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Industrial Heterogeneity and Trade Flows of India: A Fixed Effect Vector Decomposition Approach

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Abstract

In the present study, an attempt has been made to estimate the effect of industrial heterogeneity on trade flows of India. It is based on the Chaney model of firm heterogeneity on gravity structure. It says that firm heterogeneity when interacts with trade barriers, contorts the gravity structure. The study also explains the effect of bilateral income growth, income similarity and remoteness along with other trade barriers. The data set is across the countries and over the industries for the year 2009. Fixed effect vector decomposition method is used to know the effect of industry variant and industry invariant variables. The study confirms the effect of firm heterogeneity on gravity structure.

1. Introduction

1.1 Traditionally, theories on international trade focused on the causes and consequences of international trade assuming that firms are homogeneous in nature. But modern trade theories have made a significant departure from the traditional theories by considering that firms are heterogeneous and their heterogeneity distorts the basic results of gravity model of international trade. Chaney (2008) extended the Krugman model by considering firm heterogeneity, an idea proposed by Melitz, and found that when the trade costs go down, the existing producers face lower costs so they sell at lower price and get the larger market share by increasing their exports of existing varieties (Intensive margin). At the same time, it is profitable to go for exports by the firms which were not able to export earlier and produce same varieties at same cost. These firms strictly export positive quantities of different varieties and contribute to increase the aggregate volume of exports (Extensive margin). Thus, as per his analysis, industrial heterogeneity distorts the basic results of gravity equation and in the presence of it, trade barriers increase the trade flows in between the trading countries through intensive and extensive margins of trade. The present study is an attempt to examine Chaney's hypotheses on the Indian trade flows by considering industrial heterogeneity. Before making this assessment, the next sub section presents some of the relevant trends of India's firm level trade.

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1.2 India's Firm Level Trade

1.2.1 Understanding of the export behavior of Indian firms becomes important since it is the microeconomic basis of the observed trade flows among countries. Figure 1 explores the export intensity of Indian firms by the type of firm according to its ownership structure. It is clear from Figure 1 that increment in exports has been higher among Indian private sector firms and Indian business groups. Further, figure 2 shows the percentage of firms exporting from the year 1991 to 2010.

1.2.2 Figure 2 reveals that the percentage of exporting firms rose sharply after the liberalization phase. The rise has been slow but still growing. It has declined marginally in 2009 may be because of global slowdown.

1.2.3 The analysis concludes that India's major exports do not come from big business houses but from small firms which supports our research objective of estimating the impact of industrial heterogeneity on India's trade flows. To pursue this objective, the whole study has been divided into the six sections including the present introductory one. Section 2 presents the literature review explaining the Krugman and Melitz ideas in detail. In section 3, Chaney's model has been presented and discussed to support the empirical hypotheses theoretically. Section 4 gives the detailed report on the variables used and their construction for the empirical analysis. The appropriate methodology for the analysis purpose also explained in the same section. Further, empirical results have been presented in the Section 5 and Section 6 concludes the whole study and provides noteworthy policy implications.

2. Review of Literature

2.1 Most of the New and New-New trade theories use monopolistic competition model which is characterized by a large number of firms, each producing a unique variety of differentiated products, with free entry and exit. The model was provided by Chamberlin (1936) which gave the graphical presentation of the market equilibrium. Using the model, Dixit and Stiglitz (1977) proposed utility function in which representative consumers demand number of varieties of the differentiated goods. On the basis of this, a number of new trade economists provided their New and New-New trade theories. As per these theories, each country will export a differentiated variety of goods to another country and it becomes profitable to produce different varieties under trade but under autarky firms can produce the same varieties. Increasing competition into the international market has led to some pressure among firms as they have to be more and more productive to face the pressure.

2.2 Melitz (2003) proposed a model by assuming heterogeneous firms and shows how reduction in barriers to trade induces firms to become more productive, simultaneously forcing the least productive firms to exit the market. His model introduced the fixed cost of entering into domestic and export market. These costs are the sunk costs and cannot be recovered later. Melitz explained that trade opening will increase aggregate productivity in all trading economies. Whenever the threshold level of productivity goes up, the least productive firms disappear. At the same time, the most productive firms among the survivors

(those with productivity above the threshold productivity level) takes part in the export market with the top in their domestic market and therefore, these firms employ disproportionately more labor than the less productive firms. Hence, the aggregate productivity in the economy is the average productivity of a better pool, with a larger weight on the most productive firms. This unambiguously leads to an increase in the aggregate productivity of the economy.

2.3 The reason for this increase in aggregate productivity is provided by two forces. Firstly, domestic firms now have to face the additional competition from the best foreign firms in the export market. This reduces the market share left for domestic firms, and drives down the profits of all firms due to the constant elasticity assumption and forces the least productive firms out of the market. Secondly, when the possibility of trade (at some cost) is opened up, there are additional profits to be expected by the most productive firms, those firms that are productive enough to enter the foreign market. Here, the existing high productivity firms want to expand their scale of production in order to serve the foreign markets and therefore they want to hire more workers. New firms are also attracted by the prospect of these higher profits and they also hire workers. Real wages go up and force the least productive firms to shut down.

2.4 Instead of considering the monopolistic competition, Bernard, Eaton, Jensen and Kortum (2003) considered the assumption of perfect competition but retained the CES preference assumption. Perfect competition actually gives results which are similar to monopolistic competition with the only difference that instead of charging the price exactly equal to marginal cost, they charge a constant mark-up over their marginal cost. Actually they considered Bertrand competition.

2.5 Later, Melitz and Ottaviano (2005) proposed a model which predicts the impact of productivity, size, and the mark up price on world trading scenario. Working on similar lines, Helpman, Melitz and Rubinstein (2007) proposed a simple model that is capable of explaining the zero trade flows, larger number of exporters to larger destination markets etc. The model yields the generalized gravity equation that accounts for the self-selection of firms into export market and their impact on trade volumes. They developed a two stage estimation procedure that uses a selection equation into trading partners in the first stage and a trade flow equation into the second. The method provides estimate of extensive and intensive margins of trade flows.

2.6 Chaney (2008) extended the idea of Melitz and answered the question of how firm heterogeneity and market structure can distort gravity in international market. The main idea of the Melitz model is that if firms are heterogeneous in terms of their productivity and there exist fixed costs associated with exports then there will be endogenous selection of firms into the export market. Thus, in the presence of trade barriers (fixed costs, variable costs etc.), the set of firms that can cover all these cost is going to change. So changes in trade barriers, i.e. trade liberalization will not only change how much each firm export (through intensive margin) but also the set of firms in the market (through extensive margin). The main contribution of this study is to introduce the extensive margin of trade. Therefore, there is an extensive and intensive margin of adjustment of trade flows to trade barriers. He found that elasticity of substitution has opposite effect on each margin: higher elasticity

of substitution makes the intensive margin more sensitive to changes in trade barriers, whereas extensive margin becomes less sensitive.

3. The Chaney's Model

3.1 Thomas Chaney (2008) on the basis of Krugman and Melitz model proposed his model which explains how the heterogeneous nature of firms distorts gravity. Beginning with Krugman model:

$$X_{ij} = \lambda \times L_i \times L_j \times \left(\frac{\tau_{ij}}{P^*}\right)^{1-\sigma} \quad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

where, X_{ij} is the exports to the i^{th} country from country j; L_i and L_j are the market sizes of country i and country j respectively; τ_{ij} represents variable trade costs and shows that there is positive relation between elasticity of substitution (σ) and variable trade costs; P^* is the world prices and λ is the constant. In this model, there is no fixed cost associated with trade.

$$\frac{\partial \ln X_{ij}}{\partial \ln \tau_{ij}} = \sigma - 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots..(2)$$

3.2 Melitz (2003) contributed to the literature by introducing fixed cost of entering into domestic and export markets. He explained that if a firm wants to enter into domestic and export market, it will have to pay a fixed cost of entry in both the markets and these are the types of sunk costs. Thus, the most productive firms which have the lowest marginal costs serve the export market while the firms which are less productive and cannot bear the fixed cost of entering into export market serve the domestic market. Finally, the firms which are least productive and which cannot even bear the fixed cost of entering into domestic market go out of the market. Therefore, due to heterogeneous nature of firms only most productive firms enter into international market.

3.3 Thomas Chaney (2008) contributed to the theoretical literature by utilizing the idea of Krugman model and Melitz model. Melitz proposed that there are fixed cost of entering into domestic market as well as into export market. Chaney utilized this idea of fixed cost and gave extensive margin. The following equation shows the Chaney's model:

$$X_{ij} = \lambda \times \frac{L_i L_j}{L} \times \left(\frac{\tau_{ij}}{\theta_{ij}}\right)^{-\gamma} \times f_{ij}^{-\left(\frac{\gamma}{\sigma-1}-1\right)} \quad \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

where θ_{ij} is the remoteness index of country i from countries other than j; f_{ij} is the fixed cost; τ_{ij} is the variable trade cost; γ is the firm heterogeneity. Now differentiating equation (3) with respect to variable trade cost and fixed trade cost gives,

$$\varsigma \equiv \frac{\partial \ln X_{ij}}{\partial \ln \tau_{ij}} = \gamma \text{ .....(4)}$$

$$\xi \equiv \frac{\partial \ln X_{ij}}{\partial \ln f_{ij}} = \frac{\gamma}{\sigma - 1} - 1 \text{ .....(5)}$$

Therefore, equations (4) and (5) have following implications:

First is that Chaney predicted that there is inverse relationship between elasticity of substitution and fixed trade costs and positive relation between firm heterogeneity and variable trade costs.

Second is that the elasticity of exports with respect to variable cost is larger in the presence of firm heterogeneity than in the absence. An increase in variable trade cost reduces export as well as some firms go out of the export market. The extensive margin then magnifies the impact of variable trade costs.

Finally third is that elasticity of exports with respect to variable trade cost does not depend upon elasticity of substitution.

3.4 In this way, he introduced two margins of trade i.e. extensive and intensive margins of trade. Krugman model only took intensive margin (scale effect) into account but Chaney introduced extensive margin (selection effect) also. Chaney added firm's heterogeneity in productivity as well as the fixed cost of exporting to the equation. When transportation costs vary, not only does each exporter changes the size of its exports (the intensive margin) but also the set of exporters varies (the extensive margin).

3.5 Intensive and Extensive Margin

3.5.1 The selection of firms into export market according to their productivity level is known as extensive margin. Earlier it has been seen that in Chaney model the elasticity of substitution (ó) has no effect on elasticity of trade flows with respect to variable trade costs (æ), and a negative effect on the elasticity of trade flows with respect to fixed costs (î). Then intensive and extensive margin can be found out as:

$$\frac{d\varsigma}{d\sigma} = 0 \textbf{ .....(6)}$$

And

$$\frac{d\xi}{d\sigma} < 0 \text{ .....(7)}$$

$$\varsigma = -\frac{d \ln X_{ij}}{d \ln \tau_{ij}} = (\sigma - 1) + (\gamma - (\sigma - 1)) = \gamma \text{ .....(8)}$$

where the expression $(\sigma - 1)$ shows intensive margin and the expression $(\gamma-(\sigma-1))$ shows the extensive margin. Since elasticity of intensive margin with respect to sigma is zero, the expression becomes applicable to extensive margin only. When variable costs moves, ((ó-1) increases with ó), and thus ó magnifies the intensive margin, whereas it dampens the extensive margin i.e.(-(ó -1) decreases with ó). Therefore, elasticity of trade with respect to fixed trade costs becomes,

$$\xi = \frac{d \ln X_{ij}}{d \ln f_{ij}} = 0 + \frac{\gamma}{\sigma - 1} - 1 \quad \text{.....(9)}$$

The main finding of his study is that the elasticity of substitution has opposite effects on each margin. A higher elasticity makes the intensive margin more sensitive to changes in trade barriers, whereas it makes the extensive margin less sensitive. The present research contributes towards the effect of firm heterogeneity on India's trade with its trading partners. For this purpose, three models have been estimated such as model with basic Chaney's structure with two more extended models including host of other augmented gravity equation variable.

4. Database and Methodology

4.1 Sources of Data and Construction of Variables

4.1.1 For the present study, data on different variables (see Table 1 for detail) over the various Indian industries have been culled out for the year 2009 for different country pairs (India with its trading partners). The main sources of secondary data used for the analysis are, the World Integrated Trade Solutions (WITS), World Development Indicators (WDI) provided by World Bank, CEPII database for readymade gravity equation variables and the Prowess database provided by Centre for Monitoring Indian Economy (CMIE), Government of India. Table 1 present the detailed list of variables used in the study with their description.

4.1.2 From the literature there are two possible ways to work out firm heterogeneity. First is to either measure the dispersion of productivity or of size (measured as sales), not a mixture of both and the second way is to measure the dispersion of a variable X_i across all the firms (may be either productivity or size), ordering them in decreasing order. After restricting to the 50% or 30% largest firms and then running the OLS regression on the following equation:

$$\ln(Rank_i) = \alpha + \beta \ln X_i + \mu_i$$

Where β is the coefficient of interest, and μ_i is a normally distributed error term.
Since, due to the lot of missing figures in the data we have taken the dispersion of sales into account to measure the industrial heterogeneity. Lower is the dispersion of sales among the firms low will be the industrial heterogeneity, as productivity is concentrated

among few firms only. As per the Chaney's model, we further divide the value of industrial heterogeneity with $(\sigma-1)$ and use this measure to account industrial heterogeneity.

4.1.3 For elasticity of substitution data, we have used estimates provided by Broda and Weinstein (2006) for each variety. They have used 6 digit HS import data (1992 classification system) from the COMTRADE database from 1994-2003 to estimate these elasticities. It gives the estimate of demand elasticity of substitution between any two varieties in any given sector. It is not the demand elasticity that whole sector faces when it exports. Here we have done our analysis on data of year 2009 while Broda and Weinstein estimated demand elasticities between two varieties taking the data from 1994 to 2003. These authors compared the demand elasticities between the two time periods and found that median elasticity fell marginally (from 2:5 to 2:2 at the 3-digit level). Thus, we assume that there would not be much difference for the period 2009.

Further, s_i has been calculated by using the following formula:

$$s_i = \frac{Y_i}{Y_i + Y_j}$$

Where $Y_i + Y_j$ is the sum of the real GDPs of two country and its impact on growth of trade is expected to be positive, $s_i s_j$ is the product of shares of two countries which is equivalent to

4.1.4 Helpman's size dispersion index and its expected sign is positive. In other words, it captures the effect of income convergence, which is assumed to augment trade flow growth.

Finally, to calculate the remoteness index, the following formula developed by Wei (1996) and Helliwell (1997) has been used.

$$REM_i = \sum_{m \neq j} \left(\frac{d_{im}}{Y_m} \right)$$

Where Rem_i is the remoteness index for country i used to represent the average distance (d_{im}) from all trading partners other than j weighted by their GDP's (Y). More is the remoteness of a country i from its trading partners other than j more will be the trade between i and j.

As our dataset have two dimensions (country pairs over different industries) as like panel data (country pairs over different time periods) so we have assumed it as panel like dataset and preceded with the panel data analyses.

4.2. Methodology Applied

As per the two dimensional feature of our dataset, the present study has utilized the Fixed Vector Variance decomposition (FEVD) technique, a panel data analysis to account for the loss in information in estimating fixed effects regression.

4.2.1 Fixed Effect Variance Decomposition (FEVD)

4.2.1.1 The utility of using FEVD approach for the present analysis is its advantage over the Fixed Effect (FE) panel data regression to include effects of those variables which are industry invariant (in other words, for panel data with different time periods, it gives us the effects of time invariant variables). The FEVD is an estimation strategy proposed by Plumper and Troeger (2007) which attempts to overcome the loss of information that occurs using the FE model. In the present case, there are many variables which are invariant for different industries such as distance in between country pairs, common border dummy, common language dummy, India's remoteness, sum of the country's GDP and their shares.

4.2.1.2 It is a three steps procedure known as augmented fixed effect regression to estimate the effects of independent variables on dependent variable. The three steps of FEVD estimation for our study are:

1. Estimate the following fixed effects regression with industry variant independent variables and obtain the fixed effect error component (FEEC):

$$\ln Exports_{ijk} = \alpha_{ij} + a_1 \ln tariff_{ijk} + a_2 \ln remoteness_i + a_3 \ln dist_{ij} * IndHetro_i + a_4 \ln tariff_{ijk} * IndHetro_i + a_5 border_{ij} * IndHetro_i + a_6 \ln comlang_{ij} * IndHetro_i + u_{ijk}$$

where subscripts *i, j and k* represent the exporter *i* and importer *j* over the products of *k industries.*

2. Regress the fixed effect error component vector (obtained from step 1), on industry invariant variables by applying OLS and obtain the residual series (e_{ij}).

$$FEEC_{ij} = \beta + b_1 \ln(Y_i + Y_j) + b_2 \ln(s_i s_j) + b_3 \ln dist_{ij} + b_4 border_{ij} + b_5 comlang_{ij} + b_6 \ln remoteness_i + e_{ij}$$

3. In the last step, regress dependent variable on all independent variables (industry variant as well as invariant) including the residual obtained from step 2 by using pooled OLS. In our study, estimate the following final regression equation with the help of pooled OLS.

$$\ln Exports_{ijk} = \lambda + c_1 \ln(Y_i + Y_j) + c_2 \ln(s_i s_j) + c_3 \ln dist_{ij} + c_4 \ln tariff_{ijk} + c_5 border_{ij} + c_6 comlang_{ij} + c_7 \ln remoteness_i + c_8 \ln dist_{ij} * IndHetro + c_9 \ln tariff_{ijk} * IndHetro + c_{10} border_{ij} * IndHetro + c_{11} \ln comlang_{ij} * IndHetro + c_{12} \hat{e}_{ij} + w_{ijk}$$

The results obtained are useful to explain the hypothesis set on the basis of the theories behind the fitted model. Further, the effect of residual (e_{ij}), obtained in step two, accounts for the unobserved unit fixed effects and captures the potential of omitted variable bias. The same procedure has been repeated for measuring the impact of elasticity of substitution on India's trade flows by replacing the industrial heterogeneity variable with the elasticity of substitution variable.

4.2.1.3 As per the Plumper and Troeger (2004)[2], the utility of using the method of FEVD for the panel data is that "*it does not require prior knowledge of correlation between the explanatory variables and the unit specific effects; The estimator relies on the robustness of the within-transformation and does not need to meet the orthogonality assumptions of random effects; and It maintains the consistency and efficiency of OLS*" pp. 10.

4.2.1.4 The present study has estimated all the six models (see Table 2 for details) in which first three models estimate the impact of industrial heterogeneity and the next three models estimate the impact of elasticity of substitution on India's trade flows.

5. Empirical Results:

5.1 Industrial Heterogeneity and Trade Flows

5.1.1 Table 3 presents the results of three estimated model as proposed in the study. In model – 1, distance has negative effect on India's exports but when distance interacts with firm heterogeneity it is positively affecting Indian exports. More heterogeneity means productivity is dispersed among firms and is not centered among few firms. Therefore, new firms can easily enter into export market and make the profit and more distance would not matter much in this case. This shows that extensive margin dominates in Indian case. Further, border and border *firm heterogeneity, common language and common language * firm heterogeneity are found to be insignificant and ambiguous results are found.

5.1.2 In model-2 bilateral income growth and income similarity index are found to be positive and significant. Further, distance has significant and negative impact on trade flows while when it interacts with firm heterogeneity; it has positive effect on trade flows. Therefore, new firms will quickly enter into export market and will make profit even if there is longer distance. Same is the case with tariff. Results of other variables are not significant.

[2] Plumper, T. And Troeger, V.E. (2004), "The Estimation of Time Invariant Variables in Panel Analyses with Unit Fixed Effects", SSRN Working Paper. Available at SSRN: http://ssrn.com/abstract=565904

5.1.3 Model-3 considers remoteness as another variable along with the rest of the variables but is found to be insignificant. The rest of the variables show the same results except tariff *heterogeneity which has become positive but insignificant.

5.2 Elasticity of Substitution and Trade Flows:

5.2.1 Table – 4 shows the effect of elasticity of substitution and trade costs on India's trade flows. In model – 1, distance is the only variable which is significant and rest of the basic gravity variables as well as the interaction term of gravity variables with sigma is also insignificant. Further, in model -2 when we have included the bilateral income growth, income similarity index and tariff also. Here bilateral income growth, income similarity index, tariff and distance are the significant variables. Here again the interaction terms are insignificant. In model – 3, the results are same along with one more significant variable i.e. common language at 10% level. Here it is important to note that the coefficient value of interaction terms in all the three models is very low. This shows that elasticity of substitution has very less contribution in Indian case. The basic reason behind this could be that the Indian trade mainly focuses on basic traditional goods which do not have many substitutes available in the market and even if it has some substitutes available, the demand is not too high.

6. Conclusion

6.1 Paper attempts to analyze the effect of firm heterogeneity and elasticity of substitution on Indian trade flows with respect to trade barriers. The empirical testing is done in context of Chaney model of firm heterogeneity. The results show that firm heterogeneity magnifies the effect of trade barriers on trade flows while elasticity of substitution has very meager impact. Finally, study confirms the effect of firm heterogeneity on gravity structure.

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Figure 1: Export Intensity of the Firms as per their Ownership Structure

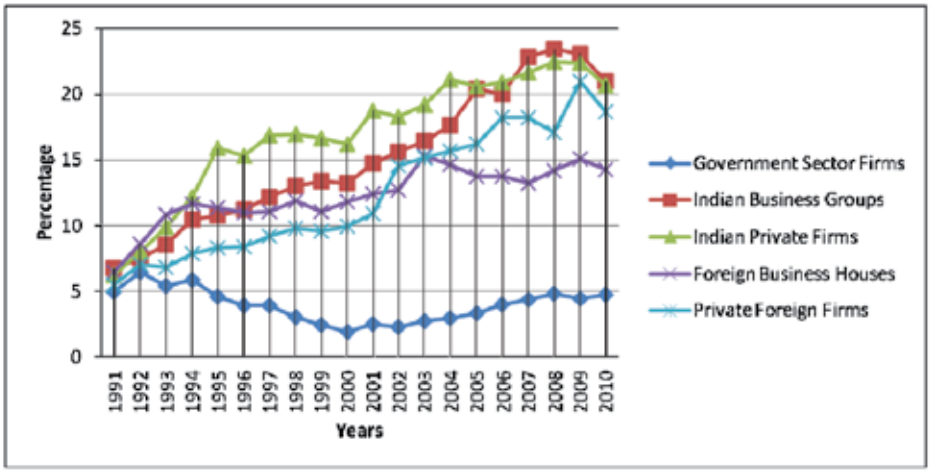

Figure 2: Percentage of Exporting Firms

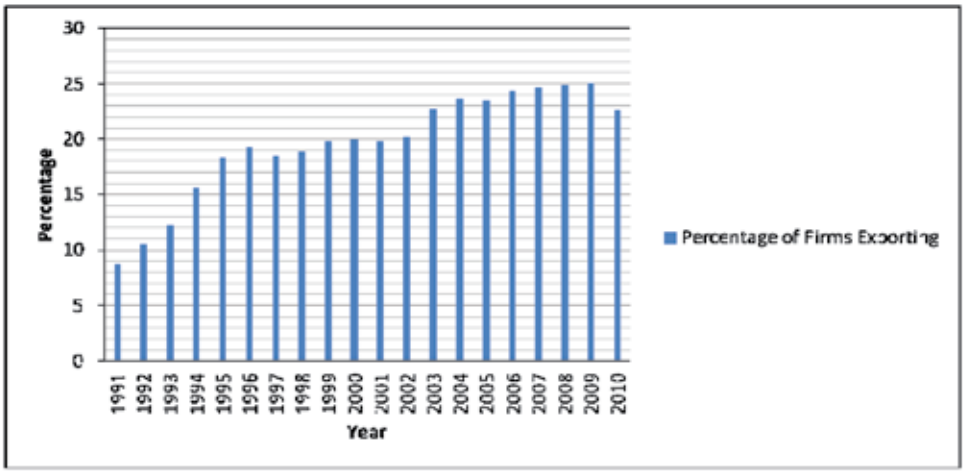

Table 1: Description of Variables and with Sources

Variable	Description	Source
Exports	India's Exports with its Trading Partners	WITS
Sum of GDP's ($Y_i + Y_j$)	National Income of both the Country Pairs	WDI
Distance (dist)	Distance in between Trading Partner	CEPII
Tariff	Tariff faced by Indian Exports	WITS
Common Language and Common Border	Dummy Variable	CEPII
Size Dispersion Index	Derived from GDP's of both the countries	Own Calculations
IndHetro	Industrial Heterogeneity	Own Calculations
Elasticity of Substitution	For Constructing Industrial Heterogeneity	Broda and Weinstein(2006) Estimates
Remoteness	India's Remoteness defined by Wei (1996) and Helliwell (1997)	Own Calculations
Source: Authors' Elaboration.		

Table 2: Description of Variables Included in the Estimated Models

Dependent variable: Exports of India (LnX_{ijk}) to Partner countries for the year 2009.			
Independent Variables	**Model 1 (Chaney's Model)**	**Model 2 (Extended Model)**	**Model 3 (Extended Model)**
Lnremoteness	×	×	√
$Ln(Y^i + Y^j)$	×	√	√
$Ln(s^i s^j)$	×	√	√
Lntariff	×	√	√
Lntariff*IndHetro	×	√	√
Lndistance	√	√	√
Border	√	√	√
Comlang	√	√	√
Lndist*IndHetro	√	√	√
Border*IndHetro	√	√	√
Comlang*IndHetro	√	√	√
Note: i) √ represent the Variable included in the estimated model; ii) In the next three models, the variable IndHetro has been replaced with elasticity of substitution.			
Source: Authors' Elaboration.			

Table 3: Results of Three Estimated Models with Industrial Heterogeneity

Dependent Variable: Exports of India (Lnexports) to Partner countries for the year 2009.			
Independent Variables	**Model 1 (Chaney's Model)**	**Model 2 (Extended Model)**	**Model 3 (Extended Model)**
Lnremoteness	—	—	5.52 (0.36)
$Ln(Y_i + Y_j)$	—	1.46 (0.00)	1.49 (0.00)
$Ln(s_i s_j)$	—	0.76 (0.00)	0.71 (0.00)
Lntariff	—	-0.50 (0.00)	-0.50 (0.00)
Lntariff * $\frac{\lambda_h}{\sigma - 1}$		0.13 (0.17)	0.13 (0.17)
Lndistance	-0.81 (0.00)	-0.67 (0.00)	-0.64 (0.00)
Border	1.47 (0.11)	-0.35 (0.71)	-0.32 (0.74)
Comlang	0.28 (0.42)	0.42 (0.23)	0.45 (0.19)
Lndist* $\frac{\lambda_h}{\sigma - 1}$	0.13 (0.00)	0.10 (0.00)	0.10 (0.00)
Border* $\frac{\lambda_h}{\sigma - 1}$	-0.25 (0.73)	-0.24 (0.74)	-0.24 (0.74)
Comlang* $\frac{\lambda_h}{\sigma - 1}$	0.06 (0.84)	0.11 (0.68)	0.11 (0.68)
Constant	14.29 (0.00)	-24.74 (0.00)	24.69 (0.65)
FEVD Residual	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
No. of Observations	**1206**	**1206**	**1206**
R^2	**0.26**	**0.27**	**0.27**
Notes: Figures in parenthesis of type ( ) are the p-values of the respective coefficients;			
Source: Authors' Calculations.			

Table 4: Results of Three Estimated Models with Elasticity of Substitution

Dependent Variable: Exports of India (Lnexports) to Partner countries for the year 2009.			
Independent Variables	**Model 1 (Chaney's Model)**	**Model 2 (Extended Model)**	**Model 3 (Extended Model)**
Lnremoteness	—	—	5.25 (0.40)
Ln($Y_i + Y_j$)	—	1.36 (0.00)	1.38 (0.00)
Ln($s_i s_j$)	—	0.74 (0.00)	0.70 (0.00)
Lntariff	—	-0.55 (0.00)	-0.55 (0.00)
Lntariff*σ_h	—	-0.00 (0.93)	-0.00 (.93)
Lndistance	-0.67 (0.00)	-0.53 (0.01)	-0.51 (0.02)
Border	1.19 (0.16)	-0.32 (0.72)	-0.28 (0.74)
Comlang	0.34 (0.27)	0.49 (0.11)	0.52 (.09)
Lndist*σ_h	0.00 (0.98)	0.00 (0.79)	0.00 (0.79)
Border*σ_h	0.00 (0.74)	0.00 (0.91)	0.00 (0.91)
Comlang*σ_h	-0.00 (0.80)	-0.00 (0.85)	-.00 (.85)
Constant	14.01 (0.00)	-22.19 (0.02)	24.83 (0.66)
FEVD Residual	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
No. of Observations	**1206**	**1206**	**1206**
R^2	**0.21**	**0.24**	**0.23**
Notes: Figures in parenthesis of type ( ) are the p-values of the respective coefficients;			
Source: Authors' Calculations.			