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# Intra-Industry Trade: The Pakistan Experience

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**Abstract** The simultaneous exports and imports of a product within country or a particular industry called intra-industry trade (IIT) or two-way trade. In the recent years, the government of Pakistan had realized factors to liberalize the international trade. The literature of international economics demonstrates that this condition (trade liberalization) induces the IIT. The case study for Pakistan has been negligence in the economic literature. This manuscript analyses the Pakistan's intra-industry (IIT) during the period 1980-2006. This study uses country-specific characteristics as explanatory variables. The results indicate that IIT is a negative function of the difference in GDP per capita between Pakistan and their trade partners. Statistically strong evidence is also found that this trade is influence by the similar demand. We also introduce an economic dimension; this proxy confirms the positive effects of IIT. This result reveals the importance of scales economies and the variety of differentiated products. Our results also confirm the hypothesis that trade increases if the transportation costs decrease.

*JEL Classifications*: F12, C20

## 1. Introduction

One of the most important in post-World War II, especially trade in manufactured goods, has been the growth of intra-industry trade. These contrasts with inter-industry trade (comparative advantages), which involves countries exchanging products of different industries.

When the intra-industry trade was first observed in the 1960s by Verdoorn (1960), Balassa (1966), the authors realized the revolution in economics, there was specialization within industries and two-way international trade. These authors became aware that certain developed countries exported and imported in the same product categories. This phenomenon occurred in the years following of European Economic Community (EEC). Grubel and Lloyd (1975) developed the most popular index for measurement of intra-industry trade, i.e the simultaneous export and import of products in the same product categories.

Helpman and Krugman (1985) synthesized the various attempts to model IIT. The tests of theoretical models of intra-industry emerged with Helpman (1987). This author analyzed the OECD countries and tests some hypotheses of the model of Helpman and Krugman (1985). His results were according to the theory.

Hummels and Levinsohn (1995) continued the work of Helpman (1987). The authors analyzed the results for all OECD countries and then extending to test non-OECD countries with panel data. Hummels and Levinsohn (1995) used the estimators OLS, Fixed Effects and Random Effects. The results have questioned at least partially, the findings obtained by Helpman (1987).

Many empirical studies of IIT have focused on IIT between developed countries. Trade between developed versus developing countries is usually explained based on the Heckscher-Ohlin theorem.

There are some empirical studies of IIT between developed countries and developing countries (see Tharakan, 1986, Balassa and Bauwens, 1987).

The pioneering models in IIT are due to Krugman (1979), Lancaster (1980) and Helpman (1981), Eaton and Kierzkowski (1984), and Helpman and Krugman (1985). All these models consider that products are differentiated and emphasize the imperfect competition in industrial markets, particularly the scale economies and industrial concentration.

Pakistan adopted commercial policy reforms to promote regional trade. Like other developing economies Pakistan was also followed import-substitution policy for industrialization that was highly supported by high tariff rates, import quotas and overvaluation of exchange rate.
Pakistan has joined two regional-trading blocks i.e. South Asian Association for Regional Cooperation (SAARC) and other is the Economic Cooperation Organization (ECO). The intra-industry trade between ECO and SAARC is very incipient (Kemal, 2004).

This paper tests the determinants of intra-industry trade (IIT) between Pakistan and the main ten trade partners (United States, United Kingdom, Japan, Germany, Saudi-Arabia, Canada, France, Italy, Netherlands, and Norway) using an unbalance panel for the period (1980-2006).

Our study demonstrates that IIT occurs more frequently among countries with similar levels of demand. It is still possible to conclude that the sizes of the markets are an important determinant. The geographical distance and the trade imbalance are according to the theoretical predictions. The same is with the geographical distance and the trade imbalance.

## 2. Literature Review

International trade patterns are traditionally explained by the Heckscher-Ohlin (HO) model, which predicts that a particular country will exports the products that use its relatively abundant factor intensively and imports the products that use its relatively less abundant factor intensively.

According to the HO model, similar countries have little reason to trade, particularly if the is in similar products. The IIT literature began in 1960s when Balassa (1966) analyzed the within industries of customs union in Europe. Grubel and Lloyd (1975) introduced a comprehensive index to measure IIT. The pioneering works on IIT (Krugman, 1979, 1980, 1981; Lancaster, 1980; Helpman, 1981) exclude the idea that traditional theories could explain IIT.

The basic structure of horizontal IIT models is that products are not differentiated by the quality, but the attributes (Krugman, 1979; Lancaster, 1980; Helpman, 1981; Brander and Krugman, 1983; Eaton and Kierzkowski, 1984). Krugman (1979) consider that consumers have similar preference (Neo-Chamberlinian models).

The model of Krugman (1979) demonstrates that IIT occurs between identical economies (geographical proximity). The model of Lancaster (1980), called "Neo-Hotelling model" shows that consumers have a preference map, i.e. "ideal variety".

Brander and Krugman (1983) demonstrated that is possible to explain IIT with Cournot style. The authors incorporate transport costs and the reciprocal dumping. Following Lancaster model, Eaton and Kierzkowski (1984) explain that IIT is determined by the prices and the distance between the product spectrums.

In vertical IIT models, the quality is assumed to be directly related to the capital-labour ratio. A capital-rich country is likely to produce higher-quality products; while a labour-rich country is likely to produce lower- quality products.

The Neo Heckscher-Ohlin model of vertical IIT (Falvey, 1981, and Falvey and Kierzkowski, 1985), the capital endowment is assumed to be industry- specific with at least one sector producing differentiated products in terms of quality (vertical differentiated product). According to Falvey and Kierzkowski (1985) the unequal income is assuming a source of the demand for variety of vertically differentiated products, a larger difference in income will increase the share of vertical IIT.

Shaked and Sutton (1984) explained the VIIT with the "natural oligopoly". The quality is associated on fixed costs. Demand for each quality of the product depends on the distribution of income. Firms face three-part decision process – entry, quality and price. The second stage involves the sunk cost of research and development.

Only a few empirical studies analyze one industry-specific of intra-industry trade (see for example Clark, 2006, Wakasugi, 2007, Leitão and Faustino, 2009, and Yoshida, Leitão and Faustino, 2009). The studies of Clark, 2006, Wakasugi, 2007 and Leitão and Faustino, 2009 show the importance of fragmentation.

The study of Clark (2006) demonstrated that globalisation will continue to reinforce the idea that there are places more efficient (i.e with low production costs) and that is linked with vertical specialization. Clark used a Tobit and Probit specifications at a country and industry level.

Wakasugi (2007) constructed an index of vertical intra-industry trade to measure the fragmentation of production, The author used a gravity model and analysed the impact of VIIT in East Asia, NAFTA, and European Union. Wakasugi (2007) concluded that fragmentation increased with intra-industry trade.

The study of Leitão and Faustino (2009) examines the determinants of intra-industry trade in the automobile component sector in Portugal. This manuscript considers Portuguese trade in automobile sector between European Union (EU-27), the BRIC (Brazil, India and China), and United States between 1995 and 2006. The authors using a panel data (static and dynamic panel data: GMM-System). This study concludes that IIT occurs more frequently among countries that are similar endowments. Leitão and Faustino (2009) also show that trade increases if the transportation costs decrease.

Yoshida, Leitão and Faustino (2009) consider the vertical intra-industry trade (VIIT) between

Japan and Various European countries. The authors conclude that IIT between European countries and Japan increases with their corresponding Japanese FDI (foreign direct investment), especially for new EU member countries.

Havrlsyshyn and Kunzel (1997) analyzed the intra-industry trade of Arab- countries. The authors concluded that Arab –region overall does not have highly advanced industrial base, with an average IIT index of 0.25 for the period 1992-1994.

## 3. Measurement of Intra-Industry Trade

The level of IIT is generally measured by the so-called Grubel and Lloyd (1975) index. They defined IIT as the difference between the trade balance of industry *i* and the total trade of this same industry. In order to make the comparison easier between industries or countries, the index is presented as a ratio in which the denominator is total trade.

$$IIT_i = 1 - \frac{|X_i - M_i|}{(X_i + M_i)} \Leftrightarrow IIT_i = \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \quad (1)$$

The index is equal to 1 if all trade is of the intra-industry trade type. If IIT is equal to 0, all trade is inter-industry trade.

## 4. Econometrical Model

Following the literature our study applies a gravity equation with panel data. The dependent variable used is intra-industry trade (*IIT*). The data for the explanatory variables is sourced from the World Bank, World Development Indicators (2008). The source has used for the dependent variable is Federal Bureau of Statistics[1] (FBS).

### 4.1. Explanatory Variables

In accordance with the theory, we have chosen the following explanatory variables:

-Economic differences between countries (DGDP): this is difference in GDP (PPP, incurrent international dollars) between Pakistan and the partner country. Loertscher and Wolter (1980) suggest a negative sign for the IIT model. Linder (1961) considers that countries with similar demands will trade similar products. Hummels and Levinshon (1995) and Greenaway et al. (1994) found a negative sign. The study of Turkcan (2005) also found a negative sign. Recent study Ferto and Soós (2008), and Leitão and Faustino found a positive sign.

-MinGDP: this is the lowest value of GDP per capita (PPP, in current international dollars) between Pakistan and the partner country. This variable is included to control for relative size effects. According to Helpman (1987) and Hummels and Levinshon (1995), a positive sign is expected, which is consistent with the hypothesis of a negative correlation between the share of IIT and dissimilarity in per-capita GDP.

- MaxGDP: this is the higher/highest value of GDP per capita (PPP, in current international dollars) between Pakistan and the partner country. This variable is also included to control for relative size effects. A negative sign is expected, as in Helpman (1987), Hummels and Levinshon (1995)

and Greenaway et al. (1994). A negative sign is consistent with the hypothesis that the more similar countries are in economic dimension, the greater the IIT between them.

- DIM: is the average of GDP per capita between Pakistan and the partner country. Usually the studies utilized this proxy to evaluate the potential economies of scales and the variety of differentiated product. Umemoto (2005) found a positive sign. The study of Leitão and Faustino (2009) also found a positive sign to Portuguese case.

-DIST: this is the geographical distance between the Pakistan and the partner country. Balassa (1986) argues that IIT will be greater when trading partners are geographically close. A longer distance will increase the transaction and transportation costs. Thus, there is a negative relationship between the share of IIT in the industry and geographical distance. Hummels and Levinshon (1995) found a negative sign.

- FDI (Foreign Direct Investment inflows): the relationship between IIT and the level of FDI in a particular industry is somewhat ambiguous since FDI may be a substitute for the trade. Gray (1988) considers an ambiguous relationship between FDI and IIT. Greenaway et al. (1994) estimated a positive sign for the coefficient of this variable;

-TIMB (Trade Imbalance): Following Lee and Lee (1993) our paper considers the trade imbalance as control variable, where TIMB is defined as:

$$TIMB_j = \frac{\left|X_j - M_j\right|}{\left(X_j + M_j\right)} \qquad (2)$$

This variable represents the net trade as a share of trade and takes a value of zero at the lower extreme if there is no trade imbalance and a value of one if there are neither exports nor imports. According to the theory, a negative correlation between this control variable and IIT is expected.

### 4.2. Model Specification

$$LogIIT_{it} = \beta_0 + \beta_1 LogDGDP_{it} + \beta_2 LogMinGDP_{it} + \beta_3 LogMaxGDP_{it} + \beta_4 LogDIM_{it} + \beta_5 LogDIST_{it} + \beta_6 LogFDI_{it} + \beta_7 LogTIMB + \delta t + \eta_i + \varepsilon_{it} \qquad (3)$$

Where:
- *IIT* is the Pakistan IIT index in logs;
- $DGDP_{it}$ measures the similarities between partners as the logarithm of difference income per capita between Pakistan and trading partner.

$$Log\left|GDP^{Pakis\tan} - GDP^{partners}\right| \qquad (4)$$

-$MinGDP_{it}$ ($MaxGDP_{it}$) is the minimum (maximum) of the logarithm of the GDPs of Pakistan and trade partner *i* in;

- $Min(LogGDP^{Pakis\tan}, LogGDP^{partner})$
- $Max(LogGDP^{Pakis\tan}, LogGDP^{partner})$ (5)

These proxies are both control relative size effects;
-$DIM_{it}$, is the logarithm of average GDP of two trading partners;
- $Dist_{it}$ is the logarithm between Pakistan and partner *i;*
- $FDI_{it}$ is the logarithm of Foreign Direct Investment inflows;
- *TIMB* is the logarithm of Trade Imbalance;

- $\eta_i$ is the unobserved time–invariant specific effects; $\delta t$ captures a common deterministic trend; $\varepsilon_{it}$ is a random disturbance assumed to be normal, and identically distributed (IID) with E ($\varepsilon_{it}$) =0 and Var($\varepsilon_{it}$)=$\sigma^2$ >0.

**5. Regression Model**

In this section we present the results with country characteristics as explanatory variable. We include in this estimation the main trade patterns of Pakistan (United States, United Kingdom, Japan, Germany, Saudi-Arabia, Canada, France, Italy, Netherlands, and Norway). In table 1, the determinants of IIT can be observed with fixed effects model[2]. All explanatory variables are significant: (LogDGDP, at 1%, LogMinGDP, at 1%, LogMaxGDP, at1%, LogDIM, at 1%, and LogDIST), with exception FDI.

The difference between per- capita incomes, in logs (LogDGDP) presents a negative sign. This result is according to literature (Greenaway et al. (1994), Loertscher and Wolter (1980)).

Following the empirical model of Helpman and Krugman (1985) and Hummels and Levinsohn (1995), our study also includes two variables to control for relative size effects. We can see that both are statically significant, but only the lower value of GDP (LogMinGDP) has an expected sign.

The positive influence of economic dimension (LogDIM) on IIT is confirmed. As in Chemsripong et al. (2005), and Leitão and Faustino (2009) economic dimension is positively related to IIT.

The geographical distance (LogDIST) presents a negative correlation confirming the results of Bandiger and Breuss (2008), Leitão and Faustino (2008), and Clark (2006).

The relationship between IIT and FDI (foreign direct investment) is ambiguous. As in Gray (1988), we can conclude an ambiguous relationship between FDI and IIT. Greenaway et al. (1994) found a positive correlation.
The trade imbalance (LogTIMB) presents a negative relationship between this proxy and IIT, this result is according to the literature (Lee and Lee 1993).

**6. Conclusions**

The objective of this manuscript was to analyze some of the determinants of intra-industry trade for that we use a country characteristics explanatory variables. Econometrics estimations support the hypothesis formulated. Our results are robust with Fixed Effects. The variable (LogDGDP) used to evaluate the similarities between trade partners presents a negative impact on IIT, this result is according to the literature (Loertscher and Wolter, 1980).

The proxy used to economic dimension (DIM) is according to the literature, i.e the market size benefit and influence the IIT. According to the literature we expected a negative sign to geographical distance, we find this sign. In relation commercial policy, we can to refer that South Asia Free Trade Agreement (SAFTA) could be an important marc to Pakistan, but intra-trade in SAFTA is incipient. Our study shows that the principal export markets are United States, Saudi-Arabia, United of Kingdom and Germany. However, our study has some limitations. We need to introduce a dynamic analysis using Brulhart (1994) marginal IIT index. Furthermore, an expansion of research would be to disentangle IIT into vertical IIT and Horizontal IIT, because these different types of IIT may have different determinants. The

methodology by which to separate HIIT from VIIT is available, having been pioneering Abel-el- Rahman (1991), and Greenaway et al. (1994).

## Endnotes

1. FBS is Pakistan's official statistical organization.
2. In panel data, pooled OLS, fixed –effects (FE) and random-effects (RE) estimators are used in this type of study. The F statistic tests the null hypothesis of the same specific effect for all countries. If we accept the null hypothesis, we could use the OLS estimator. The RE estimator was excluded because our sample is not random. Furthermore, the Hausman test rejects the null hypothesis RE versus FE.

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**Appendix**

**Table 1: Determinants of Intra-industry Trade: Fixed Effects Estimator**

| Variables | Coefficient | Expected Signs |
|---|---|---|
| LogDGDP | -0.4688 (-4.237)*** | (-) |
| LogMinGDP | 1.888 (3.068)*** | (+) |
| LogMaxGDP | 1.259 (3.981)*** | (-) |
| LogDIM | 0.807 (3.790)*** | (+) |
| LogDIST | -0.161 (-6.704)*** | (-) |
| LogFDI | -0.041 (-1.291) | (+/-) |
| LogTIMB | -0.165 (-8.421)*** | (-) |
| Adj. $R^2$ | 0.612 | |
| Observations | 265 | |

T-statistics (heteroskedasticity corrected) are in round brackets.
***- statistically significant, respectively at the 1% levels.