Trade Impact of the India-ASEAN Free Trade Agreement (FTA): An Augmented Gravity Model Analysis.

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Introduction

World trade environment is witnessing proliferation of large number of Regional Trade Agreements (RTAs) in the post WTO period. This is primarily because of the long drawn negotiations at the WTO and the difficulty in arriving at a consensus among large number of member countries on diverse aspects of trade. The relative ease with which Regional Trade Agreements (RTAs) achieved successes in improving trade volume and addressing complicated trade related issues made them more feasible among countries and this led to many countries joining the 'regionalism' bandwagon. There is a long debate on 'Multilateralism' versus 'Regionalism' by the trade economist outlining the pros and cons of these two alternate trade liberalization methodologies, but the diversity of theoretical positions and empirical substantiations could not resolve this debate once in for all. This led to regionalism competing with multilateralism as a trade policy tool and succeeded largely with the initiation of large number of RTAs. In this context it is pertinent to understand the exact nature of relationship between formation of regional grouping and its trade outcome and also the possible implications on multiple stakeholders associated with trade in the participating countries. India for long being a strong 'multilateralist' had to change its course of trade policy formulation and decided to sign number of bilateral trade agreements with important trade partners such as Srilanka, Singapore, Thailand etc. In August 2009, for the first time India signed an FTA with a regional grouping ASEAN. In a large country like India where livelihood of the millions of people depends on the performance of some crucial sectors, trade agreements can have a debilitating impact on their lives if it is not calibrated to address their concerns. The paper looks in to the trade impact of India ASEAN Free Trade Agreement using an augmented Gravity model using a panel data framework.

Emergence of Asia and the India-ASEAN FTA

The centre of gravity for the world economic production is shifting towards Asia with China, India and resurgent East Asia propelling the engine of growth and producing goods and services for world consumption. Emergence of regionalism as a powerful alternative to multilateralism makes countries to gang up under fiercely competing trade blocks namely EU, NAFTA and ASEAN, Mercusor etc. ASEAN is the vibrant regional grouping in Asia and envisioning itself to become an Asian Economic Community. It is all the more important to study how ASEAN influences the trade flow between members and non-members in the region in the emerging global economic order.

India emerged from its inward looking protectionist policies followed for a very long time with the introduction of the market oriented policies in the early nineties. India today is the fastest growing economy of the world today even outpacing China. It also set out the ambitious target of doubling the trade in five years through its trade policy and started exploring regional trade partners with large trade potential. Emerging economies of Asia and ASEAN countries were following an export led growth strategy and became most dynamic regions of the world in terms of economic growth and trade. Realising the importance of the

Asian region for sustaining high trade growth, India initiated the 'look east' policy in the early nineties. After prolonged discussions and hectic negotiations India signed a Free Trade Agreement with ASEAN in trade in goods in August 2009. This India ASEAN trade cooperation is important in the larger context of Asian Economic Union and emergence of new international economic order driven by the dynamic Asia.

Gravity Model of trade for FTAs

Gravity model is a workhorse model in international trade largely used to study the impact of regional trade agreements on trade creation/diversion and also to analyse the welfare implications to the participating nations. The origin of Gravity model is from the Newtonian concept of Law of gravitational force which says Force between two objects *i* and *j* (GFij) is directly proportional to their masses and inversely proportional to the distance between them. Tinbergen (1962) used this concept to explain trade flows between countries and found very effective. Gravity models in trade use Gross Domestic Product (GDP), Population, and Distance to explain trade flows between countries. Whenever policy measures are taken such as joining to a FTA, a policy variable dummy is introduced in the gravity equation and its effect is assessed by estimating deviations from the baseline flows. The gravity model of bilateral trade, in its most basic form shows that trade between country 'i' and country 'j' is proportional to the product of GDPi and GDPj and inversely related to the distance between them. It can be expressed in the following equation form.

$$GF_{ij} = \frac{M_i M_j}{{D_{ij}}^2} \qquad \text{i} \neq \text{j} \qquad (1)$$

By making the log transformation Equation 1 becomes a linear equation which can be expressed as below

$$lnGF_{ij} = ln\, M_i + ln\, M_j - lnD_{ij} \qquad i \neq j \qquad (2)$$

The economic mass in equation (2) can be represented in four alternate methods namely Gross Domestic Product (*GDP*) of the countries, both GDP and population of the countries, GDP per capita and both GDP and GDP per capita put together.

Application of Gravity Model in Regional Trade

Gravity models are extensively used in assessing the impact of Regional Trade Arrangements. The basic idea is to include an additional FTA dummy variable in the standard gravity model that captures variations in the levels and direction of trade due to the formation of an FTA. The dummy variable takes the value 1 when both countries in a given pair belong to the same regional group and 0 otherwise. The estimated coefficient of the dummy variable will explain how much additional trade is happening due to the formation of the FTA. Economic theory suggests that the overall welfare effects of a FTA depend on the balance between trade creation and trade diversion. Trade creation takes place when a high cost domestic production is replaced by a low cost foreign producer. Trade diversion occurs when the trade with low cost non-member countries are replaced with high cost partner courtiers of the FTA. Trade creation and trade diversion have opposite effects on welfare. Trade creation generates welfare gains for member countries without imposing any losses on non-members. In this case consumer gains in terms of lower prices are higher than the producer surplus and tariff loss to the Government put together. In contrast trade diversion generates a welfare loss. Trade diversion reduces the trade of the non-member country and tariff losses to the

home country. Even though consumers pay less price the total loss for the country as a whole is higher.

The basic Gravity model can be augmented with large number of other variables to account for large number of factors that are influencing trade. These include cultural factors, geographical factors, historical factors and other factors. Cultural factors explain whether countries share common language, customs, practices and similar ethnic groups. The geographical factors explain whether countries share common borders or they are landlocked countries or island nations. Historical nature of the relationship between countries shows that whether one colonized the other, or they have common colonizer. When all possible factors influencing trade between nations are taken in to consideration the remaining unaccounted part is the result of artificial barriers to trade.

Panel Data Gravity Models

Panel data regression differs from a regular time series or cross section regression in a sense that it has a double subscript on its variable, i.e.

$$y_{it} = \alpha + X'_{it}\beta + u_{it} \qquad i = 1, \ldots, N; t = 1, \ldots T$$

With *i* denoting households, individuals, firms, countries etc. and *t* denoting time. The *i subscript*, therefore, denotes the cross section dimension whereas t denotes the time-series dimension. α is a scalar, β is K x 1 and X_{it} is the ith observation on K explanatory variables.

Fixed Effect Vector Decomposition (FEVD) Method

The impact time invariant explanatory variables on the dependent variable cannot be estimated through Fixed Effects model as there is no variation in the data. This problem can be addressed through a different methodology using a decomposition method. The Fixed Effects Vector Decomposition (FEVD) technique involves the following three steps: First, estimation of the unit fixed effects by the baseline panel fixed effects model excluding the time-invariant but not the rarely changing right hand side variables. Second, regression of the fixed effects vector on the time invariant and/or rarely changing explanatory variables of the original model (by OLS) to decompose the unit specific effects into a part explained by the time invariant variables and an unexplained part. And third, estimation of a pooled OLS model by including all explanatory time-variant variables, the time-invariant variables, the rarely changing variables and the unexplained part of the fixed effects vector. This stage is required to control for multicollinearity and to adjust the degrees of freedom in estimating the standard errors of the coefficients.

India ASEAN trade

This section provides trade between ASEAN countries and India at two time periods namely 2010 and 2015. These two time period show the trade at the time of signing the FTA and its impact on current trade. The trade data is collected from ASEAN statistical database. The data showed that ASEAN import to India remained static during this period from 39.89 billion in 2010 to 39.10 billion in 2015. The main reason for this stagnation in trade is the prevailing global environment. The world is scrapping through a major economic depression and its repercussions are felt on the trade flows of countries. Singapore was the major exporter to India among ASEAN countries in 2010 (42.99 percent) that position changed to Indonesia in 2015 with 30.0 percent share. Indonesia, Malaysia, Thailand and Vietnam improved their trade share whereas share of Singapore came down significantly from 42.99

percent to 27.24 percent. In terms of percent share in export, Lao PDR was highest (with crude oil export) followed by Vietnam, Cambodia and Malaysia.

Table-1, ASEAN Countries Exports to India

Reporter	2010	2015	Percentage change in Export
Brunei Darussalam	48,8158529.2 [1.22]	57,7977953.2 [1.48]	18.40
Cambodia	8065592.899 [0.02]	10369525.96 [0.03]	28.56
Indonesia	991,5038943 [24.85]	1173,1001068 [30.00]	18.32
Lao PDR	46842]0.001]	1,5294021.31 [0.04]	32550.23
Malaysia	651,2144922 [16.32]	812,2762776 [20.77]	24.73
Myanmar	95,8859242.1 [2.40]	101,3990785 [2.59]	5.75
Philippines	40,9844634 [1.03]	37,2886853 [0.95]	-9.02
Singapore	1715,1303835 [42.99]	1064,6671024 [27.23]	-37.93
Thailand	345,7513441 [8.67]	413,4988467 [10.58]	19.59
Viet Nam	99,1629596 [2.49]	247,4806392 [6.33]	149.57
ASEAN	**39,89,2605578 [100.00]**	**39,10,0748866 [100.00]**	**-1.98**

Source: ASEAN Statistics

Table-2 provides ASEAN imports from India for the same period. ASEAN imports are much lower than ASEAN exports for both the period. In 2010 ASEAN imports accounted 53.70 percent of its exports to India which has deteriorated to 49.75 percent in 2015. While ASEAN exports to India remained static in the post FTA period, ASEAN imports from India declined from 21.42 billion to 19.45 billion. This can again attributed to global recession which affected the ASEAN countries much more than India which is still holding the tempo of high economic growth. The biggest decline in imports was recorded by Singapore which had an import share of 43.09 in 2010 which subsequently declined to 29.73 in 2015. Thailand also witnessed decline in imports from India (from 18.8 to 13.15 percent). The countries which showed increase in their import share during this period include Cambodia, Philippines, Malaysia, Lao PDR, Myanmar, Vietnam and Brunei Darussalam.

Table-2, ASEAN Countries Imports from India

Reporter	2010	2015	Percentage Change in Import
Brunei Darussalam	2,2509836.85 [0.11]	3,7470528.23 [0.19]	66.46

Cambodia	5,2571900.36 [0.25]	11,4463288.5 [0.59]	117.73
Indonesia	310,2118308 [14.48]	262,6866633 [13.50]	-15.32
Lao PDR	8161486.13 [0.04]	3,1930469.88 [0.16]	291.23
Malaysia	248,3788923 [11.59]	389,5727198 [20.03]	56.85
Myanmar	16,6697568.5 [0.78]	47,4040990.1 [2.44]	184.37
Philippines	56,5755543 [2.64]	128,7366863 [6.52]	127.55
Singapore	923,2741141 [43.09]	578,3297481 [29.73]	-37.36
Thailand	402,8148492 [18.80]	255,8142098 [13.15]	-36.49
Viet Nam	176,2034464 [8.22]	264,3465011 [13.59]	50.02
ASEAN	**21,42,4527663 [100.00]**	**19,45,2770561 [100.00]**	**-9.20**

Source: ASEAN Statistics

Data Analysis and Discussion of Results

The data for the models are collected from multiple sources. The trade data such as Total bilateral trade, Total Import of a country, Total Export of a country is collected using the World Integrated Trade System (WITS) maintained by the IMF, UNCTAD and the WTO. The trade data is extracted from Direction Of Trade Statistics (DOTS) of the IMF using WITS software. The disaggregated trade data such as HS-2 are collected from the COMTRADE data base of UN. The data pertaining to GDP, per capita GDP, Population of the country are collected from the World Trade Indicators database of the world bank. The geographic distance between countries and countries with common borders are collected from the database maintained by Jon Haveman. The common language and colony are collected from CEPII, France.

The data required for the gravity model is collected from 26 countries representing different geographical regions of the world. Each country has got bilateral trade pair with other 25 countries for seventeen years. The study used the data set of 11050 bilateral trade for 650 country pair (panel) for 17 years. The data are related to the period from 1991 to 2007.

A balanced panel data set consisting 11050 bilateral trade data across different gravity variables is prepared for the analysis. Two variations of augmented gravity model are used in the study. Different panel data estimation techniques such as Pooled OLS method (POLS), Maximum likelihood Estimation Method (MLE), Fixed Effect with Vector Decomposition (FEVD), Between Effect (BE) and Random Effect Method (RE) are applied to the dataset to arrive at appropriate modeling method and desirable results.

Gravity Model Specification

There are two variants of augmented gravity model used in the paper. The augmented gravity model-1 used GDP as the economic mass variable along with other traditional gravity

variables and augmented variables. The dependent variable of the model is the total bilateral trade between country 'i' and 'j'. The model used in the study is outlined below

$$\ln(TT_{ij}) = \alpha + \beta_1 lnGDP_i + \beta_2 lnGDP_j + \beta_3 lnPCGDP_i + \beta_4 lnPCGDP_j + \beta_5 lnPCGDP_{diff} - \beta_6 \ln Distance + \beta_7 ASEAN\ member + \beta_8 Cont\ Bord + \beta_9 Com\ Lang + \beta_{10} Com\ Colony + \varepsilon_{ij}$$

Where

$Ln(TT)_{ij}$ = Log of Total trade between country i and j for a year

Ln GDP_i = log of GDP of country i

Ln GDP_j = log of GDP of country j

Ln $PCGDP_i$ = log of per capita income of country i

Ln $PCGDP_j$ = log of per capita income of country j

Ln PCGDP diff = absolute difference in per capita of country i and j

Ln Distnace = log of geographical distance between country i and j

ASEAN member = dummy representing common membership to ASEAN FTA

Cont Border = dummy if countries share common border

Com Lang = dummy if countries share common official language

Com Colony = dummy if both countries were under the same colonizer

εij = Error term

The results of the panel data regression model is shown in table -3. In the Pooled OLS method (POLS) of the augmented Model-1 showed that all variables are significant except colony and continuous border. Common language is positively influencing the trade flows and it is highly significant. The adjusted R square 0.7802 shows that the model got high explanatory power with 78 percentage change in the total trade is explained by the independent variables outlined in the model. In the Maximum Likelihood Estimate (MLE) method showed apart from PCGDPi, PCGDPj, PCGDPdiff, continuous borders, colony are not significant in explaining trade flow.

Table-3, Results of the Augmented Gravity Model-1

Independent Variable	Dependent Variable = Total bilateral Trade between i and j				
	Pooled OLS	MLE Method	Fixed Effect with Vector Decomposition	Between Effect Model	Random Effect Model
Ln GDPi	0.6780*** (0.0086)	0.8396*** (0.0295)	2.3272***	0.6741*** (0.0306)	0.8321*** 0.0273

Ln GDPj	0.6773*** (0.0086)	0.8226*** (0.0292)	2.08***	0.6738*** (0.0306)	0.8157*** 0.0274
Ln PC GDPi	0.2115*** (0.0086)	0.0356 (0.0320)	-1.7429***	0.2133*** (0.0307)	0.0443 0.0294
Ln PC GDPj	0.1695*** (0.0086)	-0.0058 (0.0320)	-1.5707***	0.1714*** (0.0307)	0.0028 0.0294
Ln PC GDPdiff	0.0713*** (0.0077)	0.0015 (0.0103)	-0.0117***	0.0848*** (0.0294)	0.0020 0.0102
Ln Dist	- 0.8923*** (0.0149)	-0.8411*** (0.0554)	-0.5483***	-0.8966*** (0.0528)	-0.8428*** 0.0541
ASEAN Dummy	1.4464*** (0.0605)	1.6749*** (0.2241)	3.6043***	1.4383*** (0.2148)	1.6648*** 0.2185
Cont Border	0.0561 (0.0548)	-0.1453 (0.2029)	-1.3502***	0.0725 (0.1944)	-0.1386 0.1980
Com Language	0.3413*** (0.0282)	0.3954*** (0.1059)	0.8346***	0.3393*** (0.1001)	0.3930*** 0.1034
Colony	- 0.0319 (0.0443)	0.0201 (0.1643)	0.4755***	-0.0329 (0.1571)	0.0177 0.1604
Constant	3.2161*** (0.1511)	4.5924*** (0.5287)	14.6491***	3.1460*** (0.5398)	4.5381*** 0.5123
Adj R Sqared	0.7802				12053.15 Wald Chi2(10)
F(10, 11039)	3923.03		17161.53 F(8, 11038)		-8771.45 Hausman Test Chi2(10)
Breusch-Pagan/ Cook-Weisberg test Chi 2 (1)	747.78	7750.68 LR Chi2(10)		291.63 F(10,639)	44544.44 B&P LM Test Chi2(1)

The Fixed Effect Vector Decomposition (FEVD) method of the augmented model-1 showed that all variables are significant in explaining bilateral trade. The positive sign of the GDP coefficients of Country i and j are positive and in line with the theory which means countries with higher GDP will trade more between them. But per capita income of country 'i' and 'j' and per capita income difference are having negative sign. This could be due to the fact that there could be multicollinearity between GDP and GDP per capita. Among the augmented variables common language and colony are positively influencing trade while continuous border has a negative sign. The coefficient of ASEAN dummy is significantly higher in FEVD model (3.6043) compared to other estimation methods of the model.

Continuous border and colony are not significant in Between Effect (BE) method as in the case of POLS method. In the same way PCGDPi. PCGDPj, PCGDPdiff, Cont borders and Colony are not significant in Random Effect (RE) method as in the case of MLE method.

Augmented Gravity Model – 2

In the Augmented Model-2 GDP of country 'i' and 'j' are replaced with population of country 'i' and 'j' to address the endogeneity problem of including GDP and per capita GDP in the same equation. All other variables are same as Augmented model-1. The results in this model showed an improvement over the previous model.

$$\ln(TT_{ij}) = \alpha + \beta_1 lnPOP_i + \beta_2 lnPOP_j + \beta_3 lnPCGDP_i + \beta_4 lnPCGDP_j + \beta_5 lnPCGDP_{diff} - \beta_6 \ln Distance + \beta_7 ASEAN\ member + \beta_8 Cont\ Bord + \beta_9 Com\ Lang + \beta_{10} Com\ Colony + \varepsilon_{ij}$$

In the POLS models, all variables except continuous border and common Colony are significant. But here the coefficients of per capita income of country 'I' and 'j' have considerably improved compared to Augmented model-1. Per capita income of country 'i' and 'j' improved substantially and became highly significant when population is included in the MLE model.

Table-4, Results of Augmented Gravity Model-2

Independent Variable	Dependent Variable = Total Bilateral Trade between i and j				
	Pooled OLS	MLE Method	Fixed Effect with Vector Decomposition	Between Effect Model	Random Effect Model
Ln POPi	0.6780*** (0.0086)	0.8396*** (0.0295)	2.3273***	0.6741*** (0.0306)	0.8321*** (0.0273)
Ln POPj	0.6773*** (0.0086)	0.8226*** (0.0292)	2.08***	0.6738*** (0.0306)	0.8158*** (0.0274)
Ln PC GDPi	0.8895*** (0.0074)	0.8752*** (0.0172)	0.5843***	0.8874*** (0.0271)	0.8765*** (0.0170)
Ln PC GDPj	0.8468*** (0.0074)	0.8168*** (0.0173)	0.5093***	0.8452*** (0.0271)	0.8185*** (0.0169)
Ln PC GDPdiff	0.0713*** (0.0077)	0.0015 (0.0103)	-0.0117***	0.0848*** (0.0294)	0.0020 (0.0102)
Ln Dist	- 0.8923*** (0.0149)	-0.8411*** (0.0554)	-0.5483***	-0.8966*** (0.0528)	-0.8428*** (0.0541)
ASEAN Dummy	1.4464*** (0.0605)	1.6749*** (0.2241)	3.6043***	1.4383*** (0.2148)	1.6648*** (0.2185)
Cont Border	0.0561 (0.0548)	-0.1453 (0.2029)	-1.3503***	0.0725 (0.1944)	-0.1386 (0.19980)
Com Language	0.3413*** (0.0282)	0.3954*** (0.1059)	0.8346***	0.3393*** (0.1001)	0.3930*** (0.1034)
Colony	- 0.0319 (0.0443)	0.0201 (0.1643)	0.4755***	-0/0329 (0.1571)	0.0177 (0.1604)

Constant	-6.1461*** (0.1770)	-6.8899*** (0.5475)	-15.7953***	-6.1645*** (0.6386)	-6.8452*** (0.5331)
Adj R Sqared	78.02				12053.17 Wald Chi2(10)
F(10, 11039)	3923.05		17161.56 F(8, 11838)		-8771.67 Hausman Test Chi2(10)
Breusch-Pagan/ Cook-Weisberg test Chi 2 (1)	747.78	7750.69 LR Chi2(10)		291.63 F(10, 639)	44544.38 B & P LM TestChi2(1)

The FEVD model gives the best results in the Augmented Gravity Model-2. All explanatory variables used in the model are highly significant and yielding expected signs (except for continuous border) with very high coefficients for ASEAN dummy. The results of the Between Effect (BE) model and Random Effect (RE) model resemble the results of POLS and MLE respectively. Among the two models used to estimate the bilateral trade flows between India and ASEAN countries, both model suggest there is a positive and significant RTA dummy coefficient which means trade between the both can be improved by forming a Regional trade agreement. Augmented model-2 gives better results than augmented model -1 as it is giving better signs consistent with theory and addressed the problem of endogeneity. To decide between fixed or random effects model, Hausman model selection test was performed. The test says if the P value of Chi Sq. is less than 0.05 (significant) Fixed effect model is selected over the Random effect model. The small value of Chi. Sq. test selects fixed effect over random effect.

Conclusion

Results of Pooled OLS Model returning parameters with expected signs and highly significant coefficients. But it is not accounting the individual characteristics of countries which are very important in determining bilateral trade flows. The results of BE method are closer to Pooled OLS method and MLE results are closer to Random Effects Method. In Random effects model also, important parameters are significant and holding expected signs with a positive ASEAN dummy. But there is possibility of explanatory variables correlated and the random effect model becomes inefficient. Comparison of results across the models revealed the augmented Gravity Model-2 is best suited for the study with better parameters, signs and explanatory power. The Hausman Specification tests carried out also validate this. Also the ASEAN dummy returns highest coefficient in this model. The paper strongly reasons the possibility of greater trade between India and ASEAN countries through RTA. Since the initial tariff levels are higher in India compared to ASEAN, ASEAN is likely to gain more in the short term. For India to exploit the trade potential with ASEAN the FTA should be operationalised beyond trade in goods to services and investment agreements.

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