

A Study of Gravity model of International Trade with evidence from Trade Relationship between India and ASEAN Countries

Preeti Sharma*
Girish Kathuria**

ABSTRACT

Introduction: International trade has induced global competitiveness and hence the domestic business units have a propensity to become very competent being exposed to international competition. International trade is a crucial constituent of economic planning towards development. It is a tool that can bring the required changes in the factor-endowments of the countries.

Motive of Study: The current study applies a gravity model of international trade between India and ten ASEAN members from 2009 to 2018. For this objective, the panel data of Trade Flows, GDP, Distance, Population, Border Sharing and Common Language used, was exploited.

Methodology: To create a gravity model of international trade between India and ASEAN countries, an extension of the original model (by Walter Isard in 1954) has been used. The international trade model has been created using the OLS method of gravity.

Findings and Suggestion: From the findings of gravity trade models, it was found that there is a trade potential between India and ASEAN countries. Indo-ASEAN relationship in the trade of goods and services will prolong to be a mutually beneficial relationship that will improve the efficacy of capital markets, facilitate investment, and generate new intensification opportunities for both India and ASEAN.

Keywords: Gravity Model, Trade Flow, Ordinary Least Square Method, International Trade, ASEAN, GDP.

JEL Classification: F14, F17, F18, F39

INTRODUCTION

The economic development of underdeveloped and developing countries is taking place with increasing trading activities consisting of countries having a close economic relationship with one another. In the present world, Foreign Investment (Foreign capital) and foreign trade (international trade) are two inevitable elements for rapid growth. International trade, expedite the competence among countries it also encourages different countries to partake in global trading activities. Increasing openness and moving towards globalization encourages the opening of foreign direct investment (FDI) in the country. International Trade has exerted a reflective effect on the economic growth of a country. It can be noticed from the case of India and China that

*Amity Global Business School, Amity University, Noida.

**Professor & Director, Amity Global Business School, Noida.

these countries have shown tremendous growth after opening up of their economies to the whole world by embracing liberalization and international trade.

Different economies of the world whether they are developed and developing have dynamically shifted towards forming regional blocks to enhance their trade and development purposes, and India also took steps in this direction by taking some proactive steps of signing FTAs. India has export and import trade with all the regions of the world, both the developing and developed countries. Economies are focusing on strengthening trade relations bilateral negotiations and various persuasive activities. India has also developed trade relationships with major trading blocks of South East Asia i.e. ASEAN.

India and ASEAN countries constitute a huge, evenly-matched region representing a huge market in which producers can achieve economies of scale of large production due to factor endowment of the country, and different investors can take the advantage of productive capital most productively. Trade relations between India and ASEAN have developed rapidly over the past three decades and ASEAN is now India's fourth-largest trading partner after the EU, the US, and China. New developments or achievements of International trade include the new pattern adopted by nations including the integration of countries into trade blocs (e.g., European Union, NAFTA, EFTA, CEFTA, and ASEAN) and globalization.

"In the past, India's engagement with much of Asia, including Southeast and East Asia, was built on an idealistic conception of Asian brotherhood, based on shared experiences of colonialism and cultural ties. The rhythm of the region today is determined, however, as much by trade, investment and production as by history and culture. That is what motivates our decade-old 'Look East policy'. Table 1 shows the bilateral trade between India and ASEAN for nine years (2001-2013).

Table1: Bilateral trade between India and ASEAN¹

Year	Total Trade (US \$ million)	% Growth
2001-02	7844.23	-
2002-03	9768.71	24.53
2003-04	13254.82	35.68
2004-05	17540.55	32.33
2005-06	21294.97	21.40
2006-07	30715.91	44.24
2007-08	39088.33	27.25
2008-09	45343.59	16.00
2009-10	43911.67	-3.16
2010-11	56235.85	28.06
2011-12	78,903.19	40.31
2012-13	75,874.57	-3.84

The current study applies a gravity model of international trade between India and ten ASEAN members from 2009 to 2018. Many researcher have used the gravity model to show the association among gross domestic product (GDP), the population of the countries, the geographical distance between/among the countries, common language, boarder sharing and other important variables with can affect international trade among the nations. Researches like Blomqvist (2004) on Singapore and Montanari (2005) on Balkans have also done similar works on international trade between countries.

THE TRADITIONAL GRAVITY MODEL

Let F_{ij} denote the bilateral trade between countries i and j (denoted as a gravitational attraction), G is the gravitational force, M_i and M_j are GDPs of countries i and j (denoted as masses of two objects) and D_{ij} is the distance between two countries.

$$F_{ij} = G \frac{M_i M_j}{D_{ij}^2}$$

Where:

F_{ij} is the gravitational attraction

M_i and M_j are the mass of two objects

D_{ij} is the distance

G is the gravitational constant

In simple words, the model mentioned above states that the volume of international trade between any two economies is proportionate to the product of their total production (GDP) and the distance dissuasion function where distance is generally interpreted to include all factors that might create trade confrontation.

REVIEW OF LITERATURE

The gravity model introduced by Tinbergen (1962) is the most successful empirical trade flow equation. The gravity model hypothesizes that the larger, the richer, the closer and together, the two countries are, the more they trade. In the paper "The Gravity Model for International Trade: Specification and Estimation Issues", TAMÁS KRISZTIN & MANFRED M. FISCHER have created a gravity model of international trade using Poisson gravity model along with pseudo maximum likelihood (ML). In their research work in "Trade Specialization in the Gravity Model of International Trade" by Dan Ciuriak and Shinji Kinjo, analyzed trade patterns and trends using the gravity model. Dhar and Panagariya (1996) estimated country-specific and pooled cross-country gravity equations to examine the question of openness. Deluna et al used OLS methods, to examine the factors influencing the transfer of goods between the Philippines and its trade partners while applying the gravity model to panel data for the period 2008 to 2012.

The research paper "An International Trade Flow Model with Substitution: An extension to the gravity model", the author Jacob A. BIKKER has created a gravity model using GNP, Population and distance as predictors for international trade between countries. Konstantinos Kepaptsoglou, Matthew G. Karlaftis and Dimitrios Tsamboulas (2010) have analyzed the effects of Free Trade Agreements on international trade using the gravity model. They have also reviewed the empirical literature on the gravity model. Fukunari Kimura and Hyun-Hoon Lee in their paper have assessed the impact of various factors on bilateral trade services relative to that on bilateral goods. They have created a regression equation of bilateral trade in services for 10 OECD countries. In his Paper "Stochastic varying coefficients gravity model: an application in trade analysis", K. Kalirajan has compared the actual and potential trade between Australia and its trading partner. For calculating potential trade, he has used the gravity model of international trade. A similar study, conducted by Karamuriro & Karukuza analyzed the determining factors of exports in Uganda, covering the period from 1980 to 2012. Sharma, P. (2017) also created a dynamic foreign trade model of international trade flows between India and ASEAN. The foreign exchange rate has been incorporated into the gravity model of trade in their study. Santos Silva & Tenreyro (2006) propose a Poisson specification of the gravity model along with the Poisson pseudo maximum likelihood (PPML) estimator introduced by Gourieroux et al. (1984).

OBJECTIVES OF THE STUDY

1. To study the Dynamic Pattern of Indo-ASEAN trade over a period of time and prepare a Predictive Model of India's International Trade using the Gravity Model.
2. To compare the Estimated and Actual Trade Flow between India and ASEAN.

NEED OF THE STUDY

The bilateral trade relationship between India and ASEAN is still in a budding phase, there is a lot to achieve to gain the potential benefits from bilateral trade between the two. Both nations are enthusiastic to elevate the foundations of the existing trade relationship between them. In the opinion of the researcher the growing economic power of Asia -- particularly China, India, and ASEAN--can exploit full comparative advantage from interchange and bilateral relationships among them. For India and ASEAN, sturdier trade linkages and more closely cohesive capital markets will enable the sustainable growth momentum that is required to meet the needs of their growing and huge populations of the two. Keeping these points into consideration, the current topic A Study of Gravity model of International Trade with evidence from Trade Relationship between India and ASEAN Countries has been taken for the study.

RESEARCH METHODOLOGY

Data Collection: Secondary data has been used for the current study. The data includes total trade flow between India and ASEAN countries individually, the GDP of India and the GDP of all the ASEAN members, the population of India and all ASEAN countries and distance between India and ASEAN countries for a period from 2009 to 2018. Besides these two dummy variables also have been used for the current study. These variables are the contiguity and common language used in India and these countries. The data for dummy variables and weighted distance have been collected from the CEPII database. The data for GDP and Population has been collected from World Bank sources. The data of trade flow between India and ASEAN have been collected from the official DGFT website. To find out the data of trade flow between India and ASEAN members, the data for imports and exports have been added.

ANALYTICAL STATISTICAL TECHNIQUES USED

The gravity model of international trade has been utilized to explain the total trade between India and ASEAN. Tinbergen is a Dutch economist who first applied the gravity model to analyze foreign trade flows in 1962. As per his model trade flow between the countries has been taken as an independent variable while GDP and geographical distances between the countries as independent variables. The results showed that the distance is a negative variable whereas GDP is a positive variable to enhance international trade. Krugman and Obstfeld (2005) also utilized gravity model to find out trade flows and they provided a common model as follows:

$$T_{ij} = G \frac{Y_i Y_j}{D_{ij}}$$

Where: T_{ij} is the total trade flow from origin country i to destination country j , Y_i and Y_j are the economic size of two countries i and j , Y_i are usually gross domestic product (GDP) or gross national product (GNP) D_{ij} is the distance between two countries i and j A is a constant term.

DATA DESCRIPTION AND RATIONALE BEHIND VARIABLES TAKEN

To find out the gravity model of international trade between India and ASEAN, the researcher has used a different variation of the initial gravity model (given by Krugman and Obsfeld in 2005). The current model has one dependent variable i.e. total trade and four independent variables which are GDP of countries, Population, common language, border sharing and distance between India and other countries.

$$\log T_{ijt} = \beta_0 + \beta_1 \log(Y_{it}) + \beta_2 \log(Y_{jt}) + \beta_3 \log(N_{it}) + \beta_4 \log(N_{jt}) + \beta_5 \log D_{ij} + \beta_6 C_{it} + \beta_7 B_{jt} + e_{ijt}$$

or (y_log_ols ~ dist_log + inc_o_log + inc_d_log + comlang_off + contig + pop_o + pop_d)

The most customary method for estimation of the multiplicative gravity model for trade can be given by following log Equation is to use a log-log transformation yielding. The gravity model for current study can be written as under:

i = India

j = ASEAN members

t = 2009, 2010, 2011, 2012..... 2019

T_{ijt} = India's trade with ASEAN members in year t(Y)

Y_{it} = India's GDP in year t(inc_o)

Y_{jt} = GDP of member countries in year t(inc_d)

N_{it} = India's Population in year t(pop_o)

N_{jt} = Population of member countries in year t(pop_d)

D_{ij} = Distance in kilometers between India and ASEAN countries(distw)

C_{it} = Common language between India and ASEAN country in year t(comlang_off)

B_{jt} = Boarder sharing between India and ASEAN countries in year t(contig)

e_{ijt} = Error term

Gross Domestic Product of India and ASEAN countries has been used as a measure of economic size. These variables are expected to have a positive impact on international trade between India and the ASEAN group. The Population of India and ASEAN is used to estimate the market size of each country, which is a factor affecting international trade positively. The logic behind considering it as a positive factor is, because the larger the market size, the more it trades.

Distance represents transportation cost when participating in international trade. It is calculated in kilometers between India and ASEAN member countries (weighted distance has been used in the current study, data source: CEPII). This variable is expected to cause a negative impact on trade flows because transportation costs would be proportional to the distance between the two countries.

The two dummy variables contig and comlang_off represent the border sharing by ASEAN members with India and common language spoken in India and ASEAN countries respectively. The presence of both factors creates a positive impact on international trade flow and their absence has been treated as creating a negative impact. For both the dummy variables 1 has been used to show their presence and 0 has been used to show absence. Table 2 presents the coding for variables taken for the current study.

Empirical Results

Table 3 presents the result of the gravity model using OLS. The first column reports OLS estimates using the logarithm of total trade as the dependent variable. The value of adjusted R-squared is 0.8995, so it can be said that the current model explains 89% variance in trade flow from the variables taken. It can be seen that *dist_log*, *inc_d_log*, *comlang_off*, *contig* and *pop_d* have a high level of significance (at 1% level of significance) in explaining trade flow between India and ASEAN members.

Table 2: variables and the code used

Coding	Variable
iso_o	Alphanumeric code for India (Exporter)
iso_d	Alphanumeric code for ASEAN countries (Importer)
Flow	Total trade between India and ASEAN countries
contig	1 for contig and 0 for no contig (sharing of the common border)
comlang_off	1 for common language otherwise 0
distw	Weighted distance (pop-wt, Km)
Year	
pop_o	Population for India
Pop_d	Population for ASEAN Members
gdp_o	GDP of India
gdp_d	GDP for ASEAN members

Table3: Results of OLS Regression

	Estimate	Std. Error	t-value	Pr(> t)
Intercept	18.276945	4.411312	4.143	7.60e-05 ***
dist_log	-2.460842	0.440833	-5.582	2.38e-07 ***
inc_o_log	0.411006	1.309165	0.314	0.754
inc_d_log	1.603887	0.065724	24.403	< 2e-16 ***
comlang_off	-1.397322	0.215166	-6.494	4.19e-09 ***
contig	1.769422	0.298576	5.926	5.34e-08 ***
pop_o	0.002980	0.006726	0.443	0.659
pop_d	-0.012550	0.001475	-8.508	3.14e-13 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				
Residual standard error: 0.6095 on 92 degrees of freedom				
Multiple R-squared: 0.9066, Adjusted R-squared: 0.8995				
F-statistic: 127.6 on 7 and 92 DF, p-value: < 2.2e-16				

Table 4 presents the comparison between Actual and estimated trade between India and ASEAN members. It can be noticed that Laos, Myanmar, and Philippines have underperformed in terms of total trade. While other members Brunei, Cambodia, Indonesia, Malaysia, Singapore, Thailand and Vietnam have outperformed. As a conclusion, it can be said that there is a potential for trading activities between India and ASEAN members.

Table 4: Comparison between Actual and Estimated Trade flow between India and ASEAN members

Country	Actual Total trade (USD \$ million)	Estimated Total trade (USD \$ million)	Over/Under Performance (USD \$ million)	% Over/Under Performance
Brunei	647.29	562.98366	84.30634	13.02450833
Cambodia	238.61	216.8877392	21.72226078	9.1036674
Indonesia	21,125.27	20161.79886	963.4711442	4.560751859
Laos	40.42	107.1747815	-66.75478155	-165.1528489
Myanmar	1,727.09	1751.504708	-24.41470766	-1.413632623
Malaysia	17,254.90	17223.48461	31.41539164	0.182066495
Phillipines	2,324.74	2344.386753	-19.64675326	-0.845116153
Singapore	27,853.91	27456.32033	397.5896719	1.427410629
Thailand	11,883.21	11835.72152	47.48847848	0.399626687
Vietnam	13,699.61	13597.82866	101.781344	0.742950668

CONCLUSION

The current study focuses on the use of standard practice log-linear (OLS) to form the gravity model and estimate the parameters of interest by least squares. The gravity model of international trade is considered as one of the successful models in international economics. The extension of the model includes every aspect between the trading countries which can be useful from import and export point of view. It functions to emphasize the importance of geographical proximity, economic and socio-economic aspects, in shaping the pattern of global economic interaction. It is totally different from traditional theories of international trade (i.e. absolute advantage or comparative advantage). In the current study, the researchers have developed a way to present an extended form of the gravity model of international trade. The study has also tried to present major determinants of international trade. An augmented trade gravity model was estimated using the OLS equation of gravity model. The acceptance of Tinbergen's log-linear specification of the gravity model is because of its strong theoretical foundations and it is apparently good in modelling trade flows. The log-linear specification of the gravity model along with OLS estimation also has certain limitations. The basic problem with this approach is the presence of heteroscedasticity log-linearization. So to overcome this problem we can find the scope of the current study in the use of other econometric models such as Poisson specification of the gravity model along with the Poisson pseudo maximum likelihood (PPML) and other models.

BIBLIOGRAPHY

- Bergstrand J H. *The gravity equation in international trade: some microeconomic foundations and empirical evidence.* *Rev Econ Stat* 1985; 67(3): 474-81.
- Bikker, J. A. (1987). *An international trade flow model with substitution: an extension of the gravity model.* *Kyklos*, 40(3), 315-337.
- Binh, D. T. T., Duong, N. V., & Cuong, H. M. (2011). *Applying gravity model to analyze trade activities of Vietnam.* *In Forum for Research in Empirical International Trade Working Paper.*

- Ciuriak, D., & Kinjo, S. (2006). *Trade specialization in the gravity model of international trade*. *Trade policy research*, 2005, 189-197.
- De Benedictis, L., & Taglioni, D. (2011). *The gravity model in international trade*. In *The trade impact of European Union preferential policies* (pp. 55-89). Springer, Berlin, Heidelberg.
- Gujarati, D. N. (2003). *Basic Econometrics* (4th ed.). New York, NY: The McGraw-Hill.
- Kalirajan, K. (1999). *Stochastic varying coefficients gravity model: an application in trade analysis*. *Journal of Applied Statistics*, 26(2), 185-193.
- Kepaptsoglou, K., Karlaftis, M. G., & Tsamboulas, D. (2010). *The gravity model specification for modeling international trade flows and free trade agreement effects: a 10-year review of empirical studies*. *The open economics journal*, 3(1).
- Kimura, F., & Lee, H. H. (2006). *The gravity equation in international trade in services*. *Review of world economics*, 142(1), 92-121.
- Krisztin, T., & Fischer, M. M. (2015). *The gravity model for international trade: Specification and estimation issues*. *Spatial Economic Analysis*, 10(4), 451-470.
- Krugman, P.R. & Obstfeld, M. (2005). *International economics: Theory and Practice*. (7th ed.). Boston, MA: Addison-Wesley.
- Santos Silva, J. M. C. & Tenreyro, S. (2006) *The log of gravity*, *The Review of Economics and Statistics*, 88(4), 641–658.
- Santos Silva, J. M. C. & Tenreyro, S. (2010) *On the existence of the maximum likelihood estimates in Poisson regression*, *Economics Letters*, 107(2), 310–312.
- Sharma, P. (2017). *The study of Effectiveness of FTA between India and ASEAN on international trade relations between India and ASEAN*. Available at SSRN 3402399.
- Tinbergen, J. (1962) *Shaping the World Economy: Suggestions for an International Economic Policy*, New York, Twentieth Century Fund.
- Wang, X., & Badman, R. P. (2016). *A multifaceted panel data gravity model analysis of Peru's foreign trade*. *arXiv preprint arXiv:1612.01155*.

ANNEXURE
(Data used for study)

Note: Data of total trade indicates the trade between ASEAN member and India. While the data of India's total trade indicates trade between India and ASEAN as a group.

iso_o	iso_d	distw	gdp_o	gdp_d	flow	contig	comlang_off	pop_o	pop_d
IND	BRN	4507.664	1341.89	11.89	453.09	0	0	1186	0.38
IND	KHM	3180.24	1341.89	10.39	50.59	0	0	1186	14.14
IND	IDN	4574.944	1341.89	577.54	11,720.02	0	0	1186	234.3
IND	LAO	2870.875	1341.89	6.43	36.98	0	0	1186	6.15
IND	MMR	2133.165	1341.89	31.73	1497.77	1	0	1186	49.33
IND	MYS	3610.29	1341.89	211.88	8,012.19	0	0	1186	28.08
IND	PHL	4843.75	1341.89	168.49	1061.84	0	1	1186	91.02
IND	SGP	3742.252	1341.89	194.15	14,046.74	0	1	1186	4.99
IND	THA	2716.949	1341.89	281.71	4,671.68	0	0	1186	65.54
IND	VNM	3329.87	1341.89	101.63	2,360.76	0	0	1186	86.03
IND	BRN	4507.664	1675.62	13.71	257.24	0	0	1210.57	0.39
IND	KHM	3180.24	1675.62	11.23	74.95	0	0	1210.57	14.37
IND	IDN	4574.944	1675.62	755.26	15,619.41	0	0	1210.57	237.64
IND	LAO	2870.875	1675.62	7.5	13.33	0	0	1210.57	6.25
IND	MMR	2133.165	1675.62	39.78	1338.29	1	0	1210.57	49.71
IND	MYS	3610.29	1675.62	258.65	10,394.75	0	0	1210.57	28.59
IND	PHL	4843.75	1675.62	199.59	1310.49	0	1	1210.57	92.6
IND	SGP	3742.252	1675.62	239.81	16,964.75	0	1	1210.57	5.08
IND	THA	2716.949	1675.62	341.11	6,546.30	0	0	1210.57	65.92
IND	VNM	3329.87	1675.62	112.77	3,716.34	0	0	1210.57	86.93
IND	BRN	4507.664	1823.05	18.53	1500.51	0	0	1213.37	0.39
IND	KHM	3180.24	1823.05	12.82	106.72	0	0	1213.37	14.61

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IND	MYS	3610.29	1856.72	327.87	13,427.81	0	0	1238.89	30.21
IND	PHL	4843.75	1856.72	271.84	1,810.59	0	1	1238.89	98.19
IND	SGP	3742.252	1856.72	307.58	19,273.03	0	1	1238.89	5.4
IND	THA	2716.949	1856.72	420.33	9,043.47	0	0	1238.89	66.76
IND	VNM	3329.87	1856.72	170.44	8,036.19	0	0	1238.89	89.76
IND	BRN	4507.664	2039.13	17.1	882.87	0	0	1254.02	0.41
IND	KHM	3180.24	2039.13	16.7	160.49	0	0	1254.02	15.27
IND	IDN	4574.944	2039.13	891.5	19,047.96	0	0	1254.02	252.17
IND	LAO	2870.875	2039.13	13.27	152.59	0	0	1254.02	6.64
IND	MMR	2133.165	2039.13	53.27	2004.78	1	0	1254.02	51.42
IND	MYS	3610.29	2039.13	342.87	16,934.29	0	0	1254.02	30.71
IND	PHL	4843.75	2039.13	284.59	1,818.62	0	1	1254.02	99.88
IND	SGP	3742.252	2039.13	314.86	16,933.83	0	1	1254.02	5.47
IND	THA	2716.949	2039.13	407.34	9,330.71	0	0	1254.02	67
IND	VNM	3329.87	2039.13	185.76	9,261.23	0	0	1254.02	90.73
IND	BRN	4507.664	2103.59	12.93	582.47	0	0	1268.96	0.41
IND	KHM	3180.24	2103.59	18.8	197.44	0	0	1268.96	15.52
IND	IDN	4574.944	2103.59	860.74	15,951.42	0	0	1268.96	255.59
IND	LAO	2870.875	2103.59	14.36	217.97	0	0	1268.96	6.74
IND	MMR	2133.165	2103.59	63.23	2,054.92	1	0	1268.96	51.85
IND	MYS	3610.29	2103.59	301.36	12,790.66	0	0	1268.96	31.19
IND	PHL	4843.75	2103.59	292.77	1,895.50	0	1	1268.96	101.56
IND	SGP	3742.252	2103.59	308	15,028.19	0	1	1268.96	5.54

IND	IDN	4574.944	1823.05	892.59	21,443.92	0	0	1213.37	241.99
IND	LAO	2870.875	1823.05	8.96	104.23	0	0	1213.37	6.35
IND	MMR	2133.165	1823.05	54.12	1926.53	1	0	1213.37	50.11
IND	MYS	3610.29	1823.05	302.19	13,454.00	0	0	1213.37	29.06
IND	PHL	4843.75	1823.05	224.14	1434.29	0	1	1213.37	94.18
IND	SGP	3742.252	1823.05	279.36	25,246.20	0	1	1213.37	5.18
IND	THA	2716.949	1823.05	370.82	8,244.85	0	0	1213.37	66.21
IND	VNM	3329.87	1823.05	134.6	5,441.96	0	0	1213.37	87.84
IND	BRN	4507.664	1827.64	19.5	854.82	0	0	1223.58	0.4
IND	KHM	3180.24	1827.64	14.6	124.18	0	0	1223.58	14.78
IND	IDN	4574.944	1827.64	919	20,210.79	0	0	1223.58	245.43
IND	LAO	2870.875	1827.64	10.2	167.55	0	0	1223.58	6.45
IND	MMR	2133.165	1827.64	58.47	1957.35	1	0	1223.58	50.54
IND	MYS	3610.29	1827.64	318.91	14,395.13	0	0	1223.58	29.51
IND	PHL	4843.75	1827.64	250.9	1,691.19	0	1	1223.58	96.5
IND	SGP	3742.252	1827.64	295.9	21,105.62	0	1	1223.58	5.31
IND	THA	2716.949	1827.64	397.56	9,085.78	0	0	1223.58	66.49
IND	VNM	3329.87	1827.64	155.48	6,282.15	0	0	1223.58	88.81
IND	BRN	4507.664	1856.72	18.9	796.05	0	0	1238.89	0.4
IND	KHM	3180.24	1856.72	15.23	154.03	0	0	1238.89	15.03
IND	IDN	4574.944	1856.72	916.65	19,598.50	0	0	1238.89	248.82
IND	LAO	2870.875	1856.72	11.97	89.29	0	0	1238.89	6.54
IND	MMR	2133.165	1856.72	60.54	2182.68	1	0	1238.89	50.98

A Study of Gravity model of International Trade with evidence from
Trade Relationship between India and ASEAN Countries

IND	THA	2716.949	2103.59	401.27	8,498.02	0	0	1268.96	67.24
IND	VNM	3329.87	2103.59	191.29	7,826.38	0	0	1268.96	91.71
IND	BRN	4507.664	2290.43	11.4	670.73	0	0	1283.6	0.42
IND	KHM	3180.24	2290.43	20.4	141.16	0	0	1283.6	15.77
IND	IDN	4574.944	2290.43	932.7	16,916.11	0	0	1283.6	258.5
IND	LAO	2870.875	2290.43	15.92	233.1	0	0	1283.6	6.85
IND	MMR	2133.165	2290.43	60.45	2,175.14	1	0	1283.6	52.25
IND	MYS	3610.29	2290.43	301.26	14,158.45	0	0	1283.6	31.63
IND	PHL	4843.75	2290.43	304.9	1,977.14	0	1	1283.6	103.24
IND	SGP	3742.252	2290.43	318.6	16,651.15	0	1	1283.6	5.61
IND	THA	2716.949	2290.43	412.41	8,548.84	0	0	1283.6	67.46
IND	VNM	3329.87	2290.43	201.33	10,107.12	0	0	1283.6	92.69
IND	BRN	4507.664	2652.55	12.13	498.02	0	0	1298.04	0.43
IND	KHM	3180.24	2652.55	22.19	177.25	0	0	1298.04	16.01
IND	IDN	4574.944	2652.55	1015.29	20,402.57	0	0	1298.04	261.36
IND	LAO	2870.875	2652.55	17.7	193.63	0	0	1298.04	6.95
IND	MMR	2133.165	2652.55	61.39	1605.83	1	0	1298.04	52.65
IND	MYS	3610.29	2652.55	318.96	14,713.14	0	0	1298.04	32.02
IND	PHL	4843.75	2652.55	313.62	2,457.19	0	1	1298.04	104.92
IND	SGP	3742.252	2652.55	338.4	17,669.81	0	1	1298.04	5.61
IND	THA	2716.949	2652.55	455.32	10,788.29	0	0	1298.04	67.65
IND	VNM	3329.87	2652.55	220.38	12,831.63	0	0	1298.04	93.64
IND	BRN	4507.664	2726.32	13.57	647.29	0	0	1312.24	0.44

IND	KHM	3180.24	2726.32	24.44	238.61	0	0	1312.24	16.25
IND	IDN	4574.944	2726.32	1022.45	21,125.27	0	0	1312.24	264.16
IND	LAO	2870.875	2726.32	18.12	40.42	0	0	1312.24	7.06
IND	MMR	2133.165	2726.32	68.67	1,727.09	1	0	1312.24	52.83
IND	MYS	3610.29	2726.32	358.58	17,254.90	0	0	1312.24	32.39
IND	PHL	4843.75	2726.32	330.91	2,324.74	0	1	1312.24	106.6
IND	SGP	3742.252	2726.32	364.14	27,853.91	0	1	1312.24	5.64
IND	THA	2716.949	2726.32	504.93	11,883.21	0	0	1312.24	67.79
IND	VNM	3329.87	2726.32	241.26	13,699.61	0	0	1312.24	95.58