"Has Gravity lost its pull: Why Augmented Gravity Trade Model fails to predict Intra-industry trade exchanges?"

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Abstract

The research paper will empirically demonstrate that Augmented Gravity Trade Model (GTM) fails to predict intraindustry trade between North-North and North-South economies and the reason for the failure of GTM under the fragmentation of production.

Overview:

Gravity trade model (GTM), the workhorse model of international trade, has widely been used in the analysis of international trade flow. "Tinbergen (1962) and Poyhonen (1963) did the first econometric studies of trade flows based on the gravity equation" (Deardorff 1998). GTM captures bilateral trade flows based on GDP size of trading partners and some sort of trade frictions to signify the distance (trade costs) for realizing such interactions. However, problem arises when Intra-industry trade (IIT) is modelled as the dependent variable in the gravity equation. IIT signifies the most astonishing aspect of international trade - the phenomenon of simultaneous exchange of export and import of goods and services among countries. Growth of IIT which represents almost fifty per cent of the contemporary trade is attributed to the fact that "trade in parts and components have risen in volume than trade in finished products" (Judith Dean 2008). The research paper will empirically demonstrate fact that Augmented Gravity Trade

Model fails to predict the intra-industry trade exchanges between North to North (USA-EU, USA-Japan) and North- South countries (USA, Japan, China and ASEAN 5 economies) and will also highlight the reason for the failure of GTM under the fragmentation of production.

Introduction

Gravity Trade Model (GTM) has widely been used in the analysis of international trade. "Tinbergen (1962) and Poyhonen (1963) did the first econometric studies of trade flows based on the gravity equation" (Deardorff 1998). Since then, GTM has been considered as the work horse trade model to empirically analyze and predict trade exchanges between the countries despite its weak theoretical foundations. Model's inspiration comes from the natural phenomenon of gravitational pull among the physical objects.

Taking cue from the Newton's Law of Gravity[1], trade economists modelled the gravity trade equation (GTM) where "volume of trade between two countries is proportional to their gross domestic products and inversely related to trade barriers between them" (Evenett & Keller, 2002). "As a workhorse model of international trade, the gravity equation relates countries' bilateral trade to their economic size and bilateral trade costs, and it has one of the strongest empirical track records in economics" (Novy, 2009). Gravity Model has been employed to empirically test various strands of the classical and new trade theories2. (See Anderson (1979) in Anderson, James E. "A Theoretical Foundation for the Gravity Equation." American Economic Review, March 1979, 69(1), pp. 106–16; and Deardorff, Alan V. "Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?" in J. A. Frankel, ed., The regionalization of the world economy. Chicago: University of Chicago Press, 1998, pp. 7–22;

and Eichengreen, Barry and Irwin, Douglas A. "The Role of History in Bilateral Trade Flows," in J. A. Frankel, ed., The regionalization of the world economy. Chicago: University of Chicago Press, 1998, pp. 33–57).

Newtonian gravitational equation is transformed into Gravity trade model by using the trade exchanges from country 'i' to 'j' as a proxy for gravitational force; GDP and some its variants (Per Capita GDP, Differences in GDP, GDP and population (with negative sign), GDP in terms of the purchasing power parity etc.) as a proxy for the masses of the objects; some sort of tangible separators like border effects (Reinert, Kenneth A. 2010)3 like trade costs are considered as a proxy for distance between the masses. All these variables in the Gravity trade models are then converted into natural logarithmic values, "ln". The gravity trade model can be written as:

$$\ln E_{ij} = \alpha + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln D_{il}$$

Where the expected signs of β_1 & $\beta_2 > 0$. Sometimes, $\beta_j<0$ as the Engel's Law allows for GDP in the destination country to have negative influence on demand for imports. In all other liner combinations of the GDP with populations etc., the parameters of the country masses (GDP) will be the transformation on one another.

The distance or trade costs encompasses "any cost of engaging in international trade such as transportation costs, tariffs, non-tariffs barriers, informational costs, time costs and different product standards, among others" (Chen and Novy 2011). For measuring the trade costs, various variables have been considered to accurately measure the frictions to capture the border effects. "Distance-related trade and FDI costs are costs directly affected by, but also indirectly associated with geographical distance. The latter are based on high correlation of geographical to ‘regulatory’, and ‘cultural distance’ between countries, which in turn impact on the cost of trade and FDI in a number of complex modes. The analysis highlights that not all distance related costs are relevant to all patterns of exchange. It is additionally pointed out that from an empirical, as well as a policy point of view, distance-related costs are more likely to remain unaffected if there is symmetric treatment of all markets” (Miroudot and Ragoussis 2009). Thus, the distance should not only capture the physical distance between two separate production and value chain units but also the regulatory hurdles. Thus, the trade costs should be the “proxy for distance-related trade costs that is all the costs associated with discovering markets, moving goods and supplying services in a remote country. These costs are likely to be different across and among manufacturing and services sectors. Moreover, these costs are regarded as the main variable that explains the choice between exports and FDI, as well as one of the primary determinants of the vertical specialisation strategy, which has led to new patterns of trade” (Miroudot and Ragoussis 2009).

Intraindustry trade (IIT) and Grubel Lloyd Index (GLI)

Intra-industry trade phenomenon was first observed and measured by many trade economists (Verdoorn 1960, Michaely 1962, Kojima 1964, Balassa 1966) started in late sixties. However, Grubel and Lloyd (1971, 1975) developed an index, later known as Grubel Lloyd (GL) index. It is most widely used measure in the international trade literature to record the Intra-industry trade is the Grubel-Lloyd (GL) index. The GL index measures the share of the absolute value of intra-industry trade turnover in a particular industry ‘i’

$$\mathrm{GL}_{\mathrm{i,t}}^{\mathrm{kk'}} = \frac{\left(\mathrm{X}_{\mathrm{i,t}}^{\mathrm{kk'}} + \mathrm{M}_{\mathrm{i,t}}^{\mathrm{kk'}}\right) - \left|\left(\mathrm{X}_{\mathrm{i,t}}^{\mathrm{kk'}} - \mathrm{M}_{\mathrm{i,t}}^{\mathrm{kk'}}\right)\right|}{\left(\mathrm{X}_{\mathrm{i,t}}^{\mathrm{kk'}} + \mathrm{M}_{\mathrm{i,t}}^{\mathrm{kk'}}\right)}$$

$$\mathrm{GL}_{\mathrm{i,t}}^{\mathrm{kk'}} = 1 - \frac{\left|\left(\mathrm{X}_{\mathrm{i,t}}^{\mathrm{kk'}} - \mathrm{M}_{\mathrm{i,t}}^{\mathrm{kk'}}\right)\right|}{\left(\mathrm{X}_{\mathrm{i,t}}^{\mathrm{kk'}} + \mathrm{M}_{\mathrm{i,t}}^{\mathrm{kk'}}\right)} \qquad \text{Equation (2)}$$

Where $\mathrm{X}_{\mathrm{i,t}}^{\mathrm{kk'}}$ and $\mathrm{M}_{\mathrm{i,t}}^{\mathrm{kk'}}$ represent the country k's exports and imports respectively with its trade partner country k' for one particular year, "t" for the product/ industry, "i" (depending upon the data disaggregation considered). As is evident from equation (2), the GL takes values ranging from 0 to 1; where 0 signifies exclusive inter-industry trade and one signifies as exclusive intra-industry.

In order to signify the share of a particular product/ industry in the IIT, weighted GL is used to represent the GL aggregated across k' trading partners and across 'N' products/ industries.

$$WeightedGL_{i,t}^{kk'} = \sum_{i=1}^{N} w_{i,t}^{kk'}\left(GL_{i,t}^{kk'}\right) where \quad w_{i,t}^{kk'} = \frac{\left|\left(X_{i,t}^{kk'} + M_{i,t}^{kk'}\right)\right|}{\sum_{i=1}^{N}\left(X_{i,t}^{kk'} + M_{i,t}^{kk'}\right)}$$

Similarly, GL indices can be aggregated across N product / industries, as a trade-weighted average of the industry indices.

GL can also be aggregated across k' partner countries and across N industries/ products:

$$GL_t^k = 1 - \frac{\sum_{K'=1}^{K'}\sum_{i=1}^{N}\left(\left|X_{i,t}^{kk'} - M_{i,t}^{kk'}\right|\right)}{\sum_{K'=1}^{K'}\sum_{i=1}^{N}\left(X_{i,t}^{kk'} + M_{i,t}^{kk'}\right)}$$

Similarly, GL index can be aggregated across k' partner countries, across K reporter countries and across N industries/ products:

$$GL_t = 1 - \frac{\sum_{K'=1}^{K'} \sum_{i=1}^{N} \sum_{k=1}^{k} \left(|X_{i,t}^{kk'} - M_{i,t}^{kk'}| \right)}{\sum_{K'=1}^{K'} \sum_{i=1}^{N} \sum_{k=1}^{k} \left(X_{i,t}^{kk'} + M_{i,t}^{kk'} \right)}$$

Professor Charles van Marrewijk has very aptly described the phenomenon of the "intra-industry trade, the simultaneous import and export of similar types of goods or services, is measured using the Grubel-Lloyd index, is to some extent based on lumping together different types of goods in one sector (aggregation problem), can be based on (horizontal) product differentiation or (vertical) fragmentation, is associated in particular with the production of sophisticated manufactured goods, and is an increasingly important part of (intra-firm) total trade flows in today's globalizing world, particularly for developed countries4."

To limit the scope of the empirically analysis, this research considers trade exchanges of the United States of America, China, Japan with the select members of the Association of the South East Asian (ASEAN).

This subset of the select countries is a microcosm of global value chain linkages. The contemporary profile of the fragmentation of production and share in the intermediate products are deeply interlinked and concentrated across the China, Japan, United States and the ASEAN countries. The ASEAN economies have witnessed growth of the vertical industries where Japanese and the Chinese value chain integration increased their overall trade and GDP growth. Intra-industry trade values for China for its major East Asian trade partners indicate a steady trend of growth from year 1992 to the year 2009. Chinese IIT grew substantially especially for

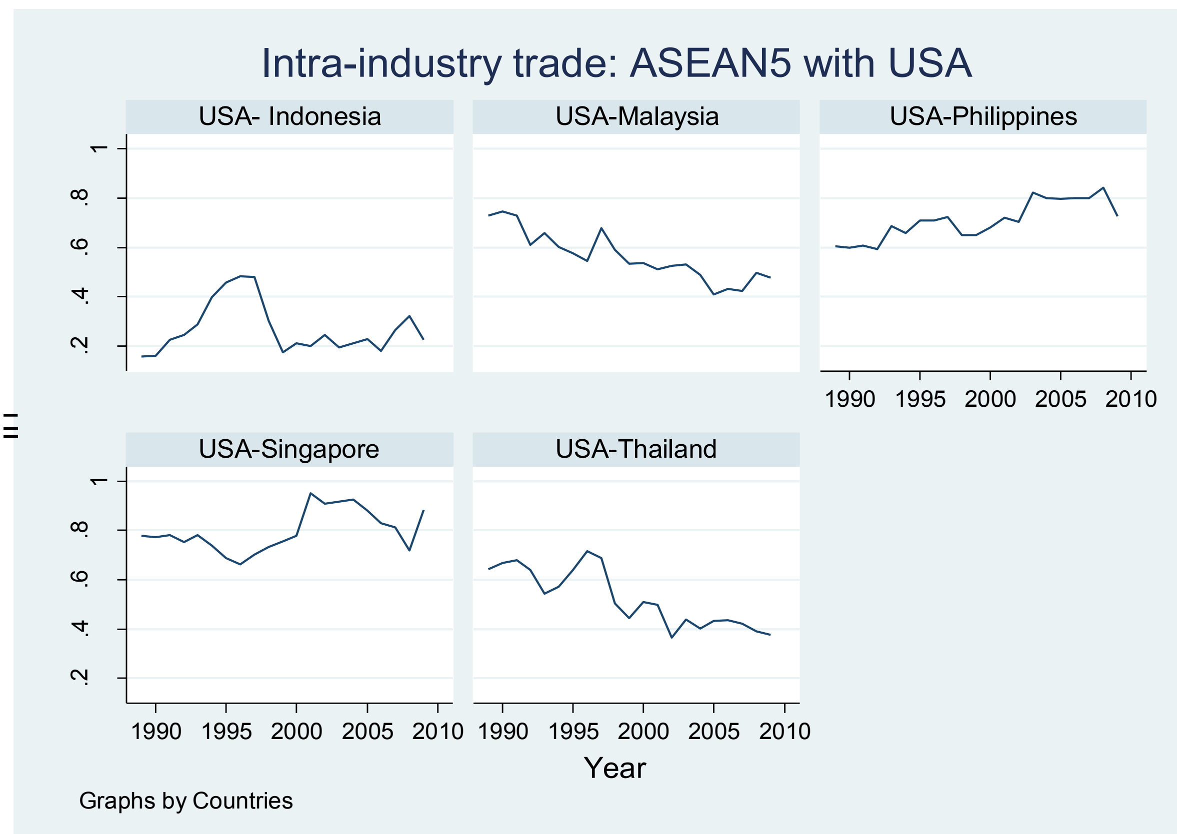
Japan from 0.343 in 1992 to 0.687 in year 2009, for Thailand from 0.257 in 1992 to 0.608 in year 2009, for Indonesia from 0.199 in 1992 to 0.452 in year 2009, for S. Korea from 0.628 in 1992 to 0.728 in year 2009, and sustained for all other East Asian partners with slight variations.

Intra-industry trade of China with its major East Asian Countries

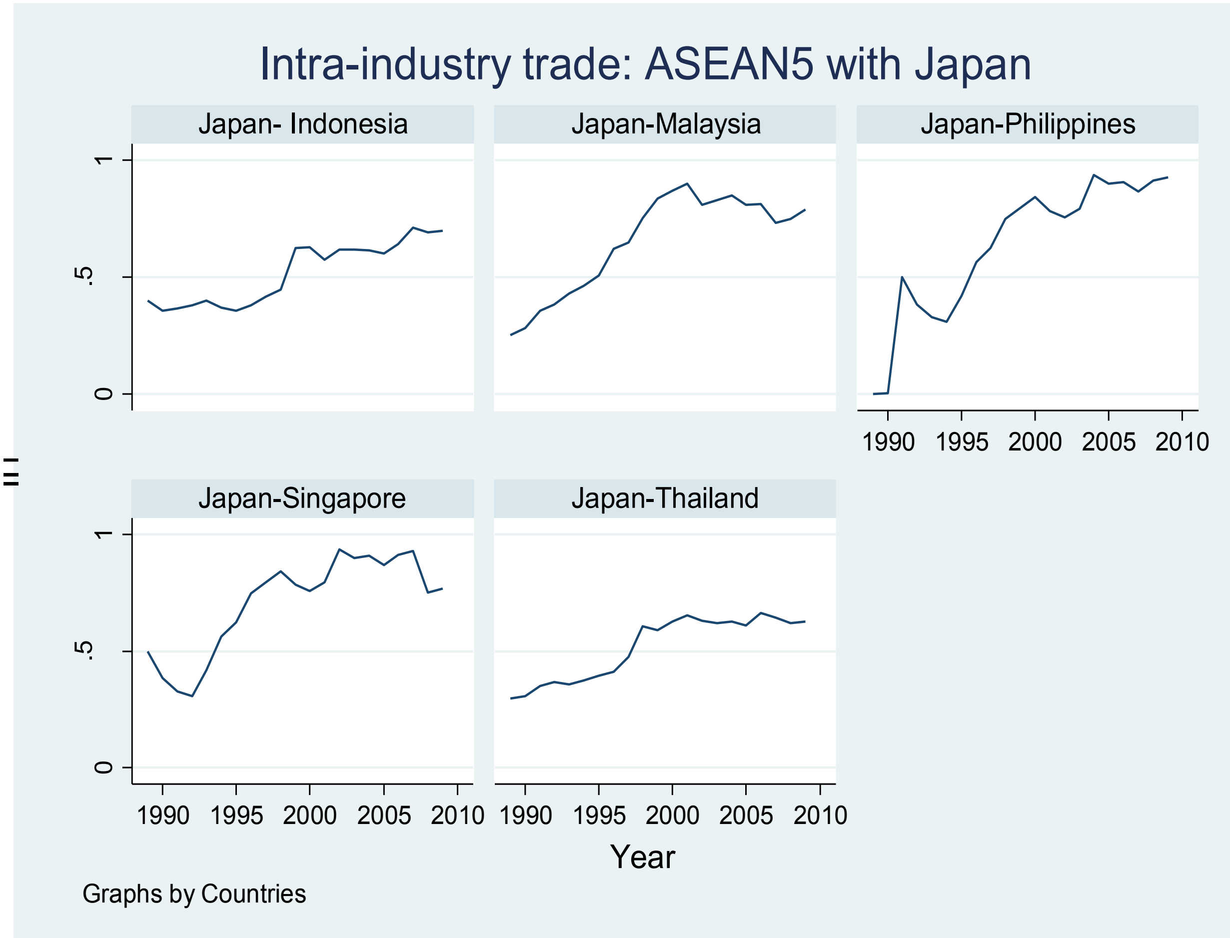
IIT_ China and Its Partners	Cambodia	Hong Kong, China	Indonesia	Japan	Korea, Rep.	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Taiwan, China	Thailand	Vietnam
1992	0.010	0.653	0.199	0.343	0.628	0.075	0.708	0.377	0.567	0.385	0.171	0.257	0.440
1993	0.001	0.622	0.236	0.342	0.456	0.109	0.630	0.500	0.645	0.560	0.193	0.715	0.441
1994	0.001	0.456	0.342	0.397	0.522	0.070	0.548	0.276	0.487	0.628	0.252	0.545	0.471
1995	0.299	0.394	0.542	0.518	0.700	0.027	0.887	0.192	0.218	0.689	0.331	0.452	0.553
1996	0.269	0.392	0.504	0.518	0.638	0.029	0.839	0.195	0.433	0.732	0.279	0.793	0.579
1997	0.858	0.279	0.538	0.563	0.680	0.025	0.895	0.268	0.271	0.692	0.332	0.770	0.500
1998	0.730	0.295	0.372	0.562	0.559	0.015	0.784	0.056	0.511	0.787	0.391	0.723	0.476
1999	0.753	0.306	0.522	0.534	0.577	0.003	0.598	0.176	0.827	0.799	0.352	0.774	0.497
2000	0.51	0.33	0.60	0.55	0.59	0.02	0.61	0.06	0.59	0.80	0.35	0.79	0.46
2001	0.242	0.314	0.717	0.582	0.602	0.017	0.680	0.041	0.513	0.789	0.314	0.816	0.525
2002	0.114	0.291	0.768	0.614	0.616	0.008	0.710	0.019	0.423	0.845	0.294	0.826	0.432
2003	0.084	0.229	0.786	0.642	0.614	0.004	0.613	0.023	0.409	0.883	0.309	0.699	0.377
2004	0.072	0.180	0.762	0.668	0.631	0.006	0.580	0.043	0.448	0.878	0.351	0.674	0.359
2005	0.052	0.145	0.690	0.708	0.628	0.461	0.574	0.026	0.353	0.863	0.367	0.649	0.317
2006	0.031	0.103	0.680	0.701	0.653	0.066	0.588	0.037	0.294	0.714	0.390	0.652	0.327
2007	0.025	0.095	0.549	0.700	0.646	0.219	0.614	0.054	0.297	0.611	0.378	0.596	0.317
2008	0.023	0.083	0.417	0.717	0.693	0.176	0.614	0.059	0.350	0.574	0.397	0.586	0.326
2009	0.029	0.068	0.452	0.687	0.728	0.198	0.574	0.094	0.488	0.586	0.382	0.608	0.342

Source: Author's Calculations based on the Comtrade Data.

From the following graphical representation of intra-industry trade of ASEAN 5 with USA and Japan, it can be argued that the falling share of the IIT of USA with ASEAN and the rising IIT share of ASEAN with Japan may be due to the fact the USA contributed IPRs for product development and ASEAN countries and Japan (EU and other OECD countries are not included in the graphs) contributed in the parts and components share whereas China maintained as a hub of production and manufacturing. The rising share of the Singapore's IIT with both Japan and USA may be misleading as Singaporean economy is not a manufacturing economy. The higher IIT Singaporean index manifests the fact that Singapore is an efficient trading hub for supply of the parts and components in the schema of the fragmented production operations.



Source: Author's calculations



Source: Author's calculations

The trade exchanges between USA with Japan and China and trade exchanges of China, Japan with ASEAN demonstrate global supply chain and value chain integration. Dean, Judith M.; Lovely, Mary E. and Mora, Jesse in their research paper on "Decomposing China-Japan-China: Vertical specialization, ownership and organizational form" (August 2009) have analyzed the pattern of trade between China and its two largest trading partners, Japan and United States and find "that only a small share of these flows can be characterized as arm's length, one-way trade in final goods" and comparing the trade flow for the year 2002 find "that about 74 per cent of China's imports from Japan were intermediate goods, while only 60 per cent of China's imports from the US were intermediates. Nearly half of the intermediates imported from Japan came in under the processing regime, which indicates that they were re-exported after processing, while only about one-quarter of those from the US did. In contrast, nearly 68 per cent of China's exports to the US were under the processing regime, while only 58 per cent to Japan were processing exports".

Measurement of Intra-industry Trade

Intra-industry trade is calculated by using the Grubel-Lloyd Index for the select ASEAN countries vis-à-vis USA, China and Japan for the period 1992 to 2009. The export and import data for 5 digit disaggregated products using the Standard International Trade Classification (SITC), Revision 3 Chapter 6 – (Manufactured goods classified chiefly by material); Chapter 7 (Machinery and transport equipment) and Chapter 8 (8 - Miscellaneous manufactured articles) 5 digit in respect of select countries have been compiled using United Nations Comtrade data from the World Bank, World Integrated Trade Solution (WITS) portal. STATA statistical software has been used for data manipulation and calculation of the IIT using the GL index. For checking the robustness of the results, the IIT for some other countries has also been calculated.

Intra-industry trade for USA and its major Asian trading partner countries

Year	Bahrain	Brazil	Brunei	Cambodia	Canada	China	Hong Kong, China	India	Indonesia	Japan
1989	0.113	0.650	0.174	0.0000	0.827	0.394	0.486	0.211	0.158	0.354
1990	0.108	0.638	0.054	0.0000	0.902	0.290	0.528	0.231	0.161	0.412
1991	0.132	0.527	0.039	0.0000	0.902	0.301	0.501	0.187	0.224	0.411
1992	0.213	0.521	0.027	0.0373	0.915	0.324	0.481	0.182	0.246	0.388
1993	0.229	0.515	0.039	0 .7607	0.924	0.348	0.496	0.154	0.287	0.357
1994	0.261	0.528	0.092	0 .192	0.918	0.264	0.495	0.179	0.399	0.377
1995	0.414	0.573	0.157	0 .104	0.908	0.234	0.512	0.229	0.456	0.435
1996	0.445	0.580	0.048	0 .202	0.916	0.244	0.519	0.243	0.483	0.498
1997	0.452	0.589	0.101	0 .058	0.940	0.229	0.521	0.266	0.481	0.486
1998	0.503	0.626	0.077	0 .0075	0.933	0.241	0.502	0.226	0.302	0.450
1999	0.354	0.656	0.040	0 .004	0.905	0.188	0.494	0.207	0.173	0.416
2000	0.161	0.666	0.094	0 .0037	0.904	0.175	0.514	0.214	0.212	0.425
2001	0.269	0.706	0.072	0 .007	0.896	0.206	0.500	0.253	0.200	0.429
2002	0.339	0.792	0.039	0 .004	0.902	0.193	0.506	0.246	0.245	0.398
2003	0.178	0.672	0.022	0 .0057	0.902	0.178	0.488	0.261	0.195	0.410
2004	0.193	0.669	0.024	0 .004	0.887	0.166	0.489	0.287	0.211	0.388
2005	0.236	0.706	0.054	0 .0062	0.902	0.176	0.494	0.343	0.228	0.384
2006	0.242	0.640	0.072	0 .0066	0.915	0.186	0.529	0.377	0.180	0.383
2007	0.286	0.622	0.075	0 .0110	0.928	0.188	0.532	0.367	0.264	0.393
2008	0.269	0.593	0.075	0 .0070	0.897	0.188	0.595	0.476	0.320	0.387
2009	0.258	0.635	0.281	0 .007	0.916	0.160	0.511	0.476	0.225	0.359

Methodology for calculation of IIT

In order to compute the unit values of exports and imports of the bilateral trade, this study used data from the Trade Unit Value Database (Berthou, 2011). Trade Unit Database is developed and maintained by the Center for International Prospective Studies (CEPII- Centre d'Etudes Prospectives et d'Informations Internationales). "The Trade Unit Values database contains Unit Value information (in US dollars per ton) over the period 2000-2008, with 173 reporters, 255 partners, and more than 5,000 product categories per year. The coverage changes over time. Unit values are provided in Harmonized System 1996 and 2002 revisions with 6 digits, Free on Board (FOB) and Cost of Insurance and Freight (CIF). The CIF unit values rely on importers' declarations, and include all trade costs (except tariffs and domestic taxes after the border). The FOB unit value is a proxy for the trade price at the factory gate, relying on exporters' declarations, and does not include trade costs" (Berthou, 2011). The database "aims at improving the reliability of unit values, as compared to existing unit values in trade datasets with World coverage such as the UN Comtrade. First, the processing that is implemented to develop the UN Comtrade dataset generates a complete dataset without missing quantity, when the value is available. Missing quantities are estimated, notably using a unique standard unit value defined at the World level. When such estimation is implemented, this removes all the difference in prices across countries. Conversely, the Trade Unit Values database does not rely on a World unit value to estimate quantity information, which enables to keep heterogeneity in terms of pricing across countries. Second, Comtrade aggregates separately values and quantities into HS 6-digits nomenclature. This can bias unit values when some of the quantity information is initially missing at a higher level of disaggregation. In our database, unit values, rather than the values themselves are computed at the highest level of disaggregation before aggregation in HS 6-digits categories, thus reducing the bias due to separate aggregation of values and quantities" (Berthou, 2011).

However, database contains the unit values for exports and imports separately. STATA econometric software has been used to process the data: first using the STATA, the bilateral export unit values and import values are extracted for a trade partners for each year starting from year 2008 to 2009. Both the extracted export unit values data for bilateral trade partners of

ASEAN countries vis-à-vis USA, China and Japan are combined into a single dataset. Due to the high memory usage of this huge dataset (247894 rows), STATA memory has been set to a maximum value of 5,000 MB.

```
. codebook  uv

--------------------------------------------------------------------------------
uv                                                                   (unlabeled)
--------------------------------------------------------------------------------

              type:  numeric (double)

             range:  [.0046444,7.084e+10]         units:  1.000e-12
     unique values:  2086721                  missing .:  0/2478942
```

Gravity Model and Intra-industry trade exchanges

The gravity equation model is employed to assess the influence of the ASEAN's big trading partners' viz., USA, Japan and China on the ASEAN member countries' trade flows as measured as exports and intra-industry trade. The panel dataset contains data for select ASEAN countries viz., Cambodia, Indonesia, Malaysia, Philippines, Singapore, Thailand and its major trading partners United States, Japan, China and South Korea spanning over the years 1989 to 2009.

Standard Gravity Equation model has been augmented as adopted by the F. Kimura et al. in their paper "Fragmentation and parts and components trade: Comparison between East Asia and Europe" (Fukunari Kimura 2007). The advantage of using the augmented GE model is to "partially control for the difference in location advantages that encourage cross-border fragmentation, such as differences in effective wages adjusted by labor quality, we employ income gaps between trading countries, in place of country per capita income, as follows":

$$\ln IIT_{ijt} = \beta_0 + \beta_1 * \ln\left(GDP_{\ ij}t\right) + \beta_2 * \ln\left(GDP_{\ j}it\right) + \beta_3 * \ln\left(Distance_{\ ij}t\right) + \beta_4 * \ln\left(ADJ_{\ ij}t\right) + \beta_5 * \ln\left(GAP_{\ ij}t\right) + \epsilon_{ijpt}$$

$\ln IIT_{ijt}$ is the intra-industry between the reporter country 'i' with partner country 'j' for the year 't'. This paper improves the accuracy of the determination by using the CEPII. "CEPII[5] make available a "square" gravity dataset for all world pairs of countries, for the period 1948 to 2006. This dataset was generated by Keith Head, Thierry Mayer and John Ries used in the paper: HEAD, K., T. MAYER AND J. RIES, 2010, "The erosion of colonial trade linkages after independence" published in the Journal of International Economics, vol. 81(1); pages 1-14.

F. Kimura et al. used the GAPij variable to model the income gaps between trading countries, in place of country per capita income. The variable "denotes the absolute value of the difference in GDP per capita between exporter i and importer j. More direct measures would be wages, though they are often contaminated and unavailable for finished machinery goods production and machinery parts production separately. On the other hand, GDP per capita seems to be a reasonably good proxy for wages" (Fukunari Kimura 2007). The dataset of the Keith Headand Anne-C´elia Disdier in their research paper on "The Puzzling Persistence of the Distance Effect on Bilateral Trade" (Head and Disdier 2008) has been modified to do the statistical analysis. Econometric programming has been done using the STATA econometric software version 11. The STATA regression output, appended below, determines that the panel regression Random effect is a valid choice for the full-sample estimations as the simple Ordinary Least Square (OLS) regression will yield spurious regression.

Using the modified Head et al. dataset (Head and Disdier 2008) to predict the exports of country 'i' to country 'j' using the F. kimura et al. augmented gravity equation, the gravity equation regression results and the coefficients for the $\ln(GDP_{ij}t)$, $\ln(GDP_{ji}t)$, lnCEPII

$(\ln(Distance_{ij}t)\}$ and $\ln(GAP_{ij}t)$ variables have the expected signs and are statistically significance: exports from country i to j are positively correlated with the market size of countries and are negatively affected by geographic distance, with signs and statistical significance quite stable over time. However, the GAPij variable has 10% significance. The Breusch and Pagan Lagrangian multiplier test for random effects confirms the adoption of the random model as the Null hypothesis can't be rejected as the Prob> chi2 = 0.0000, so the RE model is chosen and simple OLS will give spurious regression. " If you have reason to believe that differences across entities have some influence on your dependent variable then you should use random effects" (Torres_Reyna 2010). In our model, each ASEAN member country, USA, China, Japan have quite unique characteristics so the choice of the Random Effects model through the Breusch and Pagan Lagrangian multiplier test is as per the panel data set country characteristics.

```
. xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

        lnExp12[pairid,t] = Xb + u[pairid] + e[pairid,t]

        Estimated results:
                         |       Var     sd = sqrt(Var)
                ---------+-----------------------------
                 lnExp12 |   5.643669       2.375641
                       e |   .2619077       .5117692
                       u |   1.257772       1.121504

        Test:   Var(u) = 0
                             chi2(1) =  4839.60
                         Prob > chi2 =     0.0000

. * here the Null hypothesis can't be rejected so the RE model is chosen and simple OLS will give spurious regression

. xtreg  lnExp12 lnGDPpc1 lnGDPpc2 lnGAPij ldistcepii, re

Random-effects GLS regression                   Number of obs      =       883
Group variable: pairid                          Number of groups   =        50

R-sq:  within  = 0.5350                         Obs per group: min =         8
       between = 0.0702                                        avg =      17.7
       overall = 0.0750                                        max =        19

Random effects u_i ~ Gaussian                   Wald chi2(4)       =    909.29
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

------------------------------------------------------------------------------
     lnExp12 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnGDPpc1 |   .5927207   .0596016     9.94   0.000     .4759036    .7095377
    lnGDPpc2 |   .7345265   .0542152    13.55   0.000     .6282666    .8407863
     lnGAPij |  -.0878056   .0485241    -1.81   0.070    -.1829111    .0072998
  ldistcepii |   1.511273   .3626867     4.17   0.000     .8004202    2.222126
       _cons |  -13.76661   2.960966    -4.65   0.000    -19.56999   -7.963218
-------------+----------------------------------------------------------------
     sigma_u |  2.3266295
     sigma_e |   .5288324
         rho |  .95087473   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

However, the problem arises when Intra-industry trade is modelled as the dependent variable in the gravity equation. The regression results using F. Kimura et al. augmented gravity equation to predict the IIT level (dependent variable) among the country pairs is carried-out. The regression results and expected signs for the coefficients of the variables$\ln(\mathrm{GDP}_{ij}t)$, $\ln(\mathrm{GDP}_{ij}t)$, lnCEPII $\{(\ln(\mathrm{Distance}_{ij}t)\}$ and $\ln(\mathrm{GAP}_{ij}t)$ are not as per the intuition and standard economic theory: GDP can't have negative impact on the level of the IIT. Also none of the variable's p-value is statistically significant.

Table: Regression results of Gravity Trade Model

VARIABLES	log_exports12	log_exports12	log_exports21	log_exports21	Log_IIT	Log_IIT
log_GDP1	0.881***	0.683***	0.587***	0.673***	-0.0308	0.0764
	-0.0964	-0.071	-0.115	-0.0807	-0.0818	-0.0569
log_GDP2	0.497***	0.510***	0.866***	0.866***	0.429***	0.235***
	-0.0811	-0.062	-0.12	-0.0721	-0.0724	-0.0516
Log_GAP	-0.085	-0.0735	0.0602	0.0917	-0.0429	-0.00341
	-0.0525	-0.0524	-0.0731	-0.071	-0.0613	-0.0556
ldistcepii		0.919***		1.579***		0.0445
		-0.287		-0.34		-0.191
rta	0.0319***	0.0429***				
	-0.0078	-0.00787				
join1		-0.000581***				
		-9.24E-05				
join2		-0.000346***				
		-6.97E-05				
Constant	-0.762*	-5.080**	-3.406***	-17.03***	3.009***	2.908*
	-0.439	-2.586	-0.981	-2.833	-0.398	-1.641
Observations	889	889	889	889	887	887
R-squared	0.687		0.519		0.082	
Number of pairid	49	49	50	50	50	50

Notes Titles **Standard errors** **in** **parentheses**

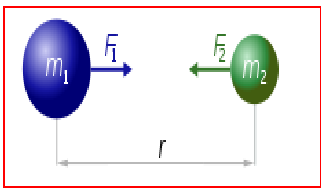
***** p<0.01** **, ** p<0.05** *** p<0.1**

The above regression results demonstrate that augmented gravity trade model fails to predict the intra-industry trade volumes, which represents almost fifty per cent of the contemporary trade volume. In next section, the reasons for failure of the standard augmented gravity model to explain the international trade exchanges under the fragmentation of production paradigm regionalism will be discussed.

```
. xtreg  lnIIT lnGAPij lnGDPpc1 lnGDPpc2 ldistcepii re

Random-effects GLS regression                   Number of obs      =       375
Group variable: pairid                          Number of groups   =        49

R-sq:  within  = 0.0201                         Obs per group: min =         2
       between = 0.0023                                        avg =       7.7
       overall = 0.0093                                        max =        11

Random effects u_i ~ Gaussian                   Wald chi2(5)       =      5.31
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.3797

------------------------------------------------------------------------------
       lnIIT |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lnGAPij |   .0393625   .0498905     0.79   0.430    -.0584211    .1371461
    lnGDPpc1 |  -.0058738   .0581489    -0.10   0.920    -.1198436     .108096
    lnGDPpc2 |   .0584297   .0509134     1.15   0.251    -.0413587     .158218
  ldistcepii |  -.0241846   .1798008    -0.13   0.893    -.3765878    .3282185
    regional |   .0206118   .0693508     0.30   0.766    -.1153133    .1565369
       _cons |   5.029122   1.563034     3.22   0.001      1.96563    8.092613
-------------+----------------------------------------------------------------
     sigma_u |  1.1043233
     sigma_e |  .29527373
         rho |  .93327812   (fraction of variance due to u_i)
```

Why the standard augmented gravity model fails to explain the international trade exchanges under the fragmentation of production paradigm regionalism?

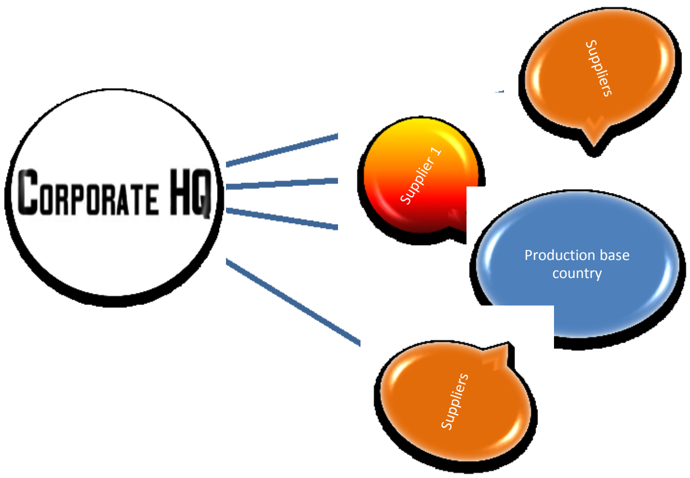
The standard augmented gravity equation model captures the bilateral trade flows based on the GDP size of trading partners[6] and some sort of trade frictions to signify the distance (trade costs) for realizing such interactions.



Since its first use, providing the micro-foundations (theoretical basis) for the GE model has always been a challenge for the trade economists. Richard Baldwin and Daria Taglioni (Baldwin and Taglioni 2006) in their paper on "Gravity for dummies and dummies for gravity equations" have narrated the ebb and flow of theoretical foundation of the gravity trade model. "Anderson (1979) seems to be the first to provide clear microfoundations that rely only on assumptions that would strike present-day readers as absolutely standard. The cornerstone of Anderson's theory, however, rested on an assumption that was viewed as ad hoc at the time, namely that each nation produced a unique good that was only imperfectly substitutable with other nations' goods. The gravity model fell into disrepute in the 1970s and 1980s; for example, Alan Deardorff refers to the gravity model as having "somewhat dubious theoretical heritage" (Deardorff 1984 p. 503)" (Baldwin and Taglioni 2006, p. 1). However, 'the emergence of the "new trade theory" in the late 1970s and early 1980s (e.g.Krugman 1979, 1980, 1981, Helpman 1981) started a trend where the gravity model went from having too few theoretical foundations to having too many. For example, in a 1995 paper on the gravity model Deardorff writes: "it is not all that difficult to justify even simple forms of the gravity equation from standard trade theories." Also see Evenett and Keller (2002) for a thorough discussion of this point' (ibid, p.2).

This research paper empirically demonstrates that augmented gravity trade model fails to predict the intra-industry trade volumes, which represents almost fifty per cent of the contemporary trade volume. Hence, we need to explore the dynamics of contemporary trade under the paradigm of the fragmentation of production.

Under the fragmentation of production (FOP) paradigm, HQ MNEs develops the products & services proto-type and then engages in the production value-chain integration arrangements with myriad suppliers spread over in many countries to produce and market their products. Hence, the FOP GE model should capture the firms' decision-making dynamics based on the satellites supplier or production centers locational advantages vis-à-vis HQ firms universe.



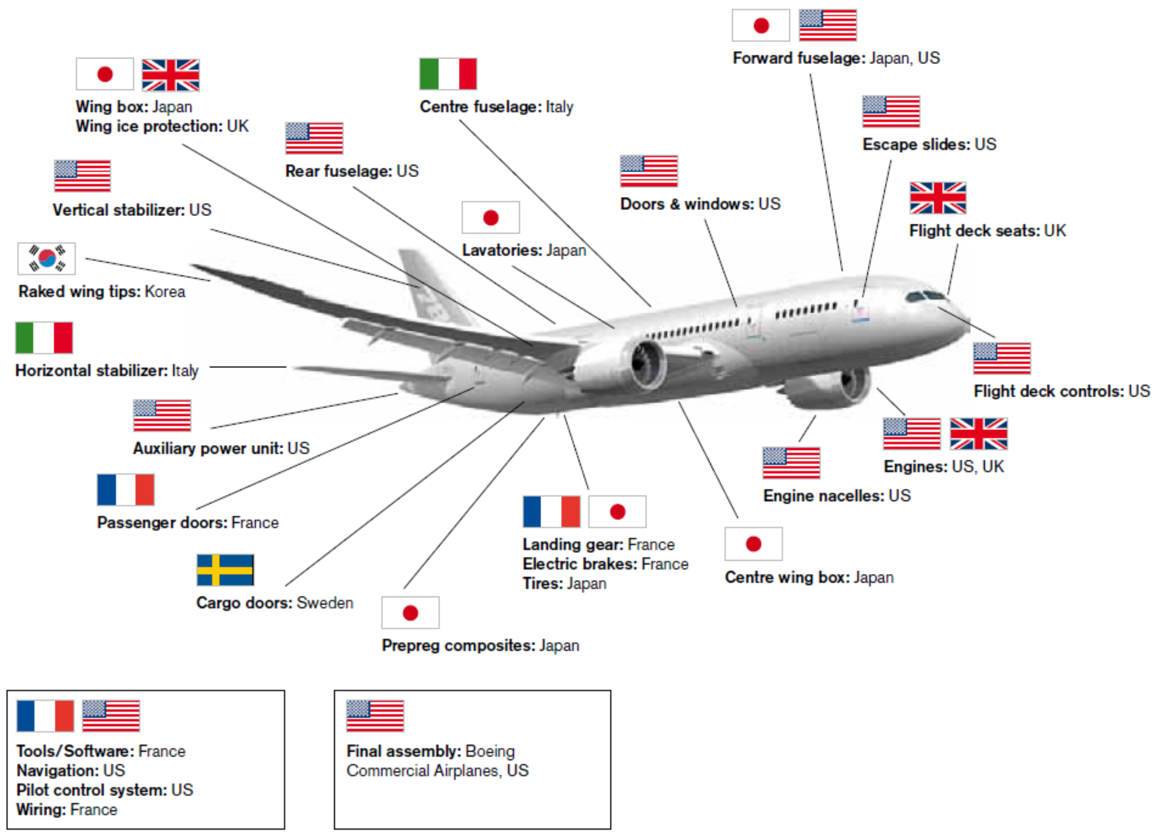
Nomenclature of a fragmented production Value Chain Integration

The pertinent question would be: what motivates a firm's decision to fragment its production network and how the firm will choose its supplier partners and relationships[7]? Since, MNE may strategize to fragment production networks across various suppliers adjacent (or at least economically competitive for parts and supplies integration) to a production base country. ASEAN countries in my example can be viewed as the satellite supplying countries augmenting the production process done in a major production base country e.g. China, Thailand or Malaysia and where HQ MNE can be either a US or a Japanese MNEs.

Fragmentation of production has necessitated the MNEs to brand and market their products with ***emphasis on the "Made by" instead of "Made in country" slogan***. Extended product service plans (extended warranties) and technical support and low-shelf life especially for high-tech products and services have made irrelevant the issue of the "Made in Country A".

Thus, the country of production is no more a symbol of quality and durability. Even the consumers care more about “ Made By” logos (Apple’s iphone, Mac books, iPods; Motorola’s Droid and Xoom, Lenovo’s ThinkPad, Dell’s Vostro, Sony Camcorder, LCD HD (3D) TV or Vaio, Microsoft Xbox, etc.) rather than “Made in” logo now. It is therefore not surprising to witness a bulk of trading activity occurring within the MNEs. Hanson et al. (2005) have used “firm-level data on U.S. multinationals to examine trade in intermediate inputs for further processing between parent firms and their foreign affiliates” and states that “multinationals now mediate a large fraction of world trade. In the United States, they account for over half of total exports (Slaughter, 2000). Within manufacturing, the majority of these exports are of intermediates. In 1999, 93% of exports by U.S. parent firms to their foreign manufacturing affiliates were inputs for further processing (U.S. BEA, 2002) (Gordon H. Hanson, November 2005).”

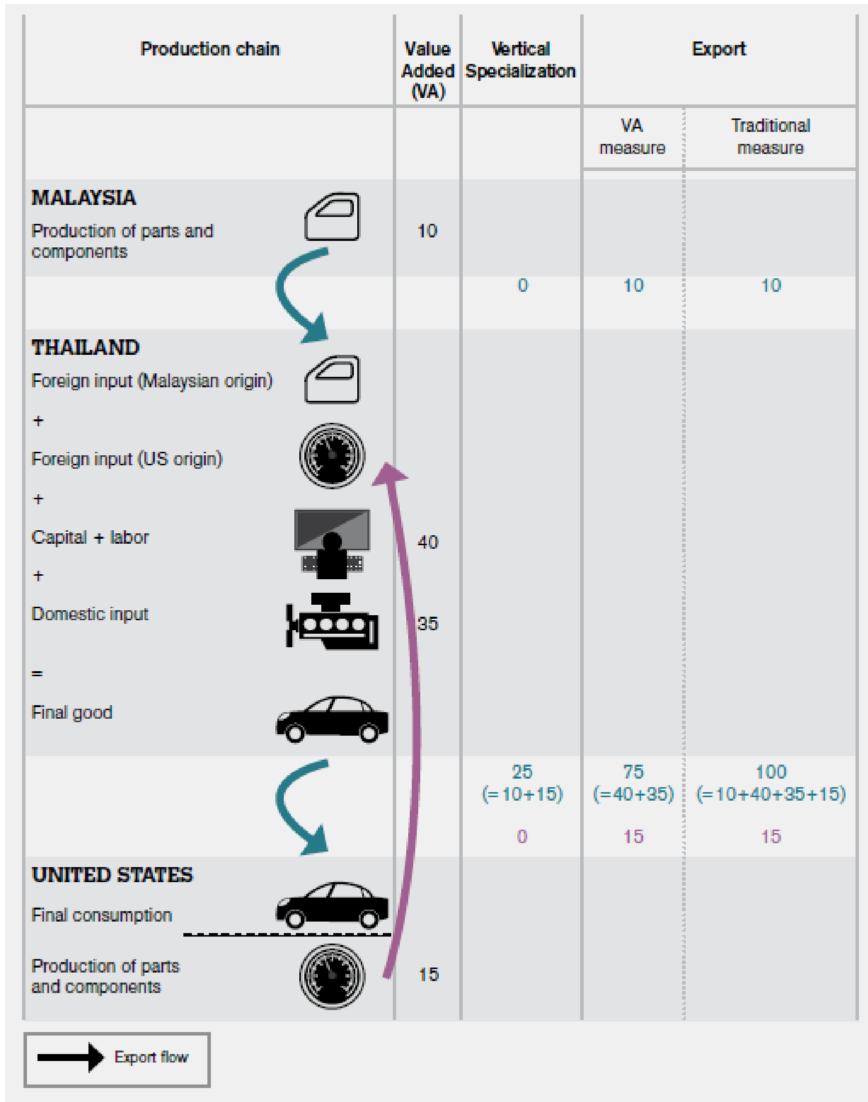
The fragmentation of production: The example of the Boeing 787 Dreamliner



Source: Meng and Miroudot (2011).

Source: 1http://wto.org/english/res_e/booksp_e/stat_tradepat_globvalchains_e.pdf

Measuring value added and vertical specialization through an international production chain: an illustrative example (hypothetical values and constellation)



Source: WTO Secretariat.

This relationship among the firms manifest the firm strategy and choice to exploit the locational competitive advantage of various supplier countries and overall ‘increase in productivity8’ resulting in the cost competitiveness of their final product. Professor Charles van Marrewijk has very summarized the empirical characteristics of the intra-industry trade from the OECD (2002) study. The 2002 OECD study narrates that “Intra-industry[9] has risen significantly since the 1980s in most (OECD) countries;

- is particularly high for sophisticated manufactured products (chemicals, machinery, transport equipment, electrical equipment, and electronics; both based on product differentiation and fragmentation);
- is particularly high for very open countries ("super trading" economies, where both imports and exports account for more than half of GDP);
- is connected to FDI inflows, particularly in Eastern European "transition" economies;
- is related to preferential trade agreements, for example the sharp increase in intra-industry trade in Mexico after the North American Free Trade Agreement; and
- is to a large extent based on intra-firm trade, either based on product variety or on fragmentation (intra-firm trade accounts, for example, for one third of exports in Japan and the USA)10."

Peterson institute's working paper on "Intra-Firm Trade and Product Contractibility" empirically demonstrated this fact: "Forty-six percent of U.S. imports occurred between related parties in 2000. This aggregate statistic, however, obscures considerable variation in intra-firm intensity across import partners as well as products. Indeed, while 74 percent of U.S. imports from Japan are intra-firm, the figure for Bangladesh is just 2 percent. Likewise, trade between related parties accounts for 2 percent of U.S. imports of rubber and plastic footwear, but more than 70 percent of U.S. imports of autos, medical equipment and instruments. There is also significant variation in intra-firm intensity across countries within products (Andrew B. Bernard, May 2010)." For some sectors, the trade in parts and components- fragments- has exceeded that of trade in final goods. This phenomenon has emerged in last decade or so especially in developing countries. Lack of accurate or harmonized statistics have made a challenge to “measure the role of international production and trade networks across many countries, products and time. Although some partial evidence can be drawn from the analysis of different data sources (such as customs statistics, international trade flows, Input-Output tables and firm-level data), it is important to develop systematic and internationally comparable empirical evidence on international production linkages (Amadora et al. 2009)." Such production linkages have been measured by the extent of the vertical specialization by Hummels, Ishii and Yi (2001). Based on this vertical specialization measure, Judith Dean, K.C. Fung and Zhi Wang (2008) have developed measures of the vertical specialization in China's exports. Dean et al. have used a new detailed Chinese dataset and the 1997 and 2002 benchmark Chinese Input and Output tables to track the origin of the imported inputs (intermediate input suppliers) to China. Dean et al. find “strong evidence of an Asian network of suppliers to China, with Japan and the Four Tigers accounted for more than half of the value of China's imported inputs, both in 1997 and in 2002. Estimates from the Non-Split and Split approaches show the foreign content of China's aggregate exports in 2002 between 25% and 46%, respectively (Judith Dean, 2008).” Baldwin, Richard E. and Ottaviano, Gianmarco I.P. posited a “model where multiproduct, final-goods firms simultaneously engage in intra-industry FDI and intra-industry trade (Richard E. Baldwin, 2000).”

In order to understand the dynamics and nature of the IIT exchanges among the HQ MNEs and the satellite production and supplying countries, we consider the most popular electronic gadget- Apple’s iPhone- manufacturing process. This example will also delve on the fact whether the fragmentation of the production fundamentally alters the competitive advantage of a production base country or just exploits its comparative advantage.

Production fragmentation enables Apple to source the various components at most competitive and efficient price across the globe and assemble these parts and components in Chinese manufacturing facilities. “IPhones are designed and marketed by Apple, one of the most innovative US companies. Apart from its software and product design, the production of iPhones primarily takes place outside the US. Manufacturing iPhones involves nine companies, which are located in the PRC, the Republic of Korea (hereafter Korea), Japan; Taipei, China; Germany; and the US. The major producers and suppliers of iPhone parts and components include Toshiba, Samsung, Infineon, Broadcom, Numunyx, Murata, Dialog Semiconductor, Cirrius Logic, etc. All iPhone components produced by these companies are shipped to Foxconn, a company from Taipei, China located in Shenzhen, PRC, for assembly into final products and then exported to the US and the rest of the world. Table 1 lists major suppliers and costs of iPhone components and parts. By any definition, the iPhone belongs to the high-tech products category, where the US has an indisputable comparative advantage. In effect, the PRC does not domestically produce any products that could compete with iPhones. The US also has an absolute advantage in the smart phone category. Ricardian theory and Hecksher-Olin theory would suggest the US should export iPhones to the PRC, but in fact the PRC exports iPhones to the US. All ready- to-use iPhones have been shipped to the US from the PRC. Foreign direct investment, production fragmentation, and production networks have jointly reversed the trade pattern predicted by conventional trade theories. The manufacturing process of iPhones illustrates how the global production network functions, why a developing country such as PRC can export high-tech goods—at least according to the currently applied methodology for calculating trade statistics—and why the US, the country that invented the iPhone, becomes an importer” (Xing, Y., and N. Detert., 2010). iSuppli a technology value chain research firm has done the teardown analysis to reveal the iphone 3G S model suppliers. As per the iSuppli teardown analysis, China has no share in parts and components except it performs the assembling of the iphone, transportation and logistics. All the suppliers for iPhone's parts and components are from the developed economies except for South Korea. Following tables reveals the iphone 3G S model's parts and components Suppliers and their origin as per the iSuppli teardown analysis:

Manufacturer	Component	Cost
Toshiba (Japan)	Flash Memory	$24.00
	Display Module	$19.95
	Touch Screen	$16.00
Samsung (Korea)	Application Processor	$14.46
	SDRAM-Mobile DDR	$8.50
Infineon (Germany)	Baseband	$13.00
	Camera Module	$9.55
	RF Transceiver	$2.80
	GPS Receiver	$2.25
	Power IC RF Function	$1.25
Broadcom (US)	Bluetooth/FM/WLAN	$5.95
Numonyx (US)	Memory MCP	$3.65
Murata (Japan)	FEM	$1.35
Dialog Semiconductor (Germany)	Power IC Application Processor Function	$1.30
Cirrus Logic (US)	Audio Codec	$1.15
	Rest of Bill of Materials	$48.00
	Total Bill of Materials	
	Manufacturing costs in China	$6.50
	Grand Total for Bill of Materials	$179.66

"iSuppli's teardown, conducted this weekend, determined that the 8 giga byte version of the iPhone has a total hardware Bill of Material (BoM) and manufacturing cost of $265.83, generating a margin in excess of 55 percent on each 8 Giga-byte iPhone sold at the $599.00 retail price," said Andrew Rassweiler, principal analyst for iSuppli. Note that these costs do not include product development, R & D, marketing, distribution, royalties and logistics expenses, which may reduce the margin of the Apple. From the table it is evident that the "Infineon, a new supplier to the iPod family, was among the biggest winners in terms of semiconductor content. The German semiconductor supplier contributed the digital baseband, radio-frequency transceiver and power-management devices, providing much of the core communications capability of the iPhone. Altogether, Infineon's silicon content accounted for $15.25 worth of the iPhone's BoM, representing 6.1 percent of the 8 giga-byte version of the product's total cost" (iSuppli Press Release) .

Even for the forthcoming model of the Apple's iphone, the iphone5, China's contribution stays the same and is concentrated in the labor-intensive assembling of the iphone. The Bloomberg's hypothetical estimate for iphone5 also suggests that china's share is very minimal less than 5 per cent of the total costs and 12 per cent if we include the logistics and testing done by solely Chinese firms. The Headquarter firm, the Apple in this case, pockets the estimated 56 per cent gross margin on "iphone5" (However, the R &D and product development and other operational and planning costs are not deducted from this margin).

Apple iphone 5 hypothetical gross Margin Analysis by Bloomberg

Component	**Cost**	**China's Share***	**Per Cent China's Share**
Display Assembly with touchscreen controller	**$ 49.00**	**$ -**	
Casing , Antennas, PCB	**$ 22.00**	**$ -**	
Flash memory (NAND) 16GB	**$ 18.00**	**$ -**	
Baseband, Power Amplifier and Transceiver	**$ 16.60**	**$ -**	
Apple A5 1Ghz App Processor	**$ 16.00**	**$ -**	
High Resolution Camera	**$ 16.00**	**$ -**	
RAM- 512 MB DDR2	**$ 13.00**	**$ -**	
Wi-fi Bluetooth GPS	**$ 7.00**	**$ -**	

Accelerometer, Gyroscope and Audio Codecs	**$ 5.00**	**$ -**	
Shipping, Packaging and Logistics	**$ 10.00**	**$ 5.00**	
Manufacturing and Testing	**$ 20.00**	**$ 20.00**	
Software, Royality & Warranty Costs	**$ 35.50**	**$ -**	
Battery, Other passives and accessories	**$ 42.00**	**$ 7.00**	
Estimated Cost (Bill of Materials) of iphone5	**$ 270.10**	**$ 32.00**	**12%**
Estimated "iphone5" gross margin	**$ 349.90**	**$ 56.44**	
Net Sales price Assumption for "iphone5" including channel markdowns in dollars and per cent	**$ 620.00**	**$ 100.00**	**5%**

(Source: Bloomberg' blog post and author's calculations)

As from the above teardown analyses, it become evident the china's contribution is almost 3.5% of the total costs of the bill of material and that contribution is highly concentrated in the labor-intensive production process. Foxconn, the company who assembles the iphone on behalf of the Apple, employs more than 900,000 employees and plans to hire more than 400,0000 workers and also considering the automation of manufacturing process due to the rising labor costs and labor problems in the Shenzhen manufacturing town (it houses almost fifty per cent of the total 0.9 million work-force)[11].

It is also evident that the capital-intensive technological inputs (parts and components) are supplied by the North (developed) countries and the China and other ASEAN countries have no share in parts and components except it performs the assembling of the high-tech products, transportation and logistics. On the contrary, the relatively developed economies viz., Japan and South Korea contributed high-tech components in the fragmentation of the production schema which is in line with the traditional trade theory predictions.

Thus, this factor-contribution as per the traditional competitive advantage trade theory for the production of the high-tech products can be explained using the theoretical framework of Heckscher-Ohlin factor endowment -traditional comparative advantage theory[12].

Another pertinent example is the business strategy transformation adopted by the USA's advanced product firms. US technological intensive firms' exploit their competitive edge by focusing on the tech-intensive products and services and relegating the labor-intensive, price-sensitive consumer product mix to firms and companies with labor-intensive competitive edge. "Hewlett-Packard, the world's top personal computer maker, announced on Thursday August 18, 2011 that it is exploring a spinoff of its PC unit in a historic shift away from the consumer market. In line with a strategic realignment towards software and solutions for businesses, the Palo Alto, California-based HP also announced it was buying British enterprise software company Autonomy for $10.24 billion" and stopping the "production of its Touch Pad tablet computer, its rival to Apple's iPad which was introduced just seven weeks ago, and phones based on the webOS mobile operating system acquired from Palm last year for $1.2 billion." (www.dawn.com)

Leo Apotheker, a former top executive of German business software giant SAP who took over as HP's chief executive in November, said the moves were part of a "transformation to position HP for a new future." This business strategy will 'retain its profitable printing business which has significant commercial applications' and 'to refocus the company on software and technology solutions and make a major push into cloud services – offering applications and storing data over the Internet' (www.Dawn.com @ http://www.dawn.com/2011/08/19/hp-to-exit-pc-hardware-market.html). The HP's strategy is in line with the IBM (International Business

Machines, Inc.) business model in which IBM sold its PC business to China's Lenovo in 2004 for $1.25 billion. It seems that companies whose HQ are located in the capital-intensive countries tend to focus on the product development, research and development; technological infra-structure development and commercial services. And the companies located in the labor-intensive countries tend to integrate in production value-chain. It is important to understand that manufacturing of high-tech products is in fact the assembling of high-tech components which these countries import from the capital-intensive countries. In case of a Lenovo PC, high-tech components viz., processor comes from Intel or AMD (US companies), Hard-drives (Japan or Germany or USA) and softwares also comes from capital-intensive countries like USA, EU based companies. The teardown analysis of the iphone also testifies to this fact.

Thus, apparently it seems the "global production networks and highly specialized production processes apparently reverse trade patterns: developing countries such as the PRC export high-tech goods—like the iPhone—while industrialized countries such as the US import the high-tech goods they themselves invented[13]. In addition, conventional trade statistics greatly inflate bilateral trade deficits between a country used as export-platform by multinational firms and its destination countries. In the case of iPhone trade, the PRC actually contributed only 3.8% of the US US$1.9 billion trade deficit; the rest was simply a transfer from Japan, Korea, and Taipei, China" (Xing, Y., and N. Detert, 2010).

On deep analysis, the production networking may not necessarily reverses the trade patterns rather it scales up the sophistication in the production and services value chain[14] which can be explained under the framework of traditional comparative advantage trade theory. Thus, another pertinent policy question is "exporting of advanced technology product under the paradigm of fragmentation of production do really help production base countries to graduate to high-tech advance economies[15]? We witnessed the sectoral shift and graduation of Japan from exporter of a labor-intensive product mix to highly technological advance products and the capital-intensive product mix. And do the strategic trade policy intervention turbo-charges the transformation of a country from a low-tech to high-tech capital intensive product / export mix? Does the Foreign investment Enterprises (FIEs) in China spur the innovation and productivity and the impact of the FIEs on the indigenous firms' in the total innovation and product development and China's ATP exports.

So, the first challenge that will have to surmount is to provide the micro-foundation for modeling the standard GE to predict the level of IIT based on the some of the explanatory variables of the model.

Given the complexity of fragmentation of production dynamics as narrated above, transforming the GE model for the intra-industry trade (and to provide micro-foundation underlying the GE model of IIT) may be even trickier to handle: the intra-firm trade flow (or trade among the affiliates or firms suppliers) may not necessarily be an indicator of / reflect the consumer tastes or demand (recall that we proxy GDP as the demand) of these satellites supplying countries; or the production base country or the HQ MNE country. Firms develop products and fragment its production in various satellite value-chain centers considering or anticipating demand in another market and may choose market the finish products in another unrelated markets /countries like in EU in this case. Factoring-in the distance variable (parameter) would be even trickier to model in the standard gravity equation.

Second issue in the GE model is standardization of the units of measurement of the regressors (IV) with that regressand (DV). If the units are not correctly harmonized then the interpretation of regression results may also be a problem. The IIT is a unit less index that is calculated involving both the export and import values. Normally, export or FDI volume is modeled in the gravity trade model and units of the left-hand side and right-hand side of the equation are the same currency units which not the case if we model the IIT on the left-hand side of the GE trade model.

It is thus recommended that the future research should delve on the above questions in detail. Here are some points to ponder and some suggestions:

1. IIT may be classified as part of re-exports and the IIT statistics may be used to predict the degree of economic inter-dependence and integration.
2. If we want to predict the flow of the trade exchanges based on the IIT exchanges,
    a. Then IIT should be calculated using input-output tables where multiple suppliers' countries provide input to a finish or a semi-finish product;
    b. The GDP of the partner countries may be multiplied by the IIT index value so as to predict the volume of trade using the Gravity Trade Model;
    c. Instead of IIT exchanges, the value-addition content and contribution of global supply chain may be factored-in to model the level of partnership of the supplying countries in the production map of the final product.

Apart from the theoretical micro-foundations of the GE model and modeling limitations mentioned above, the regression methodology and econometric technique may also be issue in specifying the accurate model to capture the true extent of the international trade flow. "Perhaps the most influential recent theoretical and empirical paper addressing omitted variables bias in the gravity equation is Anderson and van Wincoop (2003). These authors demonstrate that traditional gravity Eq. (1) is mis-specified and coefficient estimates of RHS variables are likely biased owing to omission of nonlinear “multilateral (price) resistance” terms of countries i and j in each year (or including inappropriately a theoretical “remoteness” indexes). Anderson and van Wincoop show that estimation of unbiased coefficients ($\alpha0,\ldots, \alpha4$) requires minimizing the sum-of-squared residuals of (with time-subscript t now omitted” (Baier and Bergstrand, Estimating the effects of free trade agreements on international trade flows using matching econometrics 2009). Instead Baier et al. proposed a “cross-sectional nonparametric matching estimates of long-run FTA treatment effects on levels of the volume of trade. First, we find across many settings and years that the matching estimates of treatment effects are much more stable and economically plausible than average treatment effect (ATE) estimates using typical cross-section OLS (or OLS with country fixed effects) gravity equations” (Baier and Bergstrand, Estimating the effects of free trade agreements on international trade flows using matching econometrics 2009).

As asserted in this paper, the reason for the rise of value chain integration or intra-industry in the ASEAN 5 was the historical and locational issues (dearth of raw-material, labor, land and market access restrictions by the major markets, faced by the Japanese firms and later followed by the Chinese and other MNEs’ from USA and EU. “It cannot be disputed that IIT was fuelled historically by the offshoring to Asia by multinationals of the USA and Japan. More specifically, the combination of technological progress and economic development enabled electronic products in particular to standardize the interfaces between components (Gangnes and Van Assche, 2010), there by seeing the rise of electronics as the dominant export sector in the region (Naya and Plummer, 2006). Production sharing then gradually spread to other products in the category of machinery and transport equipment (Section 7 of the Standard International

Trade Classification). Subsequently, the share of IIT in trade in manufactures within the ASEAN 5 countries grew to attain high levels, dominated mainly by VIIT (Ito and Umemoto, 2004). The growth of IIT in the region, particularly VIIT, is therefore attributed mainly to foreign direct investment (Ito and Umemoto, 2004) via the 'US MNC effect' and the 'Japanese MNC effect,' apart from other factors such as market size (Hurley, 2003), similar export structures (Hapsari and Mangunsong, 2006) and different factor endowments(Hurley, 2003)" (Devadason 2011).

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http://www.wto.org/english/tratop_e/region_e/conference_sept07_e.htm

NCCR- World Trade Institute Regionalism Page

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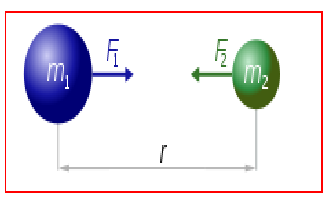
[1] Newton's law of universal gravitation encompasses this physical phenomenon: "Every point mass attracts every single other point mass by a force pointing along the line intersecting both points. The force is proportional to the product of the two masses and inversely proportional to the square of the distance between them" (Newton, 1999). The relationship is described mathematically as under:

$$F = G\frac{m_1 m_2}{r^2}$$

where m_1 & m_2 are masses of the objects under observation, r is the distance between both the masses and G is a gravitational constant.



0-**Error! Main Document Only.** 1http://en.wikipedia.org/wiki/Newton's_law_of_universal_gravitation

[2]Evenett and Keller (2002) in their research paper examined the validity of using Gravity equation for various strands of new trade theories and found that "specialization and trade are increasing as the share of Intra-industry trade in total trade rises. This provides support for the product differentiation cum IRS model of trade to play a role in North-North trade. However, the perfect specialization version of this model overpredicts the amount of bilateral trade by a large margin. Adding a factor abundance element leads to some imperfectly specialized production. In line with the predictions of this IRS/uniconeHeckscher-Ohlin model, we find that the size of the differentiated goods sector and the share of intra-industry

trade move together. This suggests that scale economies and product differentiation are important in explaining the volume of North-North bilateral trade. At the same time, the size of the differentiated goods sector is not related to relative factor abundance in the way predicted by the IRS / uniconeHeckscher-Ohlin model" (Evenett and Keller, April 2002).

[3] Economics Distance in terms of the Gravity trade provides "comparison across groups of countries gives a measure of the degree of integration in the world economy. In addition to these standard variables, the coefficients of policy variables help us to understand the impacts of the represented policies on trade flows. It is also possible to obtain estimates of border effects independently of distance and other variables, as well as to investigate some issues in economic geography as in Redding and Venables (2004)" Source : Kenneth A. Reinert, School of Public Policy, George Mason University

[4]Marrewijk, Charles van notes on "Intra-industry Trade" Department of Economics, Erasmus University Rotterdam published by Princeton University Press

[5] formerly CEPII discussion paper # 2008-27

[6] GDPs size being the proxy for the demand for the exports/ imports of goods and services

[7] In the second phase of globalizations, MNEs do not necessarily wait for the state to state level economic integration agreements to locate their satellite production facilities or to expand firms operations in terms of market access or value-chain integration.

[8]Miroudot, Sebastien et al (2009). "Trade in Intermediate Goods and Services: OECD Trade Policy Working Paper no. 93", available @ http://www.oecd.org/trade.

[9] Stream theory of international trade: In which some portion of trade can be explained by the traditional trade theories; some by the New International trade theories and some by the IIT.

[10]OECD. 2002. "Intra-Industry and Intra-Firm Trade and the Internationalization of Production." *Economic Outlook* No. 71, Chapter 6: 159-170, p. 163

[11]http://www.bloomberg.com/news/2010-08-18/foxconn-to-increase-workforce-40-move-factories-after-spate-of-suicides.html

[12] Professor Krugman (Nobel Prize Speech write-up) ***asserts that the contemporary international trade can be explained in the theoretical framework of Heckscher-Ohlin factor endowment for Intra-industry trade exchanges***

[13]This is the reason why US corporate profits soared high despite higher unemployment rate and stock volatility.

[14] Globalization of production has many challenges and opportunities. It has opened new avenues for growth and economic opportunities. Some economists are predicting that China soon will graduate to a more sophisticated production sectors. ASEAN economies have higher chance for relocation of some of the sunset Chinese production facilities. However, we should also note that the relocation decisions are not only driven by labor costs but also the availability of the skilled labor; regulatory business friendly policies; stable utility services (electricity, water and waste management systems); transportation and suppliers' networks. "A minimum wage of 30 per cent would cut the margins by 1 to 5 per cent for companies with large manufacturing base", says research report released on February 14, 2011 by the Accenture, the global management consultancy company (Quoted from the news story by Kevin Brown on the "China's rising wage bill poses risk of relocation" appeared in

FT.com on February 15, 2011 @ http://www.lexisnexis.com.ezproxy.libraries.claremont.edu/lnacui2api/delivery...eSource=false&docRange=Current+Document+%2816%29&estPage=3&delFmt=QDS_EF_HTML). "Chinese workers received real wage rises averaging 12.6 per cent a year from 2000 to 2009, compared with 1.5 per cent in Indonesia and zero in Thailand, according to ILO. At about $400 a month, Chinese workers are now three times more expensive than their Indonesian counterparts, and five times as costly as in Vietnam, although they remain considerably cheaper than in Taiwan and Malaysia. However, that simple calculation takes no account of changes in relative productivity. Stephen Roach, chairman of Morgan Stanley Asia, says World Bank data indicate productivity in Chinese manufacturing of 10 to 15 per cent a year since 1990. That averages out at close to the same level as annual wage increases over the last decade, suggesting unit labour costs may have risen very little, if at all" , write Kevin Brown of the Financial Times in a new story on the China's rising wage bill poses risk of relocation appeared in FT.com on February 15, 2011.

[15]Hausman, R, Hwang, J and Rodrik, D. 2007: What you export matters. Journal of Economic Growth12: 1–25.