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ABSTRACT

This paper analyses country-specific and industry-specific determinants of intra-industry trade (IIT) between Pakistan and other SAARC countries using panel data techniques. This paper also disentangles total IIT into horizontal and vertical IIT. Vertical IIT is further divided into high-quality and low quality IIT. This paper finds that country-specific variables are more important in explaining IIT relative to industry-specific variables. Decomposition of IIT shows that in the SAARC region Pakistan's IIT is mostly comprised of the vertical IIT and to a lesser extent is horizontal IIT. The paper offers specific policy recommendations for the promotion of IIT in the SAARC region.

JEL Classification: F12, F14, F15
Keywords: IIT, Horizontal IIT, Vertical IIT

1. INTRODUCTION

Intra-industry trade (IIT) is defined as the two-way exchange of goods within the same statistical industry group. Trade patterns observed in the post-World War-II period among European countries could not be explained within the framework of traditional trade theories based on comparative advantage. Verdoon (1960) finds that trade patterns among Europeans are of intra-industry rather than inter-industry in nature since trade takes place mainly within the same industries. Since then IIT has remained a constant feature in international trade. It consists of about one-fourth of total international trade[1] and its share in international trade has been secularly rising by about 4 to 5 percent per annum.

The world is more integrated today than it was a few decades ago. Regional groupings have become the key to prosperity. The concept of global fragmentation[2] of production has emerged with the development of cheaper and reliable transportation and communication technologies. International fragmentation of production is one of the factors that explains the high rise in IIT observed at 4-digit ISIC (or HS) level. It is now considered more efficient to out source production to different countries where factor prices are cheaper for comparative advantage. Empirical evidence demonstrates that an increase in output fragmentation leads to a surge in intermediate goods trade [Feenstra and Hanson (1997); Yeats (2001), and Hummels, *et al*. (1998)]. Most of the trade in intermediate goods among the advanced regional groupings is intra-industry in nature.[3]

IIT's significance lies firstly in the fact it does not have any substantial income distribution effects in the country since, with the opening up of international trade, trade takes place within the same industry and there is no massive dislocation of workers from one industry to another. On the other hand, inter-industry trade has substantial income-distribution effects through a change

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[1]For instance, in 2002, IIT was comprised of 77.7 percent, 72.0 percent and 68.5 percent of total manufacturing trade of Czech Republic, Germany and United States, respectively.

[2]Fragmentation occurs when the output of a final good requires multiple stages in production [Turckan (2005)].

[3]For instance, the share of IIT in intermediate goods in Turkey's total IIT with OECD countries was 48 percent in 2000.

in relative prices (*a la* Stolper-Samuelson theorem). Secondly, existence of the economies-of-scale keeps countries from producing the full range of products. Scale economies that are internal to a firm arise in two ways: (i) with an increase in the production scale, fixed costs spread more thinly over volume of output that reduces per unit cost and (ii) if there are increasing returns to scale in the production activity, which simply means that the doubling of all factor inputs leads to more than double increase in production. Increasing returns to scale are rare to observe in the real world [Siggel (2009)]. Thus, by specialising in the narrower range of products, firms gain in the form of scale economies, which reduce their average cost of production.

Krugman (1981) argues that economies of scale and consumers' preference for a diversity of products are the main determinants of IIT. Trade theorists also cite country-specific variables such as country size, per capita income, distance and trade orientation as the determinants of IIT [Stone and Lee (1995) and Hummels and Levinsohn (1993)]. Some other economists hold industry-specific variables, like scale economies, firm concentration ratio and product differentiation, as determinants of intra-industry trade [Greenaway, *et al.* (1995)]. Clark and Stanley (1999) and Greenaway, *et al*. (1999) consider both country-specific and industry-specific variables as the determinants of IIT.

Goods can be differentiated vertically and horizontally. Horizontal differentiation involves exchange of varieties, for example, automobiles of similar class and price range. These goods are a perfect substitute of one another. Horizontal differentiation benefits countries with similar factor endowments by enabling them to utilise economies of scale in production. Horizontal differentiation thus deals with goods having different characteristics. On the other hand, vertical differentiation deals with similar kinds of goods having different levels of quality, for example, Suzuki and BMW cars. Vertically differentiated goods are not perfect substitutes for one another and specialisation in vertically differentiated products may reflect the countries' comparative advantage, differences in factor endowments—principally skilled labour force or high and fixed costs of research and development (R&D) [OECD (2002)]. Developed countries, for instance, may export high quality capital-intensive (both human and material) products to developing countries and import low quality labour-intensive products from them.

According to international trade theory, intra-industry trade tends to be prevalent between countries that are similar in their factor endowments, technology and skill levels, and so on. It means intra-industry trade will be the dominant trade pattern between countries at similar level of economic development. It has been established that gains from trade will be large when economies of scale are strong and traded goods are highly differentiated [Krugman (2006)]. Product differentiation and economies of scale thus form the basis of intra-industry trade.

SAARC countries economic characteristics satisfy the basis of the theory of intra-industry trade. Almost all of them, perhaps barring India, are at the same stage of economic development. They are labour abundant and import capital-intensive goods; their services sector contributes more than 50 percent to their GDP; on average, their agriculture sector absorbs more than 50 percent of their respective labour force and the share of the manufacturing sector in their economies is on the rise.

Pakistan's trade with the SAARC region was about 8 percent of its total trade in 2010-11. This is highly unsatisfactory compared with the trade performance of other regional groupings like the ASEAN (Association of South East Asian Nations). The volume of intra-SAARC region trade is less than 5 percent; while it is only 2 percent in global trade. In Asia's total exports the share of SAARC countries is 4.7 percent and in imports, 7.5 percent. On the other hand, ASEAN countries which account for 8.7 percent of world population contribute 7 percent to world trade. The intra-ASEAN trade is 30 percent and the share of ASEAN's trade in the total trade of Asia is 23 percent.

The share of Pakistan's international trade with Bangladesh, India and Sri Lanka is very low at 1.6 percent, 2.7 percent and 0.61 percent respectively, in 2010-2011. This share can be enhanced through trade in commodities with similar comparative advantage (i.e., by engaging more in the intra-industry trade). Grubel-Lloyd indices (reported in Table 4.2) show that the share of intra-industry trade is rising over time in the total trade of Pakistan with Bangladesh, India and Sri Lanka. This implies that Pakistan and its trading partners in the South Asia region should, beside inter-industry trade, also focus on increasing the level of trade in goods with similar comparative advantage to strengthen trade and investment relations among the regional countries.

The SAARC region has vast potential to make itself a successful trading bloc of the world. This region accounts for 23 percent of the world population meaning it has a large market for business and profit. By engaging in intra-industry trade on the basis of product differentiation and economies of scale, these countries can surely gain from regional trade. Each regional country should choose a range of a product (variety) in which she deems herself competitive and let the remaining varieties of that product to be produced by other countries of the region to exploit the presence of economies of scale in the production process. This would not only make their produce valuable (efficiency gain due to greater division of labour) in international market but also fetch high price (by producing these goods with cost efficiency). Because with the increase in scale of production, the fixed cost is distributed more thinly over larger unit of output, which leads to a reduction in the average cost of output. By specialising in a narrow range of products, each country will have a niche in that range of products. This will not only reduce the firm's average cost but also improve the quality of their products. So, IIT can prove itself to be in the best economic interest of the region.

The adjustment costs associated with trade are not significant in the case of intra-industry trade. In inter-industry trade, on the other hand, the relative price of goods gets changed that, in turn, exerts a strong impact on the distribution of income. In IIT these adjustment costs are not significant if it dominates the total trade of a country. Since all trade takes place within the same industries, there is no relocation of the labour force.

Given the importance of IIT, this paper provides a comprehensive analysis of the determinants of Pakistan's intra-industry trade in the SAARC region. The contribution of the paper may be judged on the basis of the fact that: (i) there is no empirical study available for Pakistan that provides an analysis of the determinants of the intra-industry trade with countries of the SAARC region and (ii) there is no empirical study available for Pakistan that disentangles total intra-industry trade into its vertical and horizontal components.

The overall objective of the paper is to analyse the determinants of Pakistan's intra-industry trade with the selected SAARC countries. More specifically, the objectives of the study are:

- Estimate the extent of intra-industry trade between Pakistan and other countries of the SAARC region.
- Analyse overall determinants of the intra-industry trade.
- Analyse country-specific and industry-specific determinants of the intra-industry trade.
- Disentangle the intra-industry trade into horizontal and vertical components.
- Suggest policy recommendations to enhance the intra-industry trade between Pakistan and other SAARC region countries.

The rest of the paper is divided into four sections. Section 2 presents a review of the literature concerning intra-industry trade. Section 3 describes the methodology used to achieve the objective of the paper. In Section 4 estimation problems and empirical results are discussed. Finally, Section 5 concludes the paper and offers some policy recommendations for the promotion of intra-industry trade in the SAARC region.

2. LITERATURE REVIEW

Traditional trade theories predict that differences in factor endowments and technologies among the countries form the basis of international trade. Countries enjoy comparative cost advantage in the production of different commodities according to their different factor endowments or comparative labour productivity advantage. Countries export goods whose production requires intensive use of their relatively abundant and cheap factor and import goods whose production requires intensive use of their relatively scarce and expensive factor. This form of international trade that is based on cost

advantages of countries is called inter-industry trade. There is, thus, no room for international trade between countries having similar factor endowments or technologies according to traditional trade theories.

Contrary to this, industrialised countries have been experiencing that a significant proportion of their trade is taking place within industries rather than between them, that is, the countries with similar resource endowments and technologies can also trade with each other and can gain from it. Trade based on economies of scale and differentiated products is called intra-industry trade (IIT).[4] Intra-industry trade is classified into two categories: horizontal intra-industry trade (product differentiation) and vertical IIT (trade based on quality differences). Literature on intra-industry trade can be classified into three subcategories; pioneer studies, standard regression analysis, and studies for Pakistan on IIT.

2.1. Theoretical Studies

Verdoon (1960), Kojima (1964) and Blassa (1966) analysing the pattern of trade flows existing amongst industrialised countries noted that the existing flows of goods trade was taking place within the same industries rather than between industries—an empirical evidence contrary to the predictions of traditional trade theories. These studies term such flow of goods taking place within the same industries as intra-industry trade. These studies highlight the importance of IIT but do not model IIT into standard regression analysis.

2.2. Empirical Studies

2.2.1. *International Studies*

After noting the existence of IIT in the total international trade of a country, substantive empirical research has been undertaken to determine the factors that lead countries to trade within the same industries. Krugman (1979) is probably the first to model IIT into standard regression analysis. Empirical research in this field classifies IIT into two types: (1) horizontal intra-industry trade (exchange of substitutes), and (2) vertical intra-industry trade (exchange of differentiated goods having different levels of quality). Economists find that the similarity of countries in their level of economic development, imperfect competition, economies of scale that are internal to firms, and international fragmentation of production processes are the driving forces of IIT.

Turkcan (2005) analyses determinants of intra-industry trade (IIT) in final and intermediate goods between Turkey and OECD (Organisation for Economic Cooperation and Development) countries. He uses industry-specific and

[4]This type of trade pattern was earlier noted by Kojima (1964), Balassa (1966) and Grubel (1967).

country-specific variables as explanatory variables. The study concludes that these are country-specific variables that explain the variation in IIT between Turkey and nine OECD countries for the period of 1990–2005.

Fontagne, Freudenberg, and Gaulier (2006) decompose world trade into three types of trade: inter-industry trade, intra-industry trade in horizontal and vertically differentiated products. Their analysis is diachronic and they analyse country pairs such as China-United States, France-Germany, Malaysia-Singapore and India-Nigeria. They find that an increase in intra-industry trade at the world level is due to vertically differentiated goods. This study generalises the results obtained by literature on IIT using a new database that allows the breakdown of IIT into horizontal differentiation and vertically differentiated products for all countries of the world. The study finds that the country pair of France and Germany has the highest share of IIT in the world and that of Canada and United States trades most in IIT in value terms. The study observes the re-emergence of trade patterns predicted by Hecksher-Ohlin model due to participation of emerging economies in world trade.

2.2.2. *Studies on Pakistan*

According to this writer's knowledge there are only two studies available that address the issue of IIT for Pakistan. Kemal (2002 and 2004) computes only the GL indices to determine the share of IIT with respect to countries of SAARC and ECO region. The second study that is available is carried by Shahbaz (2010). He investigates the determinants of IIT for Pakistan with respect to its ten major trading partners using macroeconomic variables. These studies are briefly discussed below.

Kemal (2002 and 2004) analyses the reasons of low intra-regional trade within SAARC and ECO. He comes up with the conclusion that similar comparative advantage, low trade complementarities, limited capacity to generate export surpluses, restrictive nature of trade policies and political problems are the main impediments to intra-regional trade within SAARC and ECO. To suggest a solution for similar comparative advantage, Kemal estimates the Grubel-Lloyd indices for SAARC countries and concludes that although the proportion of IIT in total trade is very low in the region, it can be enhanced by expanding the export base of the country. Leather products, textiles and clothing, basic machinery and tools dominate the share of IIT in SAARC countries. Kemal also examines the SAFTA agreement and among other factors emphasises the role of IIT in its success.

Shahbaz and Leitao (2010) investigate the determinants of IIT for Pakistan with its ten major trading partners (United States, United Kingdom, Germany, Saudi Arabia, Canada, France, Italy, Norway, Netherlands and Japan) over 1980–2006. They use country specific characteristics as explanatory variables. The study finds that IIT is influenced by tastes and preferences of consumers and it will be higher if tastes and preferences of residents of two trading partners are the same. Tastes and

preferences are the proxy for per capita GDP which has a negative relation with IIT in terms of differences. Further, IIT is an increasing function of scale economies and product differentiation. This study uses pooled data for 1986–2006 and applies the fixed effects technique.

The above review of different studies led to the conclusion that IIT is beneficial for both producers as well as consumers. It benefits producers by allowing them to produce fewer varieties with economic efficiency. By doing so, they can produce each variety at a larger scale with higher productivity and lower average cost. It benefits consumers by providing them a wide range of choice of available goods at lower prices and benefits workers by raising the real wage rate *(w/p)* by lowering prices of goods and by raising demand for their work. There is no empirical study available that analyses the determinants of the intra-industry trade in final goods and intra-industry trade in vertically and horizontally differentiated goods with a focus on countries of the SAARC region. The present study bridges this research gap.

3. METHODOLOGY

3.1. Introduction

This section consists of three sub-sections. Sub-section 3.1 gives the introduction and background of the methodology developed in this study for analysing the research question. Sub-section 3.2 deals with theoretical foundations of the gravity model used in this dissertation. The Gravity model is considered as a workhorse in many fields. It has been extensively used to analyse the impact of regional trade agreements (RTA), GATT/WTO memberships, currency unions, and migration flows, foreign direct investment (FDI) between countries and trade flows within the same industry and to predict the bilateral flow of goods between any two places. The Gravity model is very popular because of its high explanatory power. Tinbergen (1962) proposed it to analyse the effect of bilateral trade. The last sub-section discusses the econometric model to be used for estimation purposes.

3.2. The Gravity Model

The gravity model is named after Newton's law of gravitational force that is described as:

$$F_{ij} = G\frac{M_i M_j}{D_{ij}^2}$$

Where, F_{ij} is the force of attraction between two bodies i and j, M_iM_j represents the mass of the bodies i and j respectively, D_{ij} is the distance between the bodies i and j and G is the gravitational force.

The Gravity model is written in the same manner as the Newton's law,

$$Y_{ij} = \alpha \frac{y_i y_j}{D_{ij}} \qquad i = 1, \ldots, N \text{ and } j = 1, \ldots, N \qquad i \neq j$$

Where,

a = constant of proportionality;
Y_{ij} = total bilateral trade between two countries i and j;
y = economic size of countries i and j measured in terms of GDP or population; and
D_{ij} = trade barriers between countries i and j. These barriers can be distance, common language, common currency, colonial links, etc. Initially tariffs are missed among the barriers.

In its logarithmic form, the gravity equation is defined as:

$$Y_{ij} = \alpha + \beta_1 logy_i + \beta_2 logy_j - \beta_3 logD_{ij} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

This equation is referred to as the core gravity equation. It states that bilateral trade between country i and j is an increasing function of the size of the countries measured in terms of their GDP or population and decreasing function of the distance between them. Thus, the countries similar in their relative economic size or population will trade more with each other while the volume of trade will be lesser among countries located farther from each other.

3.2.1. *Theoretical Foundations of Gravity Equation*

Tinbergen (1962) was the first economist to use this equation to measure bilateral trade flows between two countries. Since then it is being widely used in empirical literature of international trade. Initially the model lacked theoretical foundations, but overtime empirical research in this area found it to be consistent with trade theories based on Hecksher-Ohlin trade model and the imperfect competition model, proposed by Krugman (1979). Anderson (1979) is the first attempt to provide theoretical foundations to the Gravity model. To specify demand, Anderson makes the assumption that goods are differentiated on the basis of rules of origin. This assumption is known as the "Armington assumption" [Armington (1969)]. Anderson justifies the inclusion of income variables and their log-linear form in the Gravity model and explains the demand-side of the economy. Bergstrand (1985) keeps the Armington assumption and explains the supply-side of the economy. He justifies the inclusion of price variable in the form of GDP deflator as an additional variable.

Brun, *et al*. (2005) use real exchange rates to capture the price effects. Helpman (1987) derives proportionate relationship between trade flows and country size without including the distance variable. Trade theories based on imperfect competition models are another source to provide theoretical

foundations to the model. In these studies, products are differentiated among producing firms rather than by country of origin, [Bergstrand (1985) and Helpman (1987)]. Deardorff (1998) and Feenstra (2004) stress the need to examine the empirical evidence to distinguish among the potential theoretical basis: product differentiation by the country of origin, product differentiation by firms and particular forms of Hecksher-Ohlin based comparative advantage, by pointing to the compatibility of Hecksher-Ohlin model with the gravity model.

Thus the Gravity model starts with lack of theoretical foundations that often call into question the validity of the estimates of coefficients obtained through regression but today it is strengthened by theoretical justification for using it in the analysis of bilateral trade flows. Presently, additional variables are also added in this model that are deemed necessary to capture the effect of other factors besides the original variables (GDP/population, distance) of the model. This form of the model is called the Augmented Gravity Model that is explained in the next section.

3.2.2. *The Augmented Gravity Model*

Since its introduction in international trade literature by Tinbergen (1962) and its subsequent empirical success, at present, it is the most widely used tool to estimate bilateral trade flows between countries. The core Gravity model (see Equation 1) is augmented by the inclusion of several additional variables like cultural differences, linguistic differences, exchange rate, border effects, etc., that possibly affect a country's bilateral trade flows. Following Clark and Stanley (1999), Greenway, *et al.* (1999) and Turkcan (2005), this study also augments the core Gravity model with two types of variables, namely, country-specific variables and industry-specific variables for analysing the flows of intra-industry trade of Pakistan with Bangladesh, India and Sri Lanka. The augmented gravity model that this study uses is expressed as:

$$Y_{jhft} = C + \log DIST_{hf} + \log AGDP_{hft} + \log DPCGDP_{hft} + \log DHCAP_{hft} + \log AEST_{jhft} + \log DVAEST_{jhft} + \log DPCAP_{jhft} \quad \ldots \quad \ldots \quad (2)$$

where,

Y_{jhft} : Intra-industry trade flow between home country (Pakistan) *h* and trading partner *f* in year,

$DIST_{hf}$: The port distance between Pakistan and its trading partner *f*,

$AGDP_{hft}$: Average GDP between Pakistan and its trading partner *f* in year *t*,

$DPCGDP_{hft}$: Difference in per capita GDP between Pakistan and its trading partner *f* in year *t*,

$DHCAP_{hft}$: Difference in human capital between Pakistan and its trading partner *f* in year *t*,

$AEST_{jhft}$: Average number of establishments at industry level between Pakistan and its trading partner *f* in industry *j* in year *t*,

$DVAEST_{jhft}$: Absolute difference of value added per establishment at industry level between Pakistan and its trading partner *f* in year *t*,

$DPCAP_{jhft}$: Absolute difference of physical capital endowment per worker at industry level between Pakistan and its trading partner *f* in year *t*.

3.2.3. *Country-specific Variables*

A brief account of the variables and their economic relevance in the analysis are discussed below:

$DIST_{hf}$ (distance between Pakistan and its trading partner's port of entry in nautical miles): a large share of Pakistan's bilateral trade with countries of the SAARC region is carried out through sea. On *a priori* basis trade is negatively correlated with the distance. The farther the trading partners are from each other, the higher the transportation cost will be [Balassa (1986)]. Thus IIT in final and intermediate goods is negatively related with the distance.

$AGDP_{hft}$ (average GDP of Pakistan and its trading partner): the Gravity model measures country size in two ways: first in terms of GDP and then in terms of population. This study uses real GDP in 2000 US$ prices. Krugman (1979) argues that small economies have limited ability to avail themselves of the economies of scale. Trade increases the size of the market. By trading with each other, the size of the market will become larger. The firms in both the trading countries will reap the benefits of the economies of scale in the form of increased productivity, reduced average costs and consumers will enjoy the increased variety of available goods at lower prices. With free trade, firms producing intermediate goods will also be able to make use of increasing returns to scale thereby increasing the production and varieties of intermediate goods [Ethier (1982)]. Thus a positive sign is expected on the share of IIT in final and intermediate goods and the average market size (in terms of GDP).

$DPCGDP_{hft}$ (absolute difference in GDP per capita between Pakistan and its trading partner): per capita income is used as a proxy for taste and preferences. Linder (1961) argues that per capita GDP is a measure of people's taste and preferences and countries with similar levels of per capita GDP and similar tastes and preferences will engage in more bilateral trade. Countries will trade less as bilateral differences of per capita GDP escalate. Thus, a negative sign is expected between the share of final goods in IIT and differences in per capita income. Helpman-Krugman (1985) takes differences in per capita GDP as differences in capital-to-labour ratio (that means countries have dissimilar factor endowments). If there are bilateral differences in factor endowments then there will be lesser IIT in intermediate goods. Therefore, IIT in intermediate goods declines with the increase in differences in factor endowments. On the other hand, Feenstra and Hanson (1997) predict that IIT in intermediate goods increases with greater differences in per capita GDP between trading partners. Differences in factor endowments lead countries to specialise in vertically

differentiated goods, so IIT in intermediate goods increases as factor endowment differences go up. However, there is no clear consensus among economist on the sign of bilateral differences in per capita GDP and IIT in intermediate goods.

DHCAP$_{hft}$ (absolute difference of the percentage of the population with higher education between Pakistan and its trading partner): following Turkcan (2005), the level of education is classified into three categories: below secondary education, upper secondary education, and tertiary education. The fraction of labour with tertiary education indicates the fraction of skilled labour force whereas the sum of the shares of below secondary and upper secondary level of education gives the fraction of unskilled labour force. This study uses the ratio of skilled labour to unskilled labour as a proxy for human capital endowment. Krugman and Helpman (1985) demonstrate that differences in factor endowments between any two countries lead to a decrease in the level of bilateral IIT between these countries. Ethier (1982) argues that skilled labour, mainly R&D personnel, is the essential ingredient for the production of intermediate goods' variety. Therefore, if countries differ in their factor endowments, the scope of IIT will be reduced. Contrary to this, Feenstra and Hanson (1997) show that a relative increase in the supply of skilled labour to unskilled labour in the home country relative to foreign country will increase the supply of vertically differentiated goods from home to foreign country, which leads to an increase in IIT of intermediate goods. Thus the expected sign of bilateral inequality in factor endowments on IIT in final goods is negative while on the IIT in intermediate goods is ambiguous.

3.2.4. *Industry-Specific Variables*

Industry specific variables are defined as follows:

AEST (Average number of establishments at industry level between Pakistan and its trading partner): the average number of establishments is used as a proxy for product differentiation. The larger the number of establishments, the greater will be the variety of goods produced, since every firm produces a differentiated product. In simpler terms, there are as many varieties as there are firms Krugman (1981).

DVAEST$_{jhft}$ (Absolute differences of value added per establishment at industry level between Pakistan and its trading partner): it is used as a proxy for economies of scale. Economies of scale that accrue to a firm due to its large plant size are considered to be negatively related to product differentiation. Ethier (1982) argues that intra-industry trade in final manufactured goods is an increasing function of component varieties produced both, in home and in foreign country, and that the economies of scale are a result of greater division of labour rather than due to large plant size. And intra-industry trade in intermediate goods arises because firms find it profitable to split the production process at different plants due to the economies of scale achieved through

division of labour. So, small plant size is positively related to IIT in final and intermediate goods. He expects a negative sign between economies of scale accrued to a firm due to its large plant size and IIT in intermediate goods. On the other hand, Feenstra and Hanson (1997), argue that vertical specialisation allows firms to produce final goods and intermediate goods at different plants, so plant size should be small because each stage of manufacturing is conducted at different plants. Thus, vertical specialisation leads to an increase in IIT in intermediate goods.

DPCAP$_{jhft}$ (the absolute difference of physical capital endowment per worker at industry level): this variable is included to take into account the effect of the differences in factor endowments. Ethier (1982) argues that IIT is expected to be negatively correlated with the differences in the capital to labour ratio. He assumes differentiated intermediate goods to be capital intensive when the supply of capital in the home country rises relative to labour; the number of produced intermediate goods in the home country will rise and the producers of final goods in the home country will begin to rely on locally manufactured intermediate goods. Thus, the share of IIT in intermediate goods will eventually decline. Feenstra and Hanson (1997) show that for vertical specialisation, dissimilarities in the capital to labour ratio between the trading partners is a necessary condition. Therefore, the expected sign of the bilateral inequality in the capital to labour ratio on the share of IIT in intermediate goods is ambiguous whereas on the share of IIT in final goods is negative.

The data on industry-specific variables are in LCU (Local Currency Unit) of the respective countries. To make them comparable, values of all the variables are converted into US$ and in the same unit. All variables are nominal; this study makes them real by using GDP deflator.

3.3. Empirical Analysis

In the previous section, variables were defined and their relationship with intra-industry trade was discussed, on *a priori* basis. This subsection makes an attempt to find the empirical evidence, available in the literature, on the relation between intra-industry trade and the included variables. For this purpose this study investigates the following model:

$$IIT_{jhft} = C + log\ DIST_{hf} + log\ AGDP_{hft} + log\ DPCGDP_{hft} + log\ DHCAP_{hft} + log\ AEST_{jhft} + log\ DVAEST_{jhft} + log\ DPCAP_{jhft} \ldots \quad \ldots \quad (3)$$

Equation (3) is similar to Equation (2) except Y_{jhft} that is replaced with IIT_{jhft} in (3).

$$IIT_{jhft} = \frac{\sum_{i=1}^{N}\left[(X]_{jhft} + M_{jhft}\right) - \sum_{i=1}^{N}\left|X_{jhft} - M_{jhft}\right.}{\sum_{i=1}^{N}\left(X_{jhft} + M_{jhft}\right)} \quad \ldots \quad \ldots \quad (4)$$

Where, j = 1…J represents industry groups, i = 1…I are products in an industry j, f =1…F are trading partners of Pakistan and h is home country (Pakistan). IIT_{jhft} means that intra-industry trade in the *ith* good in industry j between Pakistan and its trading partner f in year t. Equation (2) is Grubel-Lloyd index and it takes values between 0 and 1. A value of 0 indicates pure inter-industry trade (no intra-industry trade) and 1 shows pure intra-industry trade. This study computes the values of *IIT* index at three-digit level of ISIC (International Standard Industrial Classification) Revision 3.

3.3.1. *Data*

Data on the number of establishments, value added at establishment level, gross fixed capital formation for Bangladesh, India and Sri Lanka are taken from United Nations Industrial Statistics published by United Nations Statistics Division. For Pakistan, the data on these variables are taken from the Census of Manufacturing Industries. Data on GDP, Per Capita GDP and Education are taken from World Development Indicators (WDI) published by the World Bank. Data on distances between ports of home country and trading partner are taken from the web.[5] Data on exports and imports of Pakistan are taken from the Foreign Trade Statistics of Pakistan 1990-91, 1995-96 and 2000-01, State Bank of Pakistan External Trade Statistics and TDAP (Trade Development Authority of Pakistan).

3.3.2. *Data Limitations*

The latest data on the number of establishments, value added at establishment level and gross fixed capital formation are available only for the period up to 2000 for Bangladesh, India, and Sri Lanka. The Census of Manufacturing Industries of Pakistan is published every five years. So, this study uses the data for 1990-91, 1995-96 and 2000-01. Data on most of the variables are not available for Bhutan, Maldives and Nepal, that is why these countries are not included in the analysis.

3.3.3. *Decomposition of Intra-industry Trade*

To decompose total intra-industry trade into horizontal intra-industry trade and vertical intra-industry trade the method proposed by Greenaway, Hine and Milner (1994) is applied. This method is based upon the ratio of the unit value of exports to the unit value of imports. This method can be described by the following formula:

$$1-\alpha \le \frac{UV_{i,t}^{hf,x}}{UV_{i,t}^{hf,m}} \le 1+\alpha \quad (5) \qquad \text{or}$$

[5] www.e-ships.net/dist.htm

$$\frac{UV_{i,t}^{hf,x}}{UV_{i,t}^{hf,m}} \leq 1-\alpha \quad \text{or} \quad \frac{UV_{i,t}^{hf,x}}{UV_{i,t}^{hf,m}} \geq 1+\alpha \quad (6)$$

Where,

$UV^{hf,x}{}_{i,t}$ is unit value of export in the *ith* industry in year *t* between home country, *h* and foreign country *f* ,

$UV^{hf,m}{}_{i,t}$ is unit value of imports in the same *ith* industry in year *t* between home, *h* and foreign country, *f*, and

σ is the arbitrarily fixed dispersion factor; often it is fixed at 0.15.

If the ratio of unit values of export to import falls within the range defined by (5), then the goods are classified under the horizontal IIT and if this ratio falls within the range defined by (6) then the goods are classified under vertical IIT.

The above formula is based on the assumption that prices of the goods reflect their quality. High priced goods have high quality whereas low price goods have low quality.

4. ESTIMATION AND RESULTS

4.1. Introduction

In the previous section methodology for analysing the determinants of IIT and decomposing IIT into its horizontal and vertical components was presented. Sub-section 4.2 discusses the descriptive statistics of the data. In sub-section 4.3 diagnostic tests performed on the data are discussed. Sub-section 4.4 describes the empirical results of the estimated model.

4.2. Descriptive Statistics

Descriptive statistics represents the nature of data. Two measures of the central tendency are used: mean and median. Mean of all variables is greater than their median, which implies that all variables are positively skewed. Minimum and maximum values and standard deviation give the range of dispersion in the data. According to the standard deviation DPCAP has the least variation while the AVGG has the maximum variation; this pattern is also indicated by maximum and minimum values (Table 4.1).

Table 4.1

Descriptive Statistics

Statistic	DIST	DPCAP	DPCG	DVAD	AVGG	AVGE
Mean	262.94	0.02	194.10	761.83	114808.20	1076.08
Median	249.00	0.01	192.00	209.54	49769.00	345.00
Maximum	440.00	0.07	337.00	6990.44	267067.00	8158.00
Minimum	42.00	6.47	83.00	0.35	37887.00	12.00
Std. Dev.	169.28	0.02	77.29	1217.11	88590.32	1613.45

4.3. Diagnostic Tests

Before going for estimation, different diagnostic tests are performed on the data to check for any econometric problem present in the data. Four series exhibit the presence of the unit root that is discussed in the following sub-section. Fixed effects and random effects estimators are based on the assumption that the error term is idiosyncratic (i.e., it is distributed with zero mean and constant variance). Since in panel data we have both time-varying and time-invariant regressors, there always will exist a possibility of the correlation between the error terms and the presence of the heteroscedasticity. This leads to underestimation of error term and over prediction of the regressors of the model. For short panels, it is possible to get error corrected estimates of the model by using the robust command. Therefore, robust command is used to adjust for heteroscedasticity in the STATA programme.

4.3.1. *Unit Root*

The underlying assumption of a time series analysis is that the variables included in the regression analysis should be stationary. A time series is stationary if its mean and variance are time-invariant. The time series process that does violate any of the conditions is said to be non-stationary. A non-stationary time series is said to have unit root. In the analysis of this study four variables, namely, average GDP, difference in per capita GDP, difference in human capital and distance are non-stationery in nature, that is, they have unit root. The Madala and Wu (MW, 1999) test is used to detect the presence of unit root in the series. All other variables are stationary at level. The MW test takes the following form,

$$\prod = -2\sum_{i=1}^{N} \ln \pi_i$$

Where, π_i are probability values from regular DF (Dickey-Fuller) test or ADF (Augmented Dickey-Fuller) unit root test for each cross section *i*.

After diagnosing the problem of the presence of unit root in the above mentioned series at level, first the difference of these series is taken and then the presence of the unit root is tested. First the difference unit root disappears. So, the time series that exhibits non-stationary process is then differenced at order 1 to make them stationary. That is, the non-stationary time series are I(1) process. Then these I(1) series are included in the analysis. The results of the unit root test are presented in the Table 4.2.

Table 4.2

Results of ADF Test

Variable	ADF test Statistics	Order of Integration
AGDP	26.61	I (1)
HCAP	9.09	I (1)
DIST	26.41	I (1)
DPCGDP	25.61	I (1)
AVGE	37.73	I (0)
DPCC	25.14	I (0)

4.4. Estimated Results

The data set used in the estimation is a panel data set having two dimensions: country and time. The panel data technique is used to estimate the model. The data set has three country pairs and three years: 1990-91, 1990-95, and 2000-01. The number of industries differs over the years and across countries. Data for the number of establishments, gross fixed capital formation, and value added are reported in SITC-3 (Standard Industrial Trade Classification) for 1990-91 and 1995-96, while data for 2000-01 of the same set of variables are in ISIC Revision-3 (International Standard Industrial Classification). To make the data comparable this study converts SITC-3 codes into ISIC-3 codes using the United Nations industrial classification registry.

4.4.1. *Evidence of IIT*

The data used in this study indicate that the share of IIT in Pakistan's total trade with Bangladesh, India and Sri Lanka is low by international standards.[6] These estimates are consistent with the findings of Kemal (2004). The results of Grubel-Lloyd indices for total manufactured goods trade are presented in Table 4.3.

Table 4.3

Grubel-Lloyd Indices of Trade between Pakistan and other Countries of SAARC Region

(Percent)

Country	1990	1995	2000
Bangladesh	3.1	7.7	19.0
India	13.0	7.4	8.3
Sri Lanka	4.8	5.4	8.4
SAARC*	6.9	6.8	11.9

*Bhutan, Maldives, and Nepal are not included due to non-availability of data.

[6]For instance, the share of bilateral intra-industry trade in 2000 for Germany-France was 88.70 percent, Germany-UK 79.78 percent and for US-Canada was 77.55 percent, Fontagne, Freudenberg, and Gaulier (2005).

The GL indices are computed at three-digit aggregation level of ISIC-3. The pattern of the intra-industry trade of Pakistan is almost the same with Bangladesh, India and Sri Lanka. These shares of IIT, albeit low, have been rising over time. Pakistan's intra-industry trade with Bangladesh was 3.1 percent in 1990 but it increased to 19 percent in 2000 and with Sri Lanka it rose from 4.8 percent in1990 to 8.4 percent in 2000, which shows a significant change in the pattern of Pakistan's trade with these countries. With India this share was 13 percent in 1990 which declined to 7.4 percent in 1995 but again rose to 8.3 percent in 2000. Pakistan's share of the intra-industry trade with India is expected to rise further in the wake of granting MFN status to India. The volume of SAARC intra-industry trade is rising, on average, over time from 6.9 percent in 1990 to 11.9 percent in 2000.

4.4.2. *Empirical Results*

In this section empirical findings of the model are discussed. The signs and magnitude of the coefficients are as expected. Country-specific variables are statistically significant at 1 percent significance level. Industry-specific variables are not very significant in explaining the determinants of the intra-industry trade as those are country-specific variables. The market size (measured by AGDP) exerts a positive significant impact on IIT (Table 4.4). AGDP measures the size of the market, which becomes larger with the opening of international trade [Krugman and Helpman (1985)]. That increase in size makes it feasible for the firms to increase their production and get the benefits of the economies of scale. The presence of economies of scale in the production process reduces the average cost of production and hence increases profit making opportunities for the firms. Thus, the level of IIT of manufactured goods increases with an increase in the size of the market.

Table 4.4

Fixed Effects (FE) Results for Intra-industry Trade

Variable	Coefficient	t-stat
DIST	–0.67	4.83
AGDP	2.39	5.05
DPCGDP	–4.38	–5.19
DHCAP	1.88	3.86
AVGE	–0.09	0.91
DPCC	0.13	1.06
DVAD	–.015	–0.97
R-Square	12.38	

Distance with the trading partners is found to be negatively affecting the intra-industry trade of Pakistan with selected SAARC countries. This finding is in line with those of Turkcan (2005), Balassa (1986) and Clark and Stanley (1999). It means that with an increase in the distance, the cost of transportation and communication increases that causes a decrease in the level of bilateral intra-industry trade.

Differences in per capita GDP (a measure of consumer's tastes and preferences) have negative and statistically significant effect on the level of IIT. This means that as the consumer tastes and preferences become dissimilar (in both the trading partners), they start demanding different goods to consume. That lessens the possibility of bilateral intra-industry trade between trading partners if products demanded by their consumers are not available in the region. Therefore, the IIT declines as the bilateral differences in tastes and preferences between consumers increase..

Bilateral inequality in human capital endowment (DHCAP) has statistically significant and positive effect on IIT. This outcome is in line with the findings of Turkcan (2005), Flam and Helpman (1987) and Falvey and Kierzkowkski (1987), but in contrast with the findings of Helpman-Krugman (1985). Flam and Helpman (1987) argue that trade between developed countries and developing countries is vertical in nature. The North choses to produce high tech goods by itself and transfer old technology to the South. By doing so, countries in the North export high quality and high capital-intensive goods to countries in the South and import low quality and labour intensive products from the South. This process increases the level of bilateral trade between North and South. This finding also supports the factor proportions explanation of North-South models of international trade, which state that countries produce and trade commodities that use more intensively their abundant factor with commodities that use more intensively their relative scarce factor.

Regarding the industry-specific variables, the average number of establishments does not turn out to be statistically significant in explaining the intra-industry trade. The sign of the coefficient is opposite to theoretical predictions about intra-industry trade. Nevertheless, there is a usual empirical finding for developing countries which Turkcan (2005) also finds for Turkey.

The variable difference in value added at industry level, a proxy for economies of scale, is negative but is statistically insignificant. This implies that plant size should be reduced to increase the level of IIT. This finding is against the theoretical prediction of Krugman (1979) but in line with the empirical finding of Greenway, *et al.* (1995), that favours production fragmentation to increase the number of differentiated variety, leading to an increase in the level of intra-industry trade.

Bilateral differences in the capital-labour ratio between trading partners measure the differences in factor endowments. This variable has positive correlation with the intra-industry trade, but turns out to be insignificant. The

positive correlation between DPCC and the level of IIT is consistent with Feenstra and Hanson (1997), who argue that bilateral inequality is a necessary condition for vertical specialisation.

Considering RE estimates (Table 4.5), RE technique does improve the significant level and magnitude of the coefficients of all variables relative to the FE model. But it does not make any of the variables significant that was found to be insignificant under the FE model. The RE model also explains more variation in the model relative to FE model as indicated by the value of R-square.

Table 4.5

Random Effects (RE) Results for Intra-industry Trade

Variable	Coefficient	z-stat
DIST	–0.58	–6.15
AGDP	1.94	5.08
DPCGDP	–3.52	–4.93
DHCAP	1.56	3.84
AVGE	–0.12	–1.38
DPCC	0.14	1.47
DVAD	–0.15	–1.06
R-Square	12.59	

While choosing between the FE and RE models, the Hausman test is performed. Hausman rejects the FE model in favour of the RE model. It is, therefore, concluded that RE estimates are efficient and consistent relative to those of FE estimates. This leads us to conclude that the level of IIT between Pakistan and its trading partners in the SAARC region is affected by random events. The results of the Hausman test are reported in Table 4.6.

Table 4.6

Hausman Test Result

	Coefficients		Difference
Variable	**FE (b)**	**RE (B)**	**(b-B)**
AVGE	–0.09	–0.12	0.02
DVAD	–0.14	–0.15	0.005
DPCC	0.13	0.14	–0.02
AGDP	2.39	1.94	0.45
DPCGDP	–4.38	–3.52	–0.86
DHCAP	1.88	1.56	0.32
DIST	–0.67	–0.58	–0.09

Note:

b = Consistent under H_0 and H_a, B = Inconsistent under H_a, efficient under H_0

Chi2 (7) = (b-B)' [(_b-V_B) ^ (–1)] (b-B)

= 0.78, and Prob > chi2 = 0 .99

4.4.3. *Horizontal and Vertical Intra-industry Trade*

Intra-industry trade is subdivided into two-way exchange of similar products with the same price (these goods are perfect substitutes for each other), and the two-way exchange of dissimilar goods that differ in quality; these goods are not similar (these goods are not perfect substitutes for each other), and differ in price ranges. The former goods are called horizontally differentiated products and the latter are called vertically differentiated products.

Vertically differentiated products are further classified into two groups: low quality vertically differentiated products and high quality vertically differentiated products. Vertically differentiated goods having high price are high quality goods. They are relatively more capital-intensive, skill-intensive, and innovative. Thus, goods with higher price presumably have high quality.

The pattern of intra-industry trade between Pakistan and her selected trading partners in the SAARC region is reported in Table 4.7. The table reveals that in the SAARC region Pakistan's intra-industry trade is mostly comprised of vertical intra-industry trade (i.e. 82.50 percent) and horizontal intra-industry trade to a lesser extent (17.50 percent). Vertical intra-industry trade is high among countries with greater differences in the level of technology and factor endowments.

Vertical intra-industry trade is further decomposed into low vertical intra-industry trade (LVIIT) and high quality vertical intra-industry trade (HVIIT). The share of low quality vertical intra-industry trade in total IIT is 69.95 percent and that of high quality vertical intra-industry trade is 12.55 percent.

The cross-country analysis of the intra-industry trade indicates that Pakistan's share of low quality vertical intra-industry trade (LVIIT) in total intra-industry trade is much higher with Bangladesh (93.20 percent) and India (85.96 percent) and is low with Sri Lanka (30.68 percent). This implies that Pakistan's intra-industry trade with Bangladesh and India is largely composed of low quality, low priced products.

The share of high quality vertical intra-industry trade (HVIIT) is higher with Sri Lanka (29.38 percent) as compared to Bangladesh (3.9 percent) and India (4.38 percent). This trade is taking place mostly in textile products (HS 61034200, HS 61169300, and HS 61091000). The reason for the higher share with Sri Lanka is that Pakistan has specialization in the production of textile products while Sri Lanka is not. Pakistan exports high quality textile products to Sri Lanka. The same is not true for Pakistan's intra-industry trade with Bangladesh and India. The reason for the low share of HVIIT with Bangladesh and India is that Pakistan, Bangladesh and India have specialization in the production of textile products and the origin of the import of their technology is the same. Besides, all three of these countries have very restricted trade policies in textiles.

Table 4.7

Shares of HIIT, LVIIT, and HVIIT in total IIT (2005-06)

(Percent)

Intra-industry Trade	Bangladesh	India	Sri Lanka	SAARC*
HIIT	2.90	9.66	39.94	17.5
LVIIT	93.20	85.96	30.68	69.95
HVIIT	3.90	4.38	29.38	12.55

*Bhutan, Maldives, and Nepal are not included due to non-availability of the data.

The share of horizontal intra-industry trade in total IIT of Pakistan is low as compared with the vertical intra-industry trade. It is 17.50 percent of the total intra-industry trade. The cross country shares reveal that in the category of horizontal intra-industry trade, Sri Lanka is leading with 39.94 percent followed by India with 9.66 percent and Bangladesh with 2.90 percent. The relatively lower share of horizontal intra-industry trade in total intra-industry trade indicates that the region is not trading much in products that are very similar in quality and price. In sum, the SAARC region's greatest potential lies in HVIIT. Thus, the regional countries should implement such policies that will further enhance the share of HVIIT in their total IIT.

5. CONCLUSION AND POLICY RECOMMENDATIONS

The focus of this study has been to analyse the determinants of the intra-industry trade of Pakistan with her major trading partners in South Asia region. The key hypothesis of the study is drawn from Turkcan (2005) regarding the country-specific and industry-specific determinants of intra-industry trade. The data set used in the study has two dimensions: country and time, which allow us to use the panel data techniques. Panel data techniques can be performed on both the fixed-effects model and random-effects model. The result of the Hausman test supports the random effects model. That is, the random effects estimates are more efficient than those of the fixed effects model. This implies that the RE estimates have less dispersion and are more reliable than the FE estimates.

Based on the results of the random effects model, this study concludes that country-specific variables are more relevant in explaining the intra-industry trade than industry-specific variables. In particular, market size is found to be positively correlated with intra-industry trade, a finding consistent with that of Turkcan (2005). The differences in per capita GDP between trading partners (i.e., tastes and preferences) are negatively correlated with the intra-industry trade, a result consistent with the findings of Shahbaz and Leitao (2010) for Pakistan. The sign of the variable distance is also as expected, that is large distance between trading partners reduces bilateral trade. This finding is also in line with the empirical finding of Shahbaz and Leitao (2010). Intra-industry trade is found to be positively related with bilateral differences in human capital

confirming the hypothesis that an increase in the intra-industry trade is due to an increase in the fragmentation of production process, Flam and Helpman (1987) and Falvey and Kierzkowkski (1987).

This study also finds an increasing share, albeit low, of the intra-industry trade in the total trade of Pakistan with these countries. The study thus suggests that Pakistan and its trading partners in the SAARC region should make concerted efforts to increase the level of intra-industry trade to enhance and sustain the overall volume of the regional trade and strengthen the regional economic interests. To this end, this study makes some policy recommendations.

As is inferred from the previous analysis, SAARC countries have vast potential to expand their economic relations within the region. The competitive nature of SAARC countries is considered as the major impediment in the way of regional trade expansion. This bottleneck can be removed by engaging extensively in the intra-industry trade at the regional level; such a proposal was also made in Kemal (2004) and Mahmood (2012).

To increase the level of intra-industry trade on the basis of the analysis conducted in this study; we put forward the following policy recommendations:

- Since distance appears to be a major constraint in the way of increasing regional trade, therefore regional governments should pay special attention to improve not only the conditions of transport and communication infrastructure but also strive to reduce the cost of shipping goods across borders.
- Manufacturing firms need to allocate more funds for research and development to develop new and better varieties in the existing lines of production so as to expand intra-industry trade in the SAARC region.
- Textiles and clothing have a large potential to increase the level of intra-industry trade in the region. Regional countries are currently restricting trade in textiles and clothing by using a negative import list and other tariff and non-tariff measures. It is, therefore, strongly recommended that in the future trade negotiations at bilateral or regional levels, the governments should make efforts to remove textile products and clothing from the negative lists of the regional countries.
- Vertical intra-industry trade has turned out as the major component of the (total) intra-industry trade in the region. Therefore, in future the regional governments should focus on expanding and promoting the production of high-end products for which the demand exists in the region.
- Finally, since the size and the share of intra-industry trade in the SAARC region is growing sharply, therefore, it is advisable for the regional governments to encourage economies-of-scale in production, which is the basis of intra-industry trade.

Appendix Table

The HS (Harmonized Commodity Description and Coding System) Codes

Bangladesh	India		Sri Lanka
HSCODES	HSCODES	HSCODES	HSCODES
12099190	7031000	52121200	30049010
12119000	7132000	54023300	33049100
21069090	7133990	57011010	33051000
24012000	7139020	58071010	34029000
29350090	9042010	58071030	38099100
30049010	12093000	58071090	38249099
30049090	12099190	58079000	39031900
33029000	12099900	59011000	39042200
39199000	12119000	61149000	39232900
39233000	14049090	62105000	39269090
39269090	21069030	63021010	39269099
41044900	21069090	63079090	40169990
41120000	25199090	68041000	44219000
52085900	28429000	70109000	52122100
52093900	29269090	70133900	61034200
53109010	30049010	70200090	61051000
58071010	30049090	72021900	61091000
58079000	30064000	72024100	61169200
61149000	32041990	72024900	61169300
62034200	35079000	72069000	62104000
63079090	37061000	73269090	73269090
69111010	39011000	74032200	78020000
69119000	39073000	74199900	85179000
73170090	39199000	76012000	87141900
73193000	39202090	84339000	90181200
84483200	39204900	84834090	90230000
84483900	39209900	87089900	93063000
84484900	39232900	87141900	95069910
84807900	39269090	90184900	
	40169990	90189090	
	41120000	90230000	
	41131000	94031000	
	48201090	95066910	
	52052200	95069920	
	52052400	95069990	
	52053200		
	52061100		
	52094200		
	52105900		
	52114200		

Source: Foreign Trade Statistics (FTS), Federal Bureau of Statistics.

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