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Pakistan's Export Potential: A Gravity Model Analysis

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Abstract

The study employs Gravity Model to estimate Pakistan's export potentials with the global and bilateral trading partners for the 19 sectors of the economy. We use cross sectional data for 132 exporting and 154 importing countries for the years 2002-03. The study applies the *pseudo maximum likelihood* methodology to estimate the gravity equation. The results depict that the model fits well with the data and estimation provides reasonable signs and results for distance, geographical, cultural and historical factors employed in the analysis.

On the aggregate level, the model identifies highest export potentials with the countries such as India, Japan, Hong Kong, China and USA whereas Pakistan is exhausting its export potentials with some countries namely UK, Turkey and Bangladesh. On the sectoral level, the bilateral results reveal additional export potential for 13 out of 15 sectors with India. Similarly, the sectoral results for China also unveil untapped potentials for Pakistani exporters in 10 out of 15 sectors.

JEL Classification: C31, F13, F14, F15

Keywords: Gravity Model, Export Potential

1. Introduction

Pakistan's trade witnessed unprecedented upsurge during initial years of 2000s, as it increased from US$ 18.8 billion (25.5 percent of GDP) in FY00 to US$ 47.5 billion (33.1 percent of GDP) in FY07 due to wider trade & tariff reforms (of the 1990s) and the turnaround in the economic activity in recent years. However, notwithstanding the rise in the overall trade to GDP ratio, this increase in overall trade seems to be more pronounced in; (1) imports rather than exports and; [1] (2) the exports tend to be more flowing towards traditional markets and concentrated in traditional products.[2] As a result, our share in the world exports not only remained dismally low (0.14 percent) in FY06 but also declined over the period. This compares unfavorably with India (1.02 percent), China (8.22 percent) and overall Asian regional counterparts (27.8 percent) (see Table A1).

Aside from the issue of lower exports share in global trade, our exports to the countries closer to Pakistan's border are also minimal when compared to the percentage of the total trade with the rest of the world. Of Pakistan's total exports of US$ 17 billion in FY07, 3.4 percent (US$ 575.9 million) went to China and just 2 percent (US$ 342.9 million) to India.[3] It is needless to mention that exports with these countries seem to be much lower keeping in view the natural advantageous factors such as proximity, transportation costs, common border, cultural and language characteristics.

In this backdrop, it is important to enhance the volume of Pakistan's export potential at global level in general and regional level in particular. These potentials may be untapped and this study may provide various policy implications to extend the export openings in a range of sectors and the countries where the potential opportunities exist. Thus, this study plans to apply gravity model analysis for this purpose. Indeed, the Gravity model has been used extensively during the last forty years, since the pioneering work of Tinbergen (1962), in explaining bilateral and multilateral trade flows. Particularly, this model has been used to solve various trade puzzles like finding of trade potentials, trade patterns, estimation of the cost of border and for identification of effects related to regionalism [Helmers and Pasteels (2005)].

[1] More specifically, the exports increased from US$ 8.5 billion in FY00 to US$ 17 billion in FY07 (increase of 99.6 percent) while the imports increased from US$ 10.3 billion in FY00 to US$ 30.5 billion (increase of 196.5 percent) in FY07.
[2] Historically, Europe and USA are considered as traditional markets because more than 50 percent of our exports are going to these places. Similarly, textile group is considered as traditional sector because above 60 percent of our exports are concentrated in this group.
[3] Source: Federal Bureau of Statistics, Government of Pakistan.

This study is predominantly concerned with finding the untapped *Pakistan's exports potential* in these non-traditional markets (bordering Pakistan) such as India and China and non-traditional sectors of these economies. [4] Broadly, the study investigates the following three questions (for the year 2002-2003);

1. What is the level of Pakistan's aggregate export potential with some selected trading partners at the global level?
2. Like a normal country, what is the Pakistan's export potential in various sectors of the Indian economy?
3. What sectoral trade potential exists for Pakistani exports in the Chinese market?

The study is organized as follows. After the introduction in section I, the section 2 reviews some literature on the evolution on the Gravity Model. Section 3 presents Analytical framework of the model and depicts some common econometric problems in the studies undertaken during the past. Section 4 presents data, variables description and briefs about the methodology, which is followed by the empirical results of Pakistan's export potentials presented in section 5. Section 6 finally concludes the study.

2. A Literature Survey on the Application of the Gravity Model

Historically, the Gravity model originated from Physics and it is ascribed as one of the prime work of Newton. The model actually explains the force of the Gravity, which is directly proportional to the masses of two objects and inversely related to the square of distance between them [Rahman (2003)].

Keeping in view this model analogy with trade, the economists such as Tinbergen (1962), Poyhonen (1963) and Linnemann (1966) applied it to find the trade relationship among various countries. Hence, this model has been used for a protracted period to determine the pattern of trade in various empirical studies [Bayomi and Eichengreen (1997)]. The empirical results of the overall Gravity Model were encouraging as these were robust and best fitted on the data. These empirical results encouraged the economists to extend this model to establish trade relationships for developing countries and economies in transitions in addition to the initial applications only to the advanced economies.

[4] The exports potentials are defined as the difference between the *predicted* (by the gravity model) and *actual* export flows between the two countries.

Despite empirical success of the Gravity Model over the years, Baldwin (1993) and Leamer (1994) criticized the model on the grounds that there does not exist theoretical foundation of the relationships. Baier and Bergstrand (2005) have also mentioned that the earlier studies did not account for the theoretical foundations and were based on either informal economic foundations or to a physical science analogy. Generally, the gravity model has been used to determine the trade patterns and potentials after controlling for factors that generally impact the trade. This may include transportation costs, geographical and cultural features, border & non-border barriers and other regulatory constraints.

Thus, in order to justify these best fitted results the economists have searched for theoretical grounds and reached to reduced form of various models based on the basic trade theories such as Heckscher-Ohlin models [Sohn (2005)].[5] Later on, Anderson (1979), Helpman and Krugman (1985), Deardorff (1995&1998), Feenstra et al (2001), Eaton and Kortum (2002), Anderson and van Wincoop (2003) derived the theoretical foundations of the model from the trade theories such as Ricardian, Heckscher-Ohlin, and New International Trade Theory.[6]

More specifically, Anderson (1979) derived gravity model from all type of product differentiation models. Bergstrand (1985 & 1989) derived factor proportion or Heckscher-Ohlin trade model. While Helpman and Krugman (1985) developed monopolistic competition model with increasing returns and transport costs. However, recent work on Gravity Model such as Deardorff (1995), Anderson and van Wincoop (2003) and Helmers & Pasteels (2005) extended these traditional models and tried to reach at more robust and consistent conclusions.[7]

Now, the gravity equation is typically being used in cross section and panel data samples to find bilateral trade flows taking into account their incomes, bilateral distance, and dummy variables for common language, common borders and any of the regional or bilateral agreements.

By going through the literature, it is observed that the application of gravity model on Pakistan is rather limited and often focuses on SAPTA/SAFTA such as Rahman (2003),

[5] Feenstra et al (1998) introduced reciprocal-dumping model of trade with homogenous goods. It was a different kind of product differentiation originating from factor endowment differences. Deardorff (1998) finally suggested a model with Heckscher-Ohlin trade model in homogenous goods and perfect competition.

[6] In the Ricardian framework trade takes place because of differences across countries in technologies, while in Heckscher-Ohlin theory, trade results from the fact that different countries have different factor endowments. The New International Trade Theory is mainly based on the concepts of economies of scale, product differentiation and imperfect competition [Deraniyagala and Fine (2000)].

[7] Bergstrand (1989) introduced micro foundation to this model and suggested that the gravity model is a reduced form equation of a general equilibrium of supply and demand systems.

Hirantha (2004) and Newfarmer (2004). Similarly, Betra (2004) estimated US$ 6.5 billion trade potential between India and Pakistan. According to her, Pakistan's export potential with India remained restricted due to political restrictions and was just 8 percent of the India's total trade share with the SAARC in 2002-03.

However, the focus of these studies is overall trade and these ignore the sectoral and product level analysis in many of the cases. A recent study by Baroncelli (2005) estimates trade potential between India and Pakistan at sectoral level by incorporating the simulated SAFTA bound future tariffs. But even this study covers only three sectors, namely textile, chemicals and food; and do have some methodological flaws such as endogenity and violations of assumptions of Jensen's inequality. [8]

Hence, there is a need to do some research which not only takes into account the theoretical developments which took place over the years but also justifies the standard gravity equation features. Furthermore, a kind of study is also needed which takes care of issues concerning with the finding of trade potentials for Pakistani exports in various secrtors of the economy with the selected trading partners both at the aggregated and sectoral level.

3. Analytical Framework

Historically, the following Gravity Model has been followed:

$$X_{ij} = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} \prod_{m=1}^{M} (z_{ij}^m)^{\alpha_m} \varepsilon_{ij} \quad \text{.......................................} \quad (1)$$

Where;

X_{ij} = denote the total exports from country *i* to *j*,

Y_i, Y_j = the countries' incomes,

$\prod_{m=1}^{M} (z_{ij}^m)^{\alpha_m}$ = constitutes various measures either negative, i.e. trade costs, or positive, such as common language, on trade flows from i to j,

ε_{ij} = the error term.

For empirical estimation, normally the Gravity Equation has been used in the log linear form while the coefficients represent elasticities of bilateral trade to estimated parameters such as in equation (2).

[8] The authors used log-log model to find the trade potentials which violates the Jensen's inequality assumptions. The Jensen's inequality means that expected value of the logarithm of random variables is different from the logarithm of its expected value i.e. E (ln y) ≠ ln E (y).

$$\ln X_{ij} = \alpha_0 * + \alpha_1 \ln Y_i + \alpha_2 \ln Y_j + \sum_{m=1}^{M} \alpha_m \ln z_{ij}^m + \nu_{ij} \quad \text{…….……..} \quad (2)$$

with $\alpha_0 * = \ln \alpha_0;$

Later on, in order to capture the effects of bilateral trade barriers in the Gravity Equation, the remoteness variable was used to clarify the effects of bilateral trade barrier relative to all other partners [Anderson (1979)].[9] Afterwards, Anderson and van Wincoop (2003) criticized that this remoteness variable is just illustrating the distance while omitting various other important variables, which play a key role in inhibiting the trade flows. They explained that the multilateral resistance terms cannot be interpreted simply as consumer price indices, as trade costs also include non-financial costs and introduced price indices of country "i" and "j" as multilateral price terms and their product was divided on the specific *bilateral trade barrier* "t_{ij}" such as $\left(t_{ij} / P_i P_j\right)^{1-\sigma}$.[10] Besides, Eaton and Kortum (2002) and Helpman et al. (2004) have argued that the simultaneous use of both importer and exporter fixed effects and replacing of the resistance terms provides more consistent results. Hence, now the gravity equation (3) incorporates multilateral resistance terms in the model which is denoted as $\ln P_i$ and $\ln P_j$ and σ being the elasticity of substitution between traded goods. This is the advanced form of gravity equation which incorporates theoretical foundations in the model. Moreover, this augmented model includes the variables such as common language, common border, common colonial history, land-lockness and isolation in addition to the multilateral resistance terms.

$$\ln X_{ij} = \alpha_0 * + \alpha_1 \ln Y_i + \alpha_2 \ln Y_j + \sum_{m=1}^{M} \alpha_m \ln z_{ij}^m + (1-\sigma) \ln P_i + (1-\sigma) \ln P_j + \varepsilon_{ij} \quad \text{…}\mathbf{(3)}^{\mathbf{11}}$$

with $\alpha_0 * = \ln \alpha_0;$

3.1. Predominant Econometric Issues in the Previous Studies

There are some common problems in earlier estimation of various forms of the gravity equation, which have made these results not the best in terms of econometric justifications. Some of these are highlighted below;

[9] The remoteness variable explains the average distance of country i from all trading partners other than j. Anderson (1979) explained that, after controlling for country size, bilateral trade flows are a function of the bilateral trade barrier relative to the average barrier of the two countries with all their partners.

[10] "t_{ij}"is used as a measure of bilateral trade barrier.

[11] Please see the complete derivation of the Gravity model in Helmers and Pasteels (2005).

1. In the cases where studies either used or drop zero values of the dependent variable in the log-log models reflect problems in both of the cases.[12] The log of zero violates the basic assumptions of Jensen's inequality. On the other hand, the dropping of zero values [as in Frankel 1997] or using Tobit estimator (IMp_{ijt}+1) as a dependent variable may also lead to biased and inconsistent estimates.[13]
2. Another disadvantage of a log-log gravity specification is that if zero values in the dependent variable are omitted, it may lead to unrealistically high values of distance elasticity in gravity models (Grossman, 1998). Furthermore, the exclusion of zero values eliminates observations for which this elasticity is low in absolute value, and it drives the overall elasticity upwards [Anderson and van Wincoop, 2003)].
3. Regarding the measurement of the regional trade policies[14], considering these as exogenous and randomly distributed, results in biased and inconsistent parameter estimates [Baier and Bergstrand (2005)][15].
4. In some studies, trade policy changes like tariff reduction simulations have been tested by applying the gravity model analysis. Generally, it is more appropriate to use the general equilibrium model, because the gravity model by construction does not capture the dynamic effects and cross industry linkages. Consequently, this may lead to under estimation of the impact of tariff on trade. Furthermore, the tariff simulation cannot be done with a sectoral gravity model, especially when the variable for tariff measure has endogeneity problem. However, the alternate exogenous tariff measure available in MacMap takes care of this endogenity issue and can be used for sectoral analysis.[16]
5. Further, Santos Silva and Tenreyro (2005) observed that heteroskedasticity is indeed a severe problem, both in the traditional gravity equation introduced by Tinbergen (1962), and in recent gravity equations such as suggested by Anderson and van Wincoop (2003) as well.

In order to address the above-mentioned issues and following Santos Silva and Tenreyro (2005), the study has used the *linear-log* form of the model and applies the Pseudo Maximum Likelihood Technique, which takes care of issue of zero values, trade policy measurement flaws and heteroskedasticity problems.

[12] Unlike actual gravitational force in physics, the bilateral trade may have zero values in economics. For instance, some countries do not trade with each other in certain time period such as Tajikistan and Togo did not trade in such time period, so here arise the problem of zero values of dependent variable [Santos and Tenreyro (2005)].
[13] For detailed discussion on the matter, please see Santos and Tenreyro (2005).
[14]The regional trade dummy is used in the binary form that takes the value 1 for member countries and 0 otherwise.
[15] Please see the details in Baier and Bergstrand (2005).
[16] The Market Access Map (MacMap) is a database developed by International Trade Centre, UNCTAD/WTO and it can be accessed at the following link. http://www.intracen.org/mas/mac.htm.

4. Data, Variables and Methodology[17]

The data used for the study is 2002-2003 average for all countries and it includes 132 exporting and 154 importing countries. It includes developed countries and the countries in transition both for exports and imports (list of countries is shown in the annexure Table: A2 & A3). So, the study is based on cross sectional data simulation estimates for finding the trade potential for the total 19 industry sectors. Broadly, these are defined as primary and secondary sectors, where a primary sector represents four sectors and secondary sector contains fifteen sectors. The key source of trade data is COMTRADE.[18]

The primary sector includes sectors such as (1) agriculture and hunting; (2) forestry and fishing (products); (3) mining and quarrying and; (4) petroleum.

Similarly, the secondary sector consists of (1) food, beverages and tobacco; (2) textiles, clothing and leather; (3) wood and wood products; (4) publishing, printing and reproduction of recorded media; (5) coke, petroleum products and nuclear fuel; (6) chemicals and chemical products; (7) rubber and plastic products; (8) non-metallic mineral products; (9) metal and metal products; (10) machinery and equipment; (11) electrical and electronic equipment; (12) precision instruments; (13) motor vehicles and other transport equipment; (14) other manufacturing; and (15) recycling.

The construction of some of the main variables is defined as under:

1. Contrary to the most of the previous studies, this study includes the *bilateral measure of market access* because the model itself is bilateral in construction. The previous studies used dummy variables to explain trade agreements, which result in problems of endogeneity and simultaneity.[19] Being bilateral in construction, this market access measure is free from these problems. The data has been obtained from bilateral database, MacMap (www.macmap.org), as explained in Bouet et al. (2001). This includes applied tariffs, specific duties, tariff quotas and anti-dumping duties.

2. In order to capture the *transport and transaction costs*, the study followed the approach of Loungani et al. (2002). So the distance[20] variable is constructed by using the great circle

[17] The author greatly acknowledges International Trade Center Market Analysis section and Helmers and Pasteels (2005) for sharing the variables and the data. Furthermore, the author of the study greatly appreciates the aforementioned institutions and persons for provision of their technical assistance in finding Pakistan specific sectoral results with the selected trading partners particularly with India and China.

[18] Please see the U.N. trade database at http://comtrade.un.org/db/.

[19] Baier and Bergstrand (2005) explain that dummy variables of regional agreements do not allow for the analysis of the sole impact of the trade agreement on trade, but instead it also capture adjacency effects and cultural factors.

[20] This data is available at CEPII (http://www.cepii.org/francgraph/bdd/distances.htm).

distance between *i's* and *j's* capital (or main) cities.[21] However, different economic centers were used such as New York and San Francisco for the USA and Montreal and Vancouver for Canada, respectively.

3. The *language variable* is constructed keeping in view the primary and secondary languages. Primary language stands for official and secondary accounts for the un-official common languages.[22] It takes the values ranging from 0, 0.25, 0.5 and 1. If the two countries share a common main language then it will take the values as 1, while if the two countries, *i* and *j*, share a common language, that is a main language in one country but a secondary language in the other then it takes the values as 0.5, if the two countries share a common second main language then it takes values of 0.25 and if they do not share any common language then the value will be 0.

4. The *conflict variable* has been constructed by following the definition, "the clashing of overlapping interests and positional differences on national values and issues such as independence, self determination and other international issues between countries and inter country, where a state must be party on one side". [23] The study incorporated 103 bilateral conflicts and used a conflict index taking into consideration both the duration and intensity, which ranges from 1 to 5. [24] The conflicts before 1990 are not taken into account and within the sample the index reflects the intensity of conflict between India and Pakistan, which takes the values 4, which is higher in intensity and magnitude.

5. Due to estimation of Gravity model at sector-level, the study needs sector-level specific production data instead of aggregate *GDP variable*. So, having several data availability problems especially for developing countries, the exporter and importer fixed effects have been used to take care off this sectoral unavailability of the GDP data problem.[25]

6. To test the possible lower trade in primary commodities such as agriculture among Southern hemisphere countries due to similar climatic conditions, the binary *variable of*

[21] For details see Helmers & Pasteels (2005).
[22] The information about the language variable is gathered through Exporters Encyclopedia 1998/99 and CIA World Factbook. The CIA web site link address is as following; http://www.cia.gov/cia/publications/factbook/.
[23] Civil wars not implying a third country are not captured by this variable, but should be taken account of - at least partially - by the fixed effects.
[24] The term conflict is defined as the clashing of overlapping interests (positional differences) around national values and issues. The conflict variable data is collected from Heidelberg Institute for International Conflict Research www.hiik.de.
[25] Actually at the sectoral level, it is not correct to work with GDP, one should use Production of the sector for country i and consumption of the sector for country j. While consumption can be reasonably proxied by GDP (rich countries will consume many cars), it is not the case for production (a rich country, say Kuwait, may not produce any car). Since we do not have enough countries with data on production, we have to do it differently. So, the fixed effects in following equation (4) capture both the price and production/consumption effect.

Southern hemisphere has been introduced. It takes the value 1 if both countries belong to the same area while 0 in other case. The information for constructing the variable is gathered from the CEPII database. [26]

7. According to Helpman et al. (2002) and Markusen (2000), the *FDI* may be another variable for determining the bilateral trade effects. However, FDI variable is not included in the study due to its limited availability on bilateral level across the sample countries. [27] Nonetheless, the multilateral resistance terms may explain part of the effect of FDI on trade.

4.1. Methodology

The study primarily follows the model specification used by Anderson and van Wincoop (2003) and Helmers & Pasteels (2005), which are especially designed to study the trade potential of developing countries and economies in transition. This model takes care of exporter and importer fixed effects in the form of resistance terms among the regressors in order to capture the individual countries' characteristics.

Hence, the final regression equation is as follows:

$$X_{ijk} = \gamma_i + \gamma_j + \alpha_0 + \alpha_1 \ln dis_{ij} + \alpha_2 \ln tariff_{jk} + \alpha_3 border_{ij} + \alpha_4 lang_j + \alpha_5 \ln conflict_{ij} + \alpha_6 geo_j + \varepsilon_{ij} \ldots \textbf{(4)}$$

Where:

i = exporting country;

j= importing country

k=sector

$X_{ij=}$ trade from country i to country j

dis_{ij}=distance between i and j

$border_{ij=}$ i and j are neighboring countries (=1) or not (=0)

$tariff_{ij}$= bilateral market access measure (for trade from i to j)

$lang_{ij}$= bilateral measure of common language

$conflict_{ij}$= bilateral measure of conflict

geo_{ij} = Bilateral measure of geographical location

$\gamma_i ; \gamma_j$ = Multilateral resistance terms in form of fixed effects.

[26] http://www.cepii.org/francgraph/bdd/distances.htm.

[27] Due to proximity trade-of, FDI is very likely to influence exports. Yet, due to this proximity trade-off, FDI is a function of transport costs and it may cause endogeneity problems in case of inclusion in the equation.

5. Estimation of Results

In order to get the empirical results, we estimated equation (4) following Santos Silva and Tenreyro (2005) and applied the *Pseudo Maximum Likelihood Technique* on the gravity equation to get the sectoral results. This approach takes care of heteroskedasticity as well as tackles the issue of zero values of the dependent variable. The study uses the linear-log-model and includes control variables such as common border, tariffs, common language, conflict and geographical location. Further, a multilateral resistance term in the form of importer and exporter fixed effects has been employed to capture the individual country's features. The estimated equation also includes entire dataset by each sector to optimally take into account sectoral specificities.

The regression results of the equation are as follows.

Firstly, the tariff to trade semi elasticities proved to be negative and high in case of all other sectors except *Mining & quarrying* and *Petroleum*, which indicates that tariffs are actually strongly hindering the export flows in the majority of the sectors other than the two exceptions mentioned before.[28]

Secondly, the results in the case of distance variable for all sectors are negative and are in line with the theory and expectations.[29]

Thirdly, the overall equation (4) exhibits that conflicts seem to put forth a non-negligible negative influence on exports in a number of sectors. As one would expect, bilateral exports of Petroleum and Motor vehicles and other transport equipment are most affected by bilateral conflicts.[30]

Fourthly, the language variable depicts a clear positive impact of two countries sharing a common language on trade.

Last but not least, the common border variable also shows expected positive sign for all sectors.

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[28] However, the positive results in the case of *Mining and quarrying* and *Petroleum* may be justified on the grounds as the exports of these two sectors depend heavily on the presence of the corresponding natural abundant resources in a given country and not on factors, such as tariffs.

[29] These ranges between –0.585 for Mining & quarrying and –1.093 for coke, petroleum products and nuclear fuel.

[30] The positive signs that show up for some sectors are statistically not meaningful with the exception of Textiles, clothing and leather.

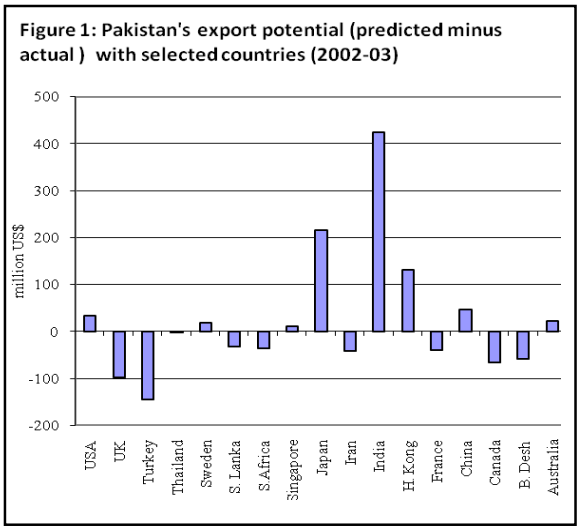
The variable Southern hemisphere provides negative impact on selected primary sectors like Agriculture & Hunting and Forestry and Fishing suggesting that there is no need for the exchange of alike primary agricultural products among countries exhibiting very similar climatic production conditions.[31]

Furthermore, in order to reach country specific and sector specific results, separate regression equations are estimated for all the 19 sectors in the sample. Further, for each exporting country i and importing country j, we calculated the predicted values of export potentials those are equivalent to within-sample predictions. The study includes fixed effects in estimation in order to capture the country specific features.[32] The results for the entire dataset and the restricted sample are displayed in the tables of Annexure A5 & A6.

Finally, we discuss the selected results for Pakistan with some key trading partners on aggregate level and with China and India at sectoral level. These sector specific results incorporate the tariff measure applied by the importing country on the same sectoral level. So, the analysis reflects single sectors export potential picture in the following sections.

5.1. Overall Export Potential

Based on the application of gravity model improved methodology and with a larger cross sectional dataset, the results provide estimates of trade potential for Pakistan with selected trading partners (Figure 1& Table A4). The model identifies trade potentials with India, Japan, Hong Kong, China, USA, Singapore, Sweden and Australia; whereas Pakistan is exporting either close to or in some cases above the trade potentials with rest of the selected countries such as UK, Turkey, Thailand, Sri Lanka, Iran, France, Canada and Bangladesh.[33]



[31] The impact of Southern hemisphere on the entire sample is not statistically significant. Hence, for the calculation of export potentials, which is explained in the following section, we only take account of the geographical measure for the two sectors concerned.
[32] Any change in the model or sample specification may produce different results.
[33] In case where there is a trade more than the potential, it means that controlling for other variables, the trade capacity is exhausted in terms of factors such as distance and the size of the economy.

However, these estimates are based on some values for control variables (common border, tariffs, common language, conflict and geographical location etc) prevailing in 2002 and 2003. Indeed, any change in these variables (say reduction in tariff or resolution of conflict) is likely to change the estimates of the trade potential.

5.2. Export Potential with India[34]

In addition to the global (aggregate) results presented above, the study also estimated the sectoral export potential with India. The results identify significant scope for expanding trade between these two countries. At the hindsight, the *true* trade potential would have been far greater had these countries not imposed tariff and non-tariff barriers on each other or did not engage in conflict.[35]

A sectoral level analysis for trade potential between India and Pakistan reveals that overall scope for export expansion exists in 13 out of 15 sectors. More specifically, the sectors such as (1) *textiles, clothing and leather products* (US$ 309.5 million); (2) *food, beverages and tobacco* (US$ 86.2 million); and (3) *chemicals and chemical products* (US$ 21.3 million) (**Table 1)** reflect significant import demand for the Pakistani products even in the presence of high tariff rates.

The other sectors such as (1) *forestry and fishing*, (2) *other manufacturing*, (3) *machinery and equipment*, (4) *mining and quarrying*, (5) *precision instruments* (6) *recycling instrument* and (7) *electrical and electronic equipment* etc. hold a moderate level of trade potential.[36] In this regard, it is interesting to note that both the countries despite being members of SAPTA in the past were unable to bring the average tariff rates to a competitive level as it exists in other regional and bilateral trade pacts such as EU and ASEAN. In the case of ASEAN, in most of the instances the applied average tariff rates are below 10 percent for the other member countries in majority of products.[37]

In the case of *forestry and fishing* and *mining and quarrying* the average tariff rates were quite competitive (around 13 percent). Pakistani exporters can focus on these areas and can explore the bigger market in the respective sectors.

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[34] The exports potential are based on the applicable tariff rates, gravity specification employed and the sample specification in 2002-03. Currently, the potentials may be different due to various recent developments during 2003-07 between Pakistan and India.

[35] This statement is reinforced by the regression results where conflict variable has shown significant and more pronounced negative effect in the case of these two countries.

[36] In this regard, a product level analysis may further unleash various landmarks in these sectors; however, this model is only focusing on the sectoral level aspects. Thus, in future there is a need to conduct further research at a product level so that the disaggregated level analysis can be used for policy purposes.

[37] For further tariff details, please see the market Access Map at http://www.macmap.org.

Table 1: Pakistan's Export Potential With India (2003)

thousands US$

	Sector	Actual	Actual exports share in total exports of sector (percent)	Total export of sector	Predicted	Predicted exports share in total exports of sector (percent)	Export Potential (predicted-Actual)	Protection (average tariff)
		1	2=(1/3)*100	3	4	5=(4/3)*100	6=4-1	7
	Total	91,988	0.9	10,194,324	515,798	5.1	423,811	
1	Coke, petroleum products and nuclear fuel	38,921	36.9	105,356	14,268	13.5	-24,653	25-30
2	Agriculture and hunting	32,611	12.5	261,624	23,311	8.9	-9,301	30-35
3	Textiles, clothing and leather	10,650	0.1	8,264,294	320,174	3.9	309,525	30-35
4	Chemicals and chemical products	2,888	1.2	245,460	24,241	9.9	21,353	15-20
5	Food, beverages and tobacco	1,944	0.3	632,536	88,156	13.9	86,213	30-35
6	Wood and wood products	786	1.9	42,378	2,952	7.0	2,167	25-30
7	Forestry and Fishing (products)	738	2.2	33,313	8,898	26.7	8,159	10-15
8	Other manufacturing	673	0.2	359,065	5,777	1.6	5,104	30-35
9	Rubber and plastic products	510	2.4	21,556	2,603	12.1	2,093	25-30
10	Machinery and equipment	469	0.9	51,017	3,889	7.6	3,420	25-30
11	Mining and quarrying	432	1.9	23,032	10,381	45.1	9,949	10-15
12	Precision instruments	405	0.3	117,726	5,738	4.9	5,334	20-25
13	Publishing, printing and reproduction of recorded media	396	4.3	9,155	1,366	14.9	969	30-35
14	Recycling	184	3.3	5,612	3,299	58.8	3,115	30-35
15	Electrical and electronic equipment	184	0.8	22,201	745	3.4	561	10-15

Sources: COMTRADE, Market Access Map and author's calculations.

On the other hand, Pakistani exporters were capturing more than their potentials in sectors such as (1) *coke, petroleum products and nuclear fuel*, and (2) *agriculture and hunting*. These sectors, despite high average tariff rates of around 30 and 32.1 percent, were competitive and were able to export 36.9 percent and 12.5 percent of total of sector exports in these categories respectively.

In sum, though common border facilitates trade between two countries, the degree of protection and nature of relationship shape the trade pattern. Currently, India and Pakistan maintain a high level of protection against imports from each other. However, the expected possible reduction in both tariff and non-tariff barriers (following the softening up of the strained relationship and full implementation of SAFTA), may lead to expansion in the trade between these two countries.

5.3. Export Potential with China[38]

Pakistan's trade with China is standing at US$ 4.1 billion in FY07. Although trade with China is rising sharply yet the balance remains overwhelmingly in favor of China.[39] The Chinese exports amounted to $3.53 billion compared to Pakistan's US$575.9 million in FY07. Keeping in view, the China's potential as a major emerging economic power, which has total annual exports of US$ 1.22 trillion and import of US$ 955.8 billion from the World during FY07, it is imperative to try to plug into gigantic Chinese import market and improve the bilateral trade balance for Pakistan.[40]

Our sectoral results, based on the gravity model, indicate a reasonable sectoral export potential for Pakistani exports to China. The total Pakistani export may be US$ 431.3 million and hence exhibit a potential US$ 46.4 million for the major categories during 2002-03 (Table 2).

Table 2: Pakistan's Export Potential With China (2003)

Thousands US $

	Sector	Actual	Actual exports share in total exports of sector (percent)	Total export of sector	Predicted	Predicted exports share in total exports of sector (percent)	Export Potential (predicted -Actual)	Protection (average tariff)
		1	2=(1/3)*100	3	4	5=(4/3)*100	6=4-1	7
	Total	384,866	3.7	10,372,023	431,339	4.2	46,473	
1	Textiles, clothing and leather	313,249	3.8	8,264,294	293,535	3.6	-19,714	18.14
2	Chemicals and chemical products	26,280	10.7	245,460	24,576	10.0	-1,705	7.46
3	Food, beverages and tobacco	16,143	2.6	632,536	29,770	4.7	13,627	24.85
4	Mining and quarrying	10,018	43.5	23,032	2,348	10.2	-7,670	1.57
5	Petroleum	7,523	12.5	60,338	3,129	5.2	-4,394	0.00
6	Agriculture and hunting	2,976	1.1	261,624	34,774	13.3	31,798	7.25
7	Wood and wood products	2,692	6.4	42,378	5,968	14.1	3,275	6.00
8	Forestry and Fishing (products)	1,657	5.0	33,313	6,161	18.5	4,504	5.16
9	Rubber and plastic products	1,345	6.2	21,556	1,113	5.2	-232	15.88
10	Other manufacturing	983	0.3	359,065	9,691	2.7	8,709	12.08
11	Metal and metal products	732	1.1	66,449	6,953	10.5	6,221	9.96
12	Motor vehicles and other transport equipment	516	2.5	20,737	1,304	6.3	789	16.66
13	Non-metallic mineral products	466	1.5	30,177	2,145	7.1	1,679	18.36
14	Precision instruments	180	0.2	117,726	9,419	8.0	9,239	6.35
15	Publishing, printing and reproduction of recorded media	41	0.4	9,155	452	4.9	412	2.83

Sources: COMTRADE, Market Access Map and author's calculations.

[38] The exports potential are based on the applicable tariff rates, gravity specification employed and the sample specification in 2002-03. Currently, the potentials may be different due to recent developments such as enactment of Free Trade Agreement on 24th November, 2006 between Pakistan and China.

[39] During 2000-03 and 2003-07, Pakistani exports to China grew by 35.9 percent and 135 percent, respectively. While the Pakistani imports from China surged from 78.1 percent and 320.9 percent, respectively.

[40] Source: International Financial Statistics, IMF at http://www.imfstatistics.org/imf/.

As far as the sectoral export potential is concerned, the model reveals a sizeable potential for Pakistani exports predominantly in the sectors such as *Agriculture and hunting (US $ 31.7 million)* and *Food, beverages and tobacco (US$ 13.6 million).* These are the sectors where Pakistan has sizeable edge and further opportunities may be explored by going for the product level markets. The agriculture and hunting sector is also enjoying the favorable tariff rates of around 5-10 percent. However, the applicable tariff rates in the food, beverages and tobacco sector remain in the higher range of 20-25 percent in 2002-03.

Other than these leading major potential sectors, the items like o*ther manufacturing* and *precision instruments* followed with a moderate potential of US$8.7 million and US$ 9.2 million, respectively. Furthermore, the *metal and metal products* have an export potential US$6.2 million. Accordingly, these sectors also need disaggregated analysis to find additional opportunities in the particular areas.

In addition to this, *forestry and fishing (products)* and *wood and wood products* have modest export potential of US$ 4.5 million and US$ 3.2 million, respectively. It is encouraging to note that there exists a lower protection rate in these sectors for Pakistani exporters.

However, trade potential for the sectors such as *non-metallic mineral products* (US$ 1.6 million), *motor vehicles and other transport equipment* (US$ 0.789 million) and *publishing, printing and reproduction of recorded media* (US$ 0.452 million) exhibit a relatively trivial potential market for the Pakistani exporters.

Contrary to the above mentioned results, Pakistani exports are exhausting their potential in the categories like (1) *Textile, clothing & leather;* (2) *Chemicals and chemical products;* (3) *mining and quarrying;* (4) *Petroleum* and; (5) *Rubber and Plastic Products*. These results based on the natural factors indicate that these sectors are performing well.

In the overall analysis, there is encouraging element regarding the level of protection on the Pakistani exports to China as compared to India. In the case of the former, the tariff rates are much lower in most of the sectors. The maximum tariff rate is ranging between 20-25 percent for *food, beverages and tobacco* sector, followed by 15-20 percent tariff for the sectors such as *textile, clothing & leather; motor vehicles and other transport equipment; and non-metallic mineral products*. However, the tariff in other sectors is standing at moderate level. The prevailing lower tariff rates are providing incentive for the Pakistani exporters to expand their trade potentials in the respective sectors where there exist high untapped potentials.

In nutshell, the natural factors such as common border and geographical proximity may further play its role in harnessing the existing trade potentials. Besides, it is expected that the enactment of Pakistan and China Free Trade Agreement will further slash the tariffs in the various sectors and would enhance the incentives for Pakistani exporters in the Chinese market.

6. Conclusion

The study obtained the results by using the Gravity Model Analysis and applying the *Pseudo Maximum Likelihood Technique*, which deals with most of the existing estimation problems in the Gravity Literature. In order to ensure the maximum coverage and get the unbiased results, the study includes the cross section data for 2002-03 and covers 132 exporting and 154 importing countries.

The estimates for Pakistan's global export potential indicate a higher magnitude of export potential with India, Japan, Hong Kong, China, USA, Singapore, Sweden and Australia. On the other hand, the export potential with the UK, Turkey, Thailand, Sri Lanka, Iran, France, Canada and Bangladesh exceeded the export potential based on the results of the natural factors.

The sectoral level results suggest that there exists sizeable trade potentials for Pakistani exporters in the Indian markets. 13 out of 15 sectors exhibit the existence of additional export potential while only two namely *coke, petroleum products and nuclear fuel* and *Agriculture and hunting* sector are already exceeding their potential.

Pakistan's sectoral export potential with China also found promising in 10 out of 15 sectors. The sector such as *agriculture and hunting*; *food, beverages and tobacco*; *precision instruments*; *other manufacturing;* and *metal and metal products* explain greater potential untapped opportunities. Contrary to this, the sectors such as *textiles, clothing and leather*; *mining and quarrying*; c*hemicals and chemical products*; and *petroleum* suggest that Pakistan, based on its natural factors, is exporting more than its existing potential.

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Annexure

Table A1: World merchandise exports by region and selected economy

	1948	1953	1963	1973	1983	1993	2003	2006
					Value (billion US$)			
World	**59**	**84**	**157**	**579**	**1838**	**3675**	**7371**	**11783**
					Share (%)			
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
North America	**28.10**	**24.80**	**19.90**	**17.30**	**16.78**	**18.01**	**15.78**	**14.24**
United States	21.65	18.83	14.90	12.31	11.19	12.65	9.83	8.81
Canada	5.47	5.23	4.32	4.56	4.18	3.95	3.70	3.31
Mexico	0.95	0.71	0.63	0.39	1.41	1.41	2.24	2.13
South and Central America	**11.30**	**9.70**	**6.40**	**4.30**	**4.40**	**2.97**	**2.97**	**3.65**
Brazil	2.02	1.84	0.90	1.07	1.19	1.05	0.99	1.17
Argentina	2.78	1.34	0.87	0.56	0.43	0.36	0.40	0.40
Europe	**35.10**	**39.40**	**47.80**	**50.90**	**43.49**	**45.37**	**45.94**	**42.12**
Germany *a*	1.35	5.26	9.29	11.65	9.22	10.34	10.20	9.44
France	3.44	4.79	5.23	6.32	5.17	6.03	5.32	4.16
United Kingdom	11.29	8.98	7.81	5.11	4.99	4.94	4.15	3.80
Italy	1.84	1.80	3.22	3.83	3.97	4.61	4.06	3.48
Commonwealth of Independent States (CIS) *b*	**-**	**-**	**-**	**-**	**-**	**1.51**	**2.64**	**3.61**
Africa	**7.32**	**6.49**	**5.65**	**4.82**	**4.46**	**2.53**	**2.39**	**3.08**
South Africa *c*	2.00	1.65	1.50	1.05	1.01	0.66	0.50	0.50
Middle East	**1.98**	**2.71**	**3.22**	**4.08**	**6.82**	**3.52**	**4.10**	**5.48**
Asia	**14.00**	**13.40**	**12.50**	**14.90**	**19.08**	**26.08**	**26.17**	**27.82**
China	0.89	1.22	1.29	1.01	1.21	2.50	5.95	8.22
Japan	0.44	1.52	3.47	6.38	8.00	9.86	6.40	5.52
India	2.21	1.31	1.04	0.50	0.50	0.59	0.80	1.02
Pakistan	**0.27***	**0.53**	**0.30**	**0.14**	**0.15**	**0.19**	**0.15**	**0.14**
Australia and New Zealand	3.70	3.19	2.37	2.10	1.39	1.45	1.18	1.24
Six East Asian traders	3.37	3.00	2.40	3.39	5.78	9.66	9.61	9.63
Memorandum item:								
EU *d*	-	-	27.50	38.61	30.40	36.10	42.38	38.47
USSR, former	2.21	3.52	4.63	3.70	4.97	-	-	-
GATT/WTO Members *e*	60.40	68.70	72.80	81.80	76.50	89.50	94.30	93.90

Source: International Trade Statistics 2007, WTO

a : Figures refer to the Fed. Rep. of Germany from 1948 through 1983.
b: Figures are significantly affected by i) changes in the country composition of the region and major adjustment in trade conversion factors between 1983 and 1993; and ii) including the mutual trade flows of the Baltic States and the CIS between 1993 and 2003.
c: Beginning with 1998, figures refer to South Africa only and no longer to the Southern African Customs Union.
d: Figures refer to the EEC(6) in 1963, EC(9) in 1973, EC(10) in 1983, EU(12) in 1993, and EU(25) in 2003 and 2006.
e: Membership as of the year stated.
*: approximate number.
Note: Between 1973 and 1983 and between 1993 and 2003 export shares were significantly influenced by oil price developments.

Table A2: List of Sample of Exporting Countries

Albania, Algeria, Andorra, Argentina, Armenia, Australia, Austria, Azerbaijan;
Belgium, Benin, Burkina Faso, Bangladesh, Bulgaria, Bahamas, Bahrain, Bosnia and Herzegovina, Belize, Bolivia, Botswana, Brazil, Barbados, Brunei Darussalam, Bhutan;
Central African Republic, Canada, Chile, China, Colombia, Cape Verde, Costa Rica, Cuba, Croatia, Cyprus, Czech Republic; Dominica, Denmark; Dominican Republic;
Ecuador, El Salvador, Estonia, Ethiopia;
Finland, Fiji, France ;
Gabon, Gambia, Germany, Georgia, Guinea, Greece, Guatemala, Guyana;
Hong Kong, Honduras, Hungary;
Indonesia, India, Ireland, Iran (Islamic Republic of), Iceland, Israel, Italy;
Jamaica, Japan, Jordan;
Kazakhstan, Kenya, Kyrgyzstan, Korea (Republic of), Kuweit;
Latvia, Lebanon, Lithuania;
Macedonia, Mali, Malta, Morocco, Republic of Moldova, Madagascar, Mexico, Mongolia, Mauritius, Malawi, Malaysia;
Namibia, Niger, Nigeria, Nicaragua, Nepal, Netherlands, Norway, New Zealand;
Pakistan, Panama, Paraguay, Peru, Philippines, Papua New Guinea, Poland, Portugal;
Qatar;
Romania, Russia, Rwanda;
Saudi Arabia, Senegal, Serbia and Montenegro, Singapore, Slovakia, Slovenia, South Africa, Spain, Sudan, Sweden, Switzerland, Syria;
Tanzania, Taiwan, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan;
Uganda, Ukraine, United Kingdom, Uruguay, USA;
Venezuela; Zambia, Zimbabwe;

Table A3: List of Sample of Importing Countries

Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Australia, Austria, Azerbaijan;
Belgium, Benin, Burkina Faso, Bangladesh, Bulgaria, Bahrain, Bahamas, Bosnia and Herzegovina, Belize, Bolivia, Brazil, Barbados, Brunei Darussalam, Bhutan, Botswana, Burundi;
Cambodia, Cameroon, Central African Republic, Canada, Chile, China, Colombia, Congo (Democratic Republic of), Chad, Costa Rica, Côte d'Ivoire, Croatia, Cuba, Cyprus, Czech Republic;
Djibouti, Dominica, Denmark, Dominican Republic;
Ecuador, El Salvador, Egypt, Estonia, Ethiopia, Equatorial Guinea;
Finland, France ;
Gabon, Germany, Georgia, Ghana, Greece, Guatemala, Guinea-Bissau, Guyana;
Hong Kong, Honduras, Hungary;
Indonesia, India, Ireland, Iran (Islamic Republic of), Iceland, Iraq, Israel, Italy;
Jamaica, Japan, Jordan;
Kazakhstan, Kenya, Kyrgyzstan, Korea (Republic of), Korea (Democratic Republic of), Kuwait;
Laos, Latvia, Lebanon, Lesotho, Lithuania, Libya;
Macedonia, Maldives, Mali, Malta, Mauritania, Morocco, Republic of Moldova, Madagascar, Mexico, Mauritius, Malawi, Malaysia, Mozambique, Myanmar;
Namibia, Nepal, Niger, Nigeria, Nicaragua, Netherlands, Norway, New Zealand;
Pakistan, Panama, Paraguay, Peru, Philippines, Papua New Guinea, Poland, Portugal;
Qatar;
Romania, Russia, Rwanda;
Saint Lucia, Saint Vincent and the Grenadines, Saudi Arabia, Senegal, Serbia and Montenegro, Singapore, Slovakia, Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, Sudan, Suriname, Sweden, Switzerland, Syria;
Tajikistan, Tanzania, Thailand, Togo, Turkmenistan, Trinidad and Tobago, Tunisia, Turkey;
Uganda, Ukraine, United Kingdom, Uruguay, USA, Uzbekistan;
Venezuela, Viet Nam;
Yemen;
Zambia, Zimbabwe;

Table A4: Pakistan's Export Potential with Partners (2002-03)

million US$

	Actual	Predicted	Export Potential
	1	2	(2-1)
USA	2,822	2,856	34
UK	884	787	-98
Turkey	197	51	-146
Thailand	73	72	-1
Sweden	68	87	19
S. Lanka	86	54	-32
S.Africa	96	59	-37
Singapore	99	111	12
Japan	137	352	215
Iran	89	48	-41
India	92	516	424
H. Kong	554	684	130
France	361	322	-39
China	385	431	46
Canada	184	117	-67
B. Desh	152	93	-59
Australia	123	146	22

Sources : COMTRADE and author's calculassions.

Table A5: Regression results for Primary sectors

Variables	Primary Sector			
	P1	**P2**	**P3**	**P4**
ln tariff	-6.035	-3.897	8.609	11.001
	(-0.04)	(-0.45)	(-0.39)	(0.00)
ln distance	-0.934	-1.09	-0.585	-0.908
	(0.00)	(0.00)	(0.00)	(0.00)
ln conflict	-0.134	-0.349	0.052	-3.191
	(-0.57)	(-0.14)	(-0.89)	(-0.04)
Bilateral measure of common language	0.359	0.662	0.354	1.246
	(0.00)	(0.00)	(-0.31)	(0.00)
Common border dummy variable	0.486	0.801	0.655	1.187
	(0.00)	(0.00)	(-0.01)	(0.00)
Bilateral measure of Southern hemisphere	-0.815	-0.437	..	..
	(0.00)	(-0.10)		
Pseudo R^2	0.89	0.89	0.81	0.87

Note: Pr>|z| in parenthesis

Number of observations for all sectors: 20356

Sectoral Codes and their Explanations

P1	Agriculture and hunting
P2	Forestry and Fishing (products)
P3	Mining and quarrying
P4	Petroleum

Table A6: Regression results for Secondary sectors

Variables	Secondary Sectors Results														
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15
ln tariff	-4.31	-16.3	-19.9	-20.84	-2.42	-7.36	-26.8	-12.9	-17	-16.5	-3.4	-11	-8.24	-13.4	-38.7
	(0.00)	(0.00)	(0.00)	(0.00)	(-0.38)	(-0.06)	(0.00)	(0.00)	(0.00)	(0.00)	-0.67	(0.00)	-0.01	(0.00)	-0.01
ln distance	-0.79	-0.76	-0.93	-0.889	-1.09	-0.85	-0.86	-0.88	-0.84	-0.7	-0.74	-0.65	-0.75	-0.65	-0.8
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ln conflict	0.138	0.384	-0.36	-0.806	-0.18	-0.13	-0.18	0.098	0.061	-0.05	-0.28	-0.05	-0.81	-0.42	0.474
	(0.39)	(0.04)	(0.13)	(0.00)	(-0.51)	(-0.44)	(-0.21)	(-0.45)	(-0.66)	(-0.7)	(-0.02)	(-0.82)	(0.00)	(-0.08)	(-0.23)
bilateral measure of common language	0.736	0.881	0.558	1.079	0.468	0.317	0.658	0.672	0.409	0.59	0.51	0.412	0.218	0.489	0.258
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(-0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	-0.06	(0.00)	-0.34
common border dummy variable	0.509	0.217	0.526	0.681	0.865	0.174	0.586	0.733	0.653	0.392	0.362	0.085	0.62	0.661	1.234
	(0.00)	-0.02	(0.00)	(0.00)	(0.00)	-0.04	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	-0.49	(0.00)	(0.00)	(0.00)
Pseudo R^2	0.91	0.93	0.95	0.93	0.84	0.95	0.96	0.94	0.93	0.96	0.96	0.96	0.96	0.94	0.88

Note: Pr>|z| in parenthesis

Number of observations for all sectors: 20356

Sectoral Codes and their Explanations

S1	Food, beverages and tobacco	S9	Metal and metal products
S2	Textiles, clothing and leather	S10	Machinery and equipment
S3	Wood and wood products	S11	Electrical and electronic equipment
S4	Publishing, printing and reproduction of recorded media	S12	Precision instruments
S5	Coke, petroleum products and nuclear fuel	S13	Motor vehicles and other transport equipment
S6	Chemicals and chemical products	S14	Other manufacturing
S7	Rubber and plastic products	S15	Recycling
S8	Non-metallic mineral products		