96.51 billion US\$ in 2017. As per NAFTA is concern India total trade value grew from 5.35 billion US\$ in 1991 to 84.51 billion US\$

in 2017 (Direction of trade statistics IMF, 2018). Free Trade Agreement in Goods between ASEAN and India was signed in 2009 and enacted in 2010. ASEAN-India Agreements on Trade in Service and Investments has come into force in 1 July 2015 which mark the completion of the ASEAN-India Free Trade Area (AIFTA). India and the EU have enjoyed healthy economic relations especially after the 1993 cooperation agreement signed between the two which took their bilateral relations beyond merely trade and economic cooperation. The first India-EU Summit in June 2000 marked has took the relationship of India and EU at a new peak. According to the direction of trade statistics (IMF 2018), the EU accounted for 13.3% of India's total trade in 2017. In terms of exports, the EU is the largest (16.9%) and in terms of imports, the EU is the second-largest (9.7%) trading partner of India. EU is India's largest regional trading partner while India is also a largest trading partner of the EU. NAFTA is one of largest trading block in the world. India trading relation with NAFTA as trade bloc mainly depends on its relation with the USA. Within NAFTA, the USA continued to remain the most prominent importer of Indian products.

We estimate the model with annual data for 7 ASEAN member, 7 EU member and NAFTA member countries for the period 1991 to 2017. They include Indonesia, Malaysia, Singapore, Thailand, Myanmar, Philippines and Vietnam for the ASEAN and France, Germany, UK, Italy, Belgium, Spain and Netherlands for EU while for NAFTA all members are taken into account i.e. USA, Canada and Mexico. We estimated three sets of regression models for each trade bloc to measure the significance of gravity model in trade flow between India and trade blocs during the period of 1991 to 2017. The present study reports the results of the panel data estimations of the gravity equation for trade flows in between 1991 and 2017 in Tables 1, 2 and 3 when a trade is a dependent variable, and Combined GDP product, Per capita Income, Distance and tariff as the independent variable. This section provides the analytical perspective on ASEAN-India, EU- India and NAFTA- India trade with the help of the gravity model.

4.1. India and ASEAN trade

Empirical results of the gravity model for ASEAN and India are given step by step with their interpretations. The significant coefficient of the gravity model will strengthen the study that trade between India and Trade blocs will reside on the gravity model. Table 1 provide the results of the gravity models estimated for India as a reporting country and ASEAN as a partner based on equation (1). The unbalanced panel data regression model has been estimated for the i^{th} combination of reporting (r) country (i.e., India) with trade bloc over the study period; i.e. for trade bloc (ASEAN). The model has been estimated using the multilevel mixed-effect regression estimation technique. Table 1 reports the results of the gravity model for India and ASEAN. Table 2 reports the results of the gravity model for India and EU and lastly, Table 3 reports the results of the gravity model for India and NAFTA. GDP product of India and ASEAN, per capita Income of reporting country ($pcGDP_r$), and per capita income of partner bloc ($pcGDP_p$) are significant at 1% level of significance. Distance and Tariff impact positively on the trade flow between India and ASEAN, however, the effect is negligible and the value is not significant. The per capita GDP of India and ASEAN impact positively on the trade flow between them.

Table 1. Gravity model estimates for India and ASEAN

| Mixed-effects ML regression | | | | Number of obs. = 162 | |
|--|----------|-----------|----------|------------------------|----------------------|
| | | | | Wald chi2(5) = 1678.27 | |
| Log likelihood = 26.982391 | | | | Prob > chi2 = 0.0000 | |
| LogTVrp | Coef. | Std. Err. | z | P> z | [95% Conf. Interval] |
| Log(GDP _r *GDP _p) | .333*** | .055 | 6.03 | 0.000 | .225138 .4421212 |
| Logdistance | .003 | .121 | 0.03 | 0.979 | -.234487 .2408084 |
| LogpcGDP _r | 1.942*** | .177 | 10.97 | 0.000 | 1.595757 2.289759 |
| LogpcGDP _p | .617*** | .043 | 14.24 | 0.000 | .5324432 .7023651 |
| Tariff _p | .002 | .001 | 1.32 | 0.186 | -.000907 .0046727 |
| _cons | -14.054 | .623 | -22.54 | 0.000 | -15.276 -12.8323 |
| Random-effects Parameters | | | Estimate | Std. Err. | [95% Conf. Interval] |
| Var(Residual) | | | .0419619 | .0046624 | .0337503 .0521715 |

Notes: ***Significant at 1%, **Significant at 5%.

Source: Author's calculation.

The variable GDP has a positive impact on the trade flow between the India and ASEAN. The variables distance and tariff have unexpected signs while the Combined GDP product, per capita GDP of the reporting country and per capita income of partner bloc have the expected theoretical signs during the time period. India should need to increase its trade with ASEAN with which India has a geographical advantage in the terms of distance. Distance variable is not the regressive factor in the case of ASEAN which implies that the cost of transportation is not high. The combined GDP of India and ASEAN has encouraged the trade between the two. India should need to increase its trade with the ASEAN because the per capita income of both India and ASEAN also encourage the trade between the two partners. Hence, given the fact, India should encourage the trade with ASEAN keeping in mind the cost of a trade. Gravity model variables also support the argument that India should maintain the trade with ASEAN.

4.2. India and EU trade

Table 2 provide the results of the gravity models estimated for India as a reporting country and EU as a partner based on equation 1. Distance, per capita income of the reporting country (India) (*pcGDP_r*) and per capita GDP of EU are significant at 1% level of significance. The variable tariff is significant at 5% level of significance while the Combined GDP variable is insignificant.

Table 2. Gravity model estimates for India and EU

| Mixed-effects ML regression | | | | Number of obs. = 189 | |
|--|------------|-----------|----------|-----------------------|----------------------|
| | | | | Wald chi2(5) = 543.87 | |
| Log likelihood = 18.635846 | | | | Prob > chi2 = 0.0000 | |
| LogTVrp | Coef. | Std. Err. | Z | P> z | [95% Conf. Interval] |
| Log(GDP _r *GDP _p) | .10827 | .0838139 | 1.29 | 0.196 | -.0560006 .2725439 |
| LogpcGDP _r | 2.0154*** | .1592666 | 12.65 | 0.000 | 1.703316 2.327629 |
| Logdistance | -.64435*** | .1314878 | -4.90 | 0.000 | -.9020642 -.3866416 |
| LogpcGDP _p | -.34384*** | .1126421 | -3.05 | 0.002 | -.5646178 -.1230689 |
| Tariff _p | .00297** | .0014808 | 2.01 | 0.044 | .0000752 .0058799 |
| _cons | -2.056006 | 1.744049 | -1.18 | 0.238 | -5.47428 1.362268 |
| Random-effects Parameters | | | Estimate | Std. Err. | [95% Conf. Interval] |
| Var(Residual) | | | .0480707 | .004945 | .0392933 .0588089 |

Notes: *** Significant at 1%, ** Significant at 5%.

Source: Author's calculation.

The variable Distance and per capita GDP of the EU bloc has a negative impact on the trade flow between the India and EU. The combined GDP product, per capita GDP of India and tariff impact positively on the trade flow between them in which only the Combined GDP variable is insignificant. Per capita income of the EU have the unexpected theoretical signs while the other variables like per capita GDP of India, distance, and are significant and have the expected theoretical signs during the period. India need to do less trade with the EU with which India has a geographical disadvantage in the terms of distance. Distance increases the cost of merchandise trade between India and EU. The trade with the EU is also found to be discouraged if we consider the per capita GDP of EU which has an adverse impact on the trade flow between India and the EU whereas per capita income of India has encourage the trade between the two partners. Hence trade flow between India and EU need not to be much encouraged as per the gravity model which we apply on its selected member countries.

4.3. India and NAFTA trade

Empirical results of the gravity model for NAFTA and India are given step by step with their interpretations. The significant coefficient of the gravity model will strengthen the study that trade between India and Trade blocs will reside on the gravity model.

Table 3 provide the results of the gravity models estimated for India as a reporting country and NAFTA as a partner based on equation 1. Distance, per capita income of the reporting country (India) is significant at 1% level of significance. The variable GDP has a negative impact on the trade flow between the India and NAFTA; however the value is highly insignificant. The variable distance has a negative impact on trade flow between India and i.e. with 1% increase in the distance leads to on an average 16.15% decrease in the trade flow between India and NAFTA. Tariff variable impact negatively on the trade flow between India and NAFTA, however, the effect is negligible and the value is also not significant. The per capita GDP of the NAFTA and India has a positive impact on the trade flow between India. GDP variable has unexpected signs while the other variables like per capita GDP, distance, and tariff have the expected theoretical signs during the period of 1991 to 2017.

Table 3. Gravity model estimates for India and NAFTA

| Mixed-effects ML regression | | | Number of obs. = 81 | | | |
|---|-------------|-----------|------------------------|-----------|----------------------|----------|
| Log likelihood = 33.110524 | | | Wald chi2(5) = 1928.75 | | | |
| | | | Prob > chi2 = 0.0000 | | | |
| LogTVrp | Coef. | Std. Err. | Z | P> z | [95% Conf. Interval] | |
| Log (GDP _r *GDP _p) | -.0461 | .343 | -0.13 | 0.893 | -.719 | .626 |
| Logdistance | -16.1523*** | 5.658 | -2.86 | 0.004 | -27.229 | -5.074 |
| LogpcGDP _r | 2.7504*** | .728 | 3.78 | 0.000 | 1.322 | 4.178 |
| LogpcGDP _p | .0561 | .452 | 0.12 | 0.901 | -.830 | .942 |
| Tariff | -.0005 | .001 | -0.38 | 0.704 | -.003 | .002 |
| _cons | 58.27434** | 30.208 | 1.93 | 0.054 | -.933 | 117.482 |
| Random-effects Parameters | | | Estimate | Std. Err. | [95% Conf. Interval] | |
| Var(Residual) | | | .0258506 | .004062 | .0189984 | .0351742 |

Notes: *** Significant at 1%, **Significant at 5%.

Source: Author's calculation.

India needs to do less trade with NAFTA because India has a geographical disadvantage with it in terms of distance. It increases the cost of merchandise trade between India and NAFTA. So, it will not be beneficial for India to do much trade with NAFTA keeping in mind the cost of a trade. India trade with NAFTA is found to be discouraged if we consider the GDP which has an adverse impact on the trade; however, the GDP has a highly insignificant impact on the merchandise trade flow between India with NAFTA. The per capita income has a positive impact on the trade between India and NAFTA. So India should need to trade with the NAFTA because the per capita income of both India and NAFTA encourage the trade between the two partners. Tariff discourages the trade flow between the two; however, the tariff has no significant impact on the trade flow. Hence, given the fact, India maintains the trade with NAFTA which higher GDP, however, the gravity model does not fully support the argument.

4.5. Comparisons of gravity coefficients

Combined GDP is positively and significantly affecting the trade flow between India and ASEAN whereas in case of EU and NAFTA it is not significant. It is evident from the coefficients of combined GDP in the case of ASEAN that a 1% percent increase in combined GDP of India with the ASEAN partners will increase the trade flow between India and ASEAN by 0.33%. In the case of NAFTA and EU it has been observed with the coefficient of 0.108 and -0.046 respectively, but the coefficients are insignificant in each bloc. By comparing these coefficients with each other it may be concluded that the GDP coefficient of ASEAN has largest effect on its trade flow and the coefficient of NAFTA comes in the second rank while the EU combined GDP coefficient has the lowest effect on the trade flow. The distance coefficient of EU and NAFTA are negatively affecting the trade as per theoretical expectations while the coefficient of ASEAN is positively affecting the trade not as per expectations. By observing the p-values, the coefficients of distance for NAFTA and EU are statistically significant at 1% level of significance while in case of ASEAN it is not significant. The distance coefficient in the case of NAFTA is much stronger than the EU and ASEAN i.e. distance plays a major role in the case of NAFTA.

Table 4. Comparison of gravity model coefficients for ASEAN, EU, and NAFTA

| Variable | ASEAN | | EU | | NAFTA | |
|--|-------------|-------|-------------|-------|-------------|-------|
| | Coefficient | p > z | Coefficient | p > z | Coefficient | p > z |
| Log(GDP _i *GDP _j) | 0.3336*** | 0.000 | 0.108 | 0.196 | -0.046 | 0.893 |
| Logdistance | 0.00316 | 0.979 | -0.644*** | 0.000 | -16.15*** | 0.004 |
| LogpcGDP _i | 1.9427*** | 0.000 | 2.015*** | 0.000 | 2.75*** | 0.000 |
| LogpcGDP _j | 0.617*** | 0.001 | -0.343*** | 0.002 | 0.056 | 0.901 |
| Tariff | 0.002 | 0.186 | 0.003** | 0.044 | -0.0005 | 0.704 |

Notes: ** Significant at 5%, *** Significant at 1%.

Source: Author's calculation.

The variable per capita GDP of India, i.e., reporting country per capita income positively affected the trade flow of India with each partner blocs. By comparing per capita GDP of India coefficients with each other it may be concluded that the coefficient in case of

NAFTA has the largest effect on trade flow and the coefficient in the case of EU comes in second rank while for ASEAN the coefficient has the lowest effect on the trade flow. It can be said that as the per capita income of India increase this leads to the increase in the trade flow with these trade blocs. The variable per capita GDP of partner bloc also positively affected the trade flow of India with partner blocs for ASEAN and NAFTA whereas in case of EU it impact negatively. By comparing these coefficients with each other it may be concluded that the coefficient of ASEAN has the largest effect on trade flow and the coefficient of EU comes in the second rank while NAFTA coefficient has the lowest effect on the trade flow and it is not significant for NAFTA. The tariff imposed by India on these trade blocs is positively affecting the trade flow between India and these trade blocs except NAFTA with which tariff variable shows a negative impact on the trade flow. However the coefficient is not significant for the ASEAN and NAFTA.

6. Conclusion and policy implications

The paper aims to analyze the trade bloc which has significant trade with India as per the gravity model is a concern. In this context, we tested for the effectiveness of the gravity model variables for the trade flow between the India and trade blocs which includes ASEAN, EU and NAFTA. This paper indicates that the pattern of international trade of India has changed from the EU members to the ASEAN member's countries i.e. India is shifting more towards the ASEAN economies. It shows the effects of different economic variables on the trade flow of India with the trade blocs. These variables are GDP of reporting country with the partner member countries as a whole, a distance of reporting country with a partner, per capita income of the reporting country, per capita income of the partner bloc member countries as a whole and tariff (effectively applied tariff) by reporting country. Applying the gravity model of bilateral trade flows between India and trade blocs, we found that these variables have a significant impact on the trade flow. Theoretically, GDP, per capita Income must positively affect the trade flow, while tariff and distance are supposed to affect the trade flow negatively. Nevertheless, variables such as combined GDP product, per capita income of reporting and trading partner have the expected signs and are statistically significant for ASEAN except the variable Distance which shows an unexpected sign for the ASEAN and is also not significant. Distance, per capita income of the reporting country variables shows an expected signs and is statistically significant for the EU and NAFTA except the variable per capita income of the partner bloc which shows an unexpected sign for EU bloc. Tariff variable shows an unexpected sign and significant for the EU blocs. So, the coefficients of the distance variable in the case of EU and NAFTA support the gravity model but not in the case of ASEAN, however in the case of ASEAN it is not significant. So distance has significant impact on the Trade flow between India and Trade blocs.

We can draw some policy recommendations on the basis of our analysis regards the trade relationship. In this scenario, as our empirical results shows the size and distance as main determinants of trade. Policymakers need to understand the inter-relationship between

India and trade blocs which include ASEAN, EU, and NAFTA so that jointly strengthening policies can be developed. India should need to increase the depth of trade with ASEAN and also need to increase its per capita income so that it further leads to increase in trade through various agreements and policies.

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