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Disentangling Horizontal and Vertical Intra industry Trade: Case of Pakistan

ABSTRACT

This study systematically examines and decomposes Intra Industry trade (IIT) of Pakistan into horizontal Intra industry trade (HIIT), low-quality vertical Intra industry trade (LQVIIT), and high-quality vertical Intra industry trade HQVIIT components using unit value indices. The study also investigates decade wise IIT of Pakistan using GL indices, and the country-specific determinants of Pakistan's IIT at the 1-digit industry level of SITC. Decomposition and measurement of Pakistan's IIT show that in the last forty-three years HIIT dominates VIIT, while LQVIIT dominates HQVIIT industries. The empirical analysis of the last decade shows that LQVIIT dominates HIIT as well as HQVIIT, and in the last three decades HIIT, LQVIIT, and HQVIIT show constant, increasing, and decreasing trend, respectively. The empirical analysis of the last two decades shows that IIT of Pakistan is sharply increasing, IIT of Pakistan with major developing trading partners is more than with major developed trading partners. Distance and differences in human capital variables show an insignificant impact on IIT of Pakistan.

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1. INTRODUCTION

World trade has taken a unique chromaticity with the swift development of International Economic Relations (IER), and the plethora of rapid growth in interaction and interdependence of domestic economies (globalization and liberalization). Traditional trade theories of Heckscher-Ohlin-Samuelson[1] and Ricardo[2] which assume a constant return to scale (CRS) in production and perfect competition in markets could not explicate the changing patterns, and trends of international trade. In other words, these theories explain inter-industry trade[3]and predict that trade is the result of supply-side differences (difference in factor endowments).

However, in the sixth decade of the twentieth century, various trade economists and theorists (Linder, 1961; Michaely, 1962) examined that a large percentage of international trade between developed economies is due to product differentiation and takes place between similar commodities (commodities produced with similar factor endowments) and within the same industry. This phenomenon of bilateral exchange of similar commodities between the same industry groups has been defined as "Intra-industry trade". Besides, "intra-industry trade" (IIT) theorists predict that IIT is the reason for diversification of consumer preferences (taste), as more identical the per capita income levels of two trading economies are, the larger the extent of IIT will be (Linder, 1961; Lancaster, 1980).

After the recognition of the fact that IIT is an essential portion of global trade, IIT is further decomposed into "horizontal intra-industry trade[4]" (HIIT), and "vertical intra-industry trade[5]" (VIIT), and VIIT is further disentangled into "high quality vertical intra-industry trade[6]" (HQVIIT), and "low quality vertical intra-industry trade[7]" (LQVIIT). HIIT appears between the economies with EOS in production, and similar factor endowments, moreover, HIIT deals with products of the same class (industry) but having different characteristics (product differentiation), while VIIT appears between economies having differences in factor endowments, and constant return to scale (CRS) in production, besides, VIIT deals with goods of the same class (industry) but having a different level of quality (quality differences).

A plethora of HIIT and VIIT models have been constructed so far to deeply explain horizontal and vertical IIT. HIIT models state that the IIT trade between developed economies (north-north IIT) is most likely to be HIIT, because, HIIT models explicate that horizontally differentiated products (similar goods with different characteristics, and within same price range), increasing returns to scale, the same level of economic development, same factor endowments, smaller per-capita income differences, and monopolistic competition are the main sources of HIIT. However, VIIT models explain that IIT between developing and

[1] The Hecksher-Ohlin-Samuelson theory (factors proportion theory) describes that a nation will produce and export the product whose production process uses countries abundant (cheaper) factor intensively and import the product whose production process uses scarce (expensive) factor intensively.

[2] The Recardian theory states that all countries will get the benefits of trade if each country produces, specializes, and exports the commodity in which country has a relative cost benefit.

[3] Inter-Industry trade is the two-way exchange of dissimilar goods (goods of different industries) with in different categories, based on differences in factor endowment.

[4] HIIT is the two-way exchange of similar quality goods of same category (industry), within the same price range, and goods are perfect substitutes of each other. For example, trade between Samsung and Huawei mobile phone with same specifications and almost same price range.

[5] VIIT is the two-way exchange of goods of same category (industry), but differ in quality (different price range), such products are not the perfect substitutes. For example, trade between US and Japan importing Suzuki Alto and exporting Tesla car with different specifications and price range

[6] HQVIIT is the bilateral vertical IIT in high quality (capital intensive) vertically differentiated goods. For example, trade between Suzuki Mehran and BMW cars.

[7] LQVIIT is the bilateral vertical IIT in low quality (labor intensive) vertically differentiated goods. For example, Pakistan exports of low-quality textile articles to the US and imports of high-quality articles from the US.

developed economies (south-north IIT) is most likely to be VIIT, because, according to VIIT models vertical product differentiation (similar goods with different qualities, and with huge price differences), constant return to scale, differences in per capita income, dissimilar factor endowments, and perfect competition are the most important factors that determine VIIT.

Various research studies have been carried out to measure and understand the contributing factor of Pakistan's intra-industry trade. However, no study has been found that is disentangling IIT of Pakistan into its horizontal and vertical components. Therefore, this study will disentangle the total IIT of Pakistan into HIIT, LQVIIT, and HQVIIT components, and examines various patterns (measurement, share, decade wise trends, and dominance). This research work also analyzes decade wise trends and country-specific determinants of Pakistan's IIT in all 1-digit industries of SITC with developed and developing major trading partners. The empirical findings of this research work will be essential and helpful for intra-industry trade policy recommendations and understanding IIT of Pakistan in depth.

This research paper is structured as follows: Section II will present the literature review. Section III will be describing the methodology developed to disentangle the HIIT and VIIT and finding the determinants of IIT. Section IV contains the analysis and results of the estimations. Section V will be giving conclusions of the research study.

2. LITERATURE REVIEW

Balassa (1966), and Grubel & Lloyd (1975), has begun the empirical work on the measurement of IIT. Balassa (1966) analyses the European economies trade within industries of customs and introduced the Balassa index, and Grubel and Lloyd formulated an index of IIT measurement and later presented an improved form of an index known as GL index. Moreover, the innovative work on the IIT by (Krugman, 1979; Lancaster 1980; Helpman, 1981) leads to the elimination of the idea that classical theories of trade could explain IIT.

Krugman (1979) is considered as the pioneer study in introducing IIT with the standard econometric model (regression analysis), which analyzed that similar countries trade in differentiated goods (IIT). Different international empirical studies in the field of IIT have classified IIT into HIIT (two-way exchange of goods which are differentiated horizontally), and VIIT (two-way exchange of vertically differentiated goods). However, various other international studies (Balassa, 1966; Grubel & Lloyd, 1975; Greenaway et al., 1995; Abd-el-Rahman, 1991) have been conducted to measure total IIT, HIIT, VIIT, high-quality VIIT (HQVIIT), and low-quality VIIT (LQVIIT), and to analyze the country-specific and industry-specific determinants of IIT.

Abd-el Rahman (1991), and Greenaway and Milnner (1994), made a very important contribution in IIT theory by introducing unit value indices to decompose IIT into, HIIT, LQVIIT, and HQVIIT. HIIT arises when the trade takes place between horizontally differentiated goods (products having the same quality, but with different attributes). Lancaster (1980), Krugman (1981), and Bergstrand (1990) developed the theoretical basis for horizontal IIT. However, vertical IIT is the trade-in vertically differentiated goods (goods having different qualities/significant unit value gaps). Falvey (1981) and Falvey and Kierzkowski (1987) developed the theoretical bases for vertical IIT.

Various research studies (Balassa, 1979; Krugman, 1981; Helpman, 1981; Kemal, 2004; Zhang et al., 2005; Turkcan, 2005; Shahbaz & Leitao, 2010; Akram & Mahomood, 2013; Rosen, 2016) argue that country-specific and industry-specific variables such as economies of scale, consumer preferences (taste), dissimilarities in per capita income, country size, distance, dissimilarities in factor endowments (capital-

labour ratio), technology, level of education (skills), and market size are the main determinants of IIT using a Gravity model.

The gravity model did not have the theoretical foundation that often questioned the correctness of estimated coefficients through regression, however, now the gravity model is strengthened by the theoretical justifications for using the gravity model to analyze the two-way trade flows. The strong theoretical foundation of a Gravity model was provided by the work of Helpman, (1987), and Feenstra (1997).

In the case of Pakistan few research studies have been conducted to measure the IIT and its determinants, for example, Kemal (2004) computes the Grubel Lloyd indices (GL indices) to find the share of IIT in Pakistan's total trade with the countries of SAARC and ECO. Shahbaz and Leitao (2010) investigate the deciding factors of IIT between Pakistan and ten major trading partners. Akram and Mahmood (2013) find the share of IIT of Pakistan with India, Sri Lanka, and Bangladesh, and examines the determinants of Pakistan's IIT using country and industry-specific variables. Zaheer et al. (2013), analyze IIT of Pakistan with selective eleven major trading partners and examine the country-specific deciding factors of IIT.

However, no such study has been found that has disentangled the IIT of Pakistan into its horizontal and vertical components. No paper has analyzed that which type of horizontal or vertical trade is good for Pakistan considering a trade-in 1-digit industries of SITC. This research study is addressing this gap and the empirical findings of this research work will be essential and helpful for intra-industry trade policy recommendations at the micro-level.

3. METHODOLOGY

One of the most used measures was introduced by Abd-el-Rahman (1991). This specific method is based upon the unit values, which measures the quality differences by taking the ratio of unit values of exports to unit values of imports to decompose IIT into horizontal and vertical Intra industry trade. The Abd-el-Rahman's method of taking UVs of export and imports has been used by Greenaway et al. (1994) to find the extant of Horizontal IIT and vertical IIT. Equation of computing UVs is Unit Value Index = $\sum P_n Q_n / \sum P_o Q_o \times 100$. In this index, P_n is UV of the given commodity in the present time, P_o is the UV of the given commodity in the base time, Q_n is the quantity of the given commodity in the present time, and Q_o is the quantity of the given commodity in the base period.

Unit values (UVs) are used as an indicator of quality. The unit value index measures the average price of a bundle of specific commodity groups. It is supposed that an expensive product type will certainly be of high-quality, while a cheaper product type will be of low-quality (Stiglitz, 1987). UVs could be calculated in different scenarios, i.e., UV per ton, UV per square-meter, or UV per-item. This study has used UVs per item. UVs per item has been used successfully to analyze the patterns of the Swedish VIIT (Torstensson, 1991). UVs per ton was used in the research work of the UK and France trade (Oulton, 1991; Abd-el-Rahman, 1991).

Interestingly some issues are using UVs. Unit prices of commodities can be a function of quality, size, durability, and dependability. Apart from this, prices could be negatively associated with the size. Hence, a vehicle that is expensive, huge in size, and poorly finished could be considered as of lower quality as compared to a vehicle, which is cheaper, smaller in size, and well finished. However, these issues are not considered that important, so to stop the use of the UV index.

Method of decomposing IIT into HIIT & VIIT (HQ & LQ) is described by the following formulae:

$$1-\alpha \leq \frac{UV^X}{UV^M} \leq 1+\alpha; \text{ where } \alpha = 0.15 \quad (1)$$

$$\frac{UV^X}{UV^M} < 1- \alpha \quad (2)$$

$$\frac{UV^X}{UV^M} > 1+\alpha \quad (3)$$

In the above formulae, UV^X and UV^M are unit-values of exported and imported commodities respectively in the given industry and given year between domestic and international countries. However, α is the arbitrarily fixed dispersion factor which is taken to be 0.15 in many research studies (Abd-el-Rahman, 1991). If the equation (1) holds or the ratio of UVs of export to import falls within the range of equation (1), then the products in the given industry are classified under the horizontal Intra industry trade (HIIT). As the above formulae rely on the assumption that the prices of products in a given industry reflect the quality, therefore, products in any given industry having high prices are considered as high-quality, whereas, low price products are of low-quality. Hence, if equation (2) holds then the products in the given industry shall be classified under the low-quality VIIT (LQVIIT), and if equation (3) holds then the products in the given industry are considered under high-quality VIIT (HQVIIT).

Grubel and Lloyd (1975) analyzed the G-L indices at the elementary industry level, i.e., (GLi), and the G-L index for all industries. However, the new index is given below:

$$GL_i = (1- B_t) \quad (4)$$

$$GLi = \left[1 - \frac{|X_i - M_i|}{(X_i + M_i)}\right] \quad (5)$$

$$GLi = \left[\frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)}\right] \quad (6)$$

In equation (6) GLi simply measures the IIT, the numerator of the index represents the percentage quantity of a given product in countries' trade. The value of the GL index ranges from zero to one. If either 'Xi (exports in i industry)' or the 'Mi (imports in i industry)' approaches 0, that means there is no IIT in the given product (no trade overlap), while one represents pure IIT (Trade overlap, $X_i = M_i$, then all the trade-in given product will be IIT).

In this study, we have used the one-digit aggregation level of SITC. However, this class of index is criticized for issues regarding categorical or subgroup (a higher level of SITC / 3- or 5-digit industry) aggregation issues. In this situation, for a given industry x_i and m_i (exports and imports) for the higher disaggregated level of SITC are represented as x_{ij} and m_{ij}. In this case, the percentage of IIT is computed by taking the sums of the total exported and imported commodities at a given higher SITC level '$\sum_j x_{ij}$' and '$\sum_j m_{ij}$'.

The gravity model is simply based on Newton's gravitation law that is described in the following equation.

$$F_{ij} = G \frac{M_i M_j}{D_{ij}^2} \quad (7)$$

Where the M_i and M_j are the masses of two bodies i and j respectively and the force of attraction between two bodies is F_{ij}. The distance between the bodies is D_{ij}. To transform Newton's law for trade, the gravity model is written in the following form.

$$Y_{ij} = \alpha \frac{y_i y_j}{D_{ij}} \quad (8)$$

Where i and j represent two countries (i = 1, 2, … , N; j =1, 2, …, N; $i \neq j$). Y_{ij} represents the bilateral trade flow between the two countries. D_{ij} denotes trade barricades between two countries i.e., distance, language, etc. And y embodies countries' economic size (measured in terms of GDP or population) and α stands for a constant of proportionality.

$$Y_{ij} = \alpha + \beta_1 \log y_i + \beta_2 \log y_j - \beta_3 \log D_{ij} \quad (9)$$

Equation (9) is the logarithmic representation of the gravity equation. This equation is considered as the main gravity equation. This equation implies that bilateral trade is directly proportional to the volume of the economies of two trading countries in terms of their population or gross domestic product (GDP), and inversely related (negatively related) to the capital to capital distance between them. Hence, the more will be the trade between the countries the more similar the countries are in their relative economic size and the lesser will be the trade the farther the countries from each other (as the distance is one of the trade barriers). Core Gravity model shown in equation (9) is augmented by the inclusion of various additional variables by Greenaway et al. (1999), and Turkcan (2005). In this study, the core Gravity model is also augmented by various additional variables for analyzing the bilateral IIT of Pakistan with its twelve major developed and developing trading countries. The augmented gravity model and the variables are described below:

$$\ln Y_{hf,t} = \alpha_0 + \beta_1 \ln AGDP_{hf,t} - \beta_2 \ln DPCGDP_{hf,t} - \beta_3 \ln DHCAP_{hf,t} - \beta_4 \ln DGDP_{hf,t} - \beta_3 \ln WDIST_{hf} + u_{hf,t} \quad (10)$$

$Y_{hf,t}$, $AGDP_{hf,t}$, $DPCGDP_{hf,t}$, $DHCAP_{hf,t}$, $DGDP_{hf,t}$, and $WDIST_{hf}$ represents the trade flow between domestic h, and the international country f in time period t, average GDP between the domestic & international country in time t, the difference in per capita GDP between the domestic & international country in time t, difference in human capital between the domestic & international country in time t, the difference in GDP between the domestic and international country in time t. and the capital distance between domestic and international country respectively.

The panel data approach will be used to estimate the equation (10). FE (Fixed effects) and the RE (random effects) models are the most used panel models, which encompasses legal, cultural, and institutional effects that much likely affect the two-way trade flows. However, initially to choose between models the Breusch-Pagan (BP) will be used. The BP test (Null: Pooled OLS model is appropriate, alt: RE model is appropriate) The BP test will confirm the appropriateness of the RE model over pooled OLS. After the BP test, FE and RE models will be estimated.

To choose the most appropriate model from FE and RE model in both the regressions regarding developing and developed countries Hausman specification test (Null: RE model is appropriate, alt: FE model is appropriate) will be used. Hausman test indicates that the RE model must be preferred over the FE model. Finally, it has been concluded that the RE model is the most appropriate. Some of the results like the results of the distance variable are against the theory. Therefore, the Pesaran CD test (Null: there is no serial correlation, alt: there is a serial correlation) will check either the model has a serial correlation or not. However, cross-sectional dependence is an issue that is mostly found in large or macro panels having long time series like over 20-30 years. Hence, this is not considered as much of an issue in small panels like less than 20 years.

4. DATA

Data on unit value indices for the 1-digit aggregation level of SITC (Standard International Trade Classification) has been taken from the Pakistan Bureau of Statistics (PBS) and the State bank of Pakistan (SBP). Data on exports and imports for Pakistan and its major trading partners are taken from UN

COMTRADE. Data on GDP in million dollars, higher education, and per-capita gross domestic product are collected by exploring the World Development Indicators (WDI), and the data on the distances between the capital of the domestic country and the capital of the foreign trading country has been collected from web. In our knowledge Unit value indices data are not available for higher disaggregated SITC levels.

As far as the values of standard deviation are concerned, the least variation is shown by lnIIT and maximum variation by lnDPCGDP. All the values of variables are in natural logarithmic form. These values are reported in the following Table 1.

Table 1: Descriptive Statistics

Statistic	*LNIIT*	*LNAGDP*	*LNDGDP*	*LNDHCAP*	*LNDPCGDP*	*LNWDIST*
Mean	4.9	27.9	28.2	2.6	11.3	9.1
Median	4.1	27.4	27.8	2.2	10	6.2
Maximum	4.6	29.8	30.5	3.2	11	8.8
Minimum	1.8	25.1	23.7	0.1	2	4.1
Std. Dev.	0.6	1.2	1.7	0.7	2	1.3
Observations	168	168	168	168	168	168

Source: E-Views' calculations. Data is taken from WDI

5. EMPIRICAL ANALYSIS AND ESTIMATION RESULTS

This section will discuss the various patterns of Intra industry trade, the results of different estimation techniques that are used to calculate IIT, and to decompose the intra-industry trade into its horizontal IIT and vertical IIT components. Vertical IIT component is further decomposed into its low-quality vertical intra-industry trade (LQVIIT) and high-quality vertical Intra industry trade (HQVIIT) components. Pakistan's intra-industry trade at the 1-digit industry level of SITC with major fifteen trading countries (Nine developing & six developed) shall be discussed with levels and trends. Estimation results regarding determinants of Pakistan's IIT with developed and developing countries, using panel data techniques have been presented at the end of this section. IIT is estimated for forty-three years from the time of 1976-2018. The G-L indices are calculated for the 1-digit industry level of SITC.

Table 2: IIT of Pakistan with World in 1-Digit industries of SITC (1976-2018)

Groups	GL_i	Groups	GL_i
Food & live Animals	99.37%	Mineral Fuels & Lubricants	0.36%
Beverages & Tobacco	55.81%	Chemical	1.89%
Crude Material Inedible Except Fuels	62.79%	Manufactured Goods	65.11%
Animal and vegetables oils and fats	1.87%	Machinery and Transport Equipment	0.23%
Commodity & transacts.	39.53%	Miscellaneous	30.23%
Total IIT			35.71%

Source: Own estimations and data is collected from the UN-COMTRADE

The presented values of IIT are the average of 43 years. The results of collected data that are used for estimating the intra-industry trade of Pakistan with the world indicate that in the last 43 years, IIT is reported 35.71% in overall trade of Pakistan (inter-industry trade were 64.29 %).

Pakistan IIT is found to have the largest share in the category of "Food & Live-Animals", "Crude-Materials Inedible except Fuels", and "Manufactured Goods" respectively, and IIT is found to be lowest in the category of "Animals Vegetables Oils & Fats", "Minerals Fuels & Lubricants", "Chemicals", and "Machinery & Transport Equipment". The graphical presentation of the results is depicted below.

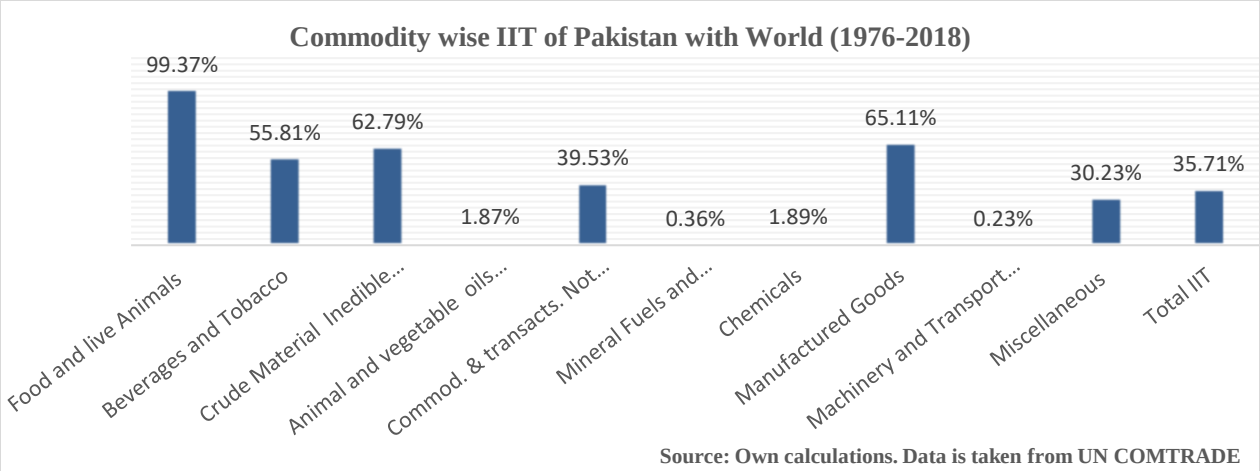


Figure 1: IIT between Pakistan and World in 1-Digit industries of SITC (1976-2018)

Levels of IIT at Three different Periods

Thirty years IIT is calculated from 1989 to 2018. The depicted values of IIT are average values for ten years each. The data, which are collected to calculate the IIT of Pakistan with the world represents that in the period of first 10 years (1989-1998) IIT is found to be more as compare to IIT in second and third ten-year periods, i.e. 1999-2008 & 2009-2018 respectively.

A big negative change has been noticed in IIT of Pakistan with the world that is a negative change of 10% from 37% to 27% in the second decade. In the third ten-year period of 2009-2018, a positive change of 7% has been reported and the IIT of Pakistan is calculated as 34% in contrast to 27% in the second ten-year period of 1999-2008. In these thirty years from 1989 to 2018 IIT of Pakistan with the world is calculated as 32% on average. These values are depicted in the Table 3.

Table 3: IIT of Pakistan with the world in three different time periods

IIT	Years			Average
	1989-1998	1999-2008	2009-2018	
With World	36%	25%	33%	31.3%

Source: Authors' estimations and data is collected from the UN-COMTRADE

Empirical Results of UV Estimations

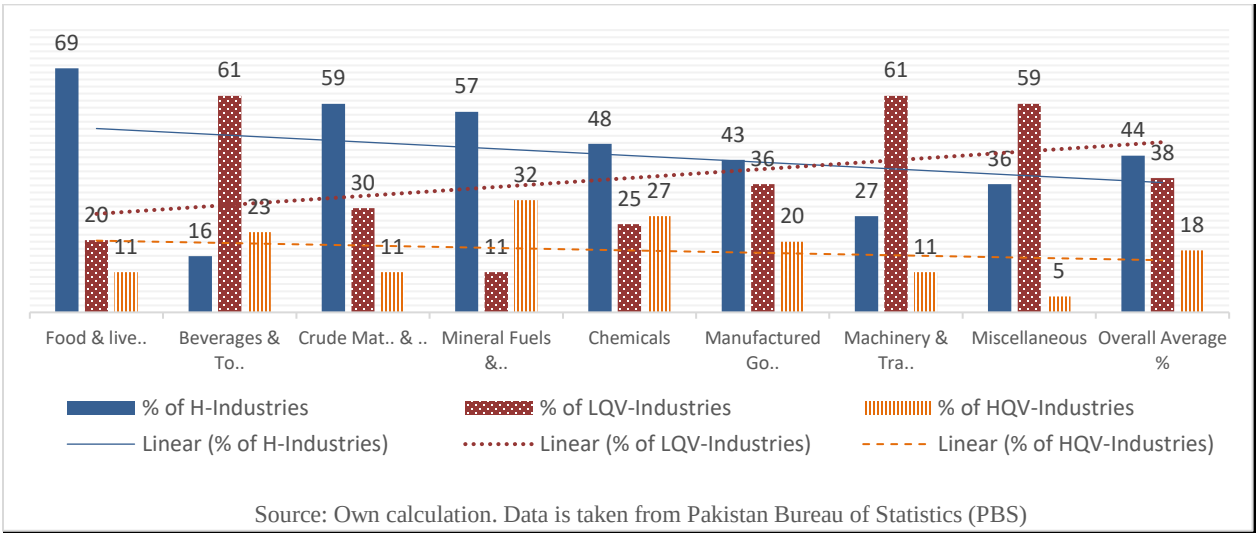
After the estimations, the study has reached the result that in the 1-digit industry level of SITC the dominant type of IIT is horizontal IIT only if $0.85 \leq UV^X/UV^M \leq 1.15$ holds. However, in the one-digit industries, the dominant type of IIT is LQVIIT if $UV^X/UV^M < 0.85$ holds. And in the one-digit industries, the dominant type of IIT is HQVIIT if $UV^X/UV^M > 1.15$ holds. VIIT has been distinguished as high-quality VIIT (if $UV^X/UV^M > 1.15$) and low-quality VIIT (if $UV^X/UV^M < 0.85$). The study has estimated all the 1-digit industries for all the year between the periods of 1976-2018. The estimated figures have been presented in Table 4 and depicted in Figure 2. Moreover, the classification of 1-digit industries of SITC under horizontal IIT, LQVIIT, and HQVIIT for the period of 1976-2018 has been depicted in Table 4. One could simply analyze from the following table that almost half (44.45%) of the 1-digit industries of SITC are classified under HIIT, and as for vertical industries are concerned LQV industries (38.07%) dominates HQV (17.56%).

Table 4: Share of Horizontal and Vertical (HQ, LQ) Industries (1976-2018)

1-Digit Industries	Horizontal Intra-Industries	Vertical Intra-Industries	
	H-Industries	LQV-Industries	HQV-Industries
Food and live Animals	69.19%	20.45%	11.36%
Beverages and Tobacco	15.90%	61.37%	22.73%
Crude Material & Inedible	59.09%	29.54%	11.36%
Mineral Fuels and Lubricants	56.82%	11.36%	31.82%
Chemicals	47.73%	25.00%	27.27%
Manufactured Goods	43.19%	36.37%	20.00%
Machinery & Transport Equipment	27.28%	61.37%	11.36%
Miscellaneous	36.37%	59.09%	4.54%
Overall Average %	44.45%	38.07%	17.56%

Source: Authors' estimations and data is collected from SBP and PBS

In Figure 3 we can see that the quantity of industries with no quality variation between import and export, i.e. horizontal industries, has the most 44.45 % share in total IIT in the specific period. However, the quantity of low-quality vertical industries has the 2nd most 38.07% share in total IIT. In contrast, high-quality vertical industries have a least 17.56% share in Pakistan overall IIT. Lines in the following chart shows the trend across the industries. Share of horizontal and vertical (HQ & LQ) industries in overall IIT has been shown in the following chart.



Source: Own calculation. Data is taken from Pakistan Bureau of Statistics (PBS)

Figure 2: **Share of Horizontal and Vertical (HQ, LQ) Industries (1976-2018)**

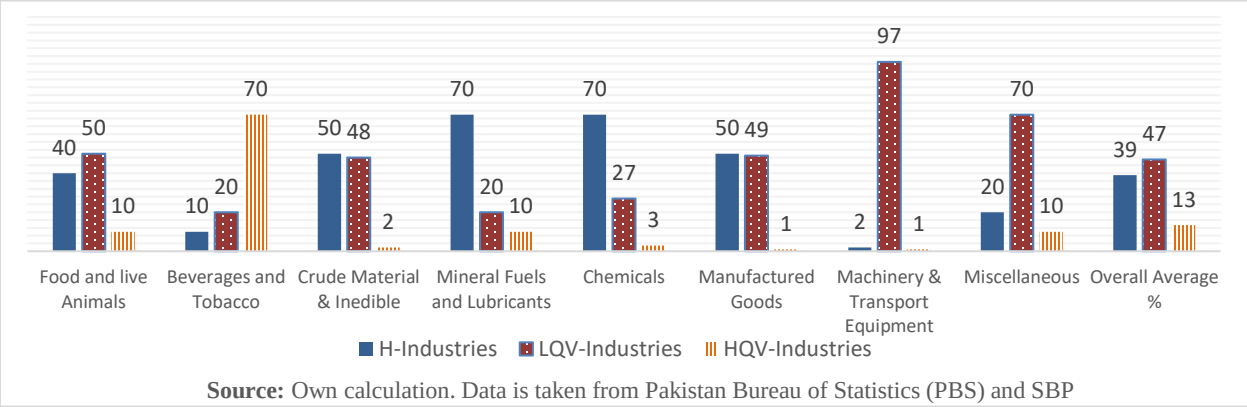
Level of Horizontal and Vertical (HQ & LQ) Industries in Time Period (1989-1998)1st decade

In decade one from 1989-1998, Pakistan's IIT was 37% as shown in Table 5. After decomposing IIT into its horizontal IIT and vertical IIT components, horizontal and vertical (HQ & LQ) industries are found to be 39%, 47%, and 13% respectively in the 1st decade. Low-quality vertical industries on average dominated 1-digit industries. Commodity wise detail shows that in the category of "Food and live Animals", "Manufactured Goods", "Machinery & Transport Equipment" and "Miscellaneous" LQ vertical IIT is found to be highest 50%, 49%, 97.00%, and 70.00% respectively and in the industries of "Beverages and Tobacco", and "Mineral Fuels & Lubricants" low-quality vertical IIT is found to be 20.00 and "20.00% lowest. Hence, in a decade, one dominance of low-quality vertical IIT justifies that the results of calculations are consistent with the literature. These values are depicted in the following Table 5 and Figure 3.

Table 5: Share of Horizontal and Vertical (HQ, LQ) Industries, Decade 1

1-Digit Industries	Horizontal Intra-Industries	Vertical Intra-Industries	
	H-Industries	LQV-Industries	HQV-Industries
Food and live Animals	40.00%	50.00%	10.00%
Beverages and Tobacco	10.00%	20.00%	70.00%
Crude Material & Inedible	50.00%	48.00%	2.00%
Mineral Fuels and Lubricants	70.00%	20.00%	10.00%
Chemicals	70.00%	27.00%	3.00%
Manufactured Goods	50.00%	49.00%	1.00%
Machinery & Transport Equipment	2.00%	97.00%	1.00%
Miscellaneous	20.00%	70.00%	10.00%
Overall Average %	39.00%	47.00%	13.38%

Source: Authors' estimations and data is collected from SBP and PBS



Source: Own calculation. Data is taken from Pakistan Bureau of Statistics (PBS) and SBP

Figure 3: Share of Horizontal and Vertical (HQ, LQ) Industries, Decade 1

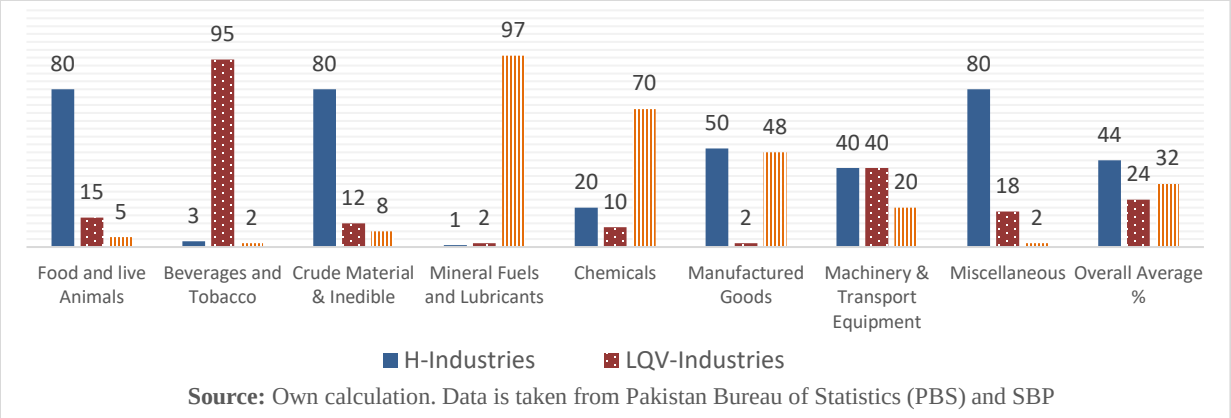
Level of Horizontal and Vertical (HQ & LQ) Industries in Time (1999-2008) decade 2

By comparing decade one and two, one can easily notice that high-quality VIIT showed an increasing trend in decade two from 14% to 32 % respectively. However, LQVIIT demonstrated a decreasing trend from 43% to 24% in decade two respectively and HIIT has demonstrated an increasing trend in decade two from 39.00 to 44.00%. These values are depicted in the following Table 6 and Figure 4.

Table 6: Share of Horizontal and Vertical (HQ, LQ) Industries, Decade 2

1-Digit Industries	Horizontal Intra-Industries	Vertical Intra-Industries	
	H-Industries	LQV-Industries	HQV-Industries
Food and live Animals	80.00%	15.00%	5.00%
Beverages and Tobacco	3.00%	95.00%	2.00%
Crude Material & Inedible	80.00%	12.00%	8.00%
Mineral Fuels and Lubricants	1.00%	2.00%	97.00%
Chemicals	20.00%	10.00%	70.00%
Manufactured Goods	50.00%	2.00%	48.00%
Machinery & Transport Equipment	40.00%	40.00%	20.00%
Miscellaneous	80.00%	18.00%	2.00%
Overall Average %	44.25%	24.25%	32.00%

Source: Authors' estimations and data is collected from SBP and PBS



Source: Own calculation. Data is taken from Pakistan Bureau of Statistics (PBS) and SBP

Figure 4: Share of Horizontal and Vertical (HQ, LQ) Industries, Decade 2

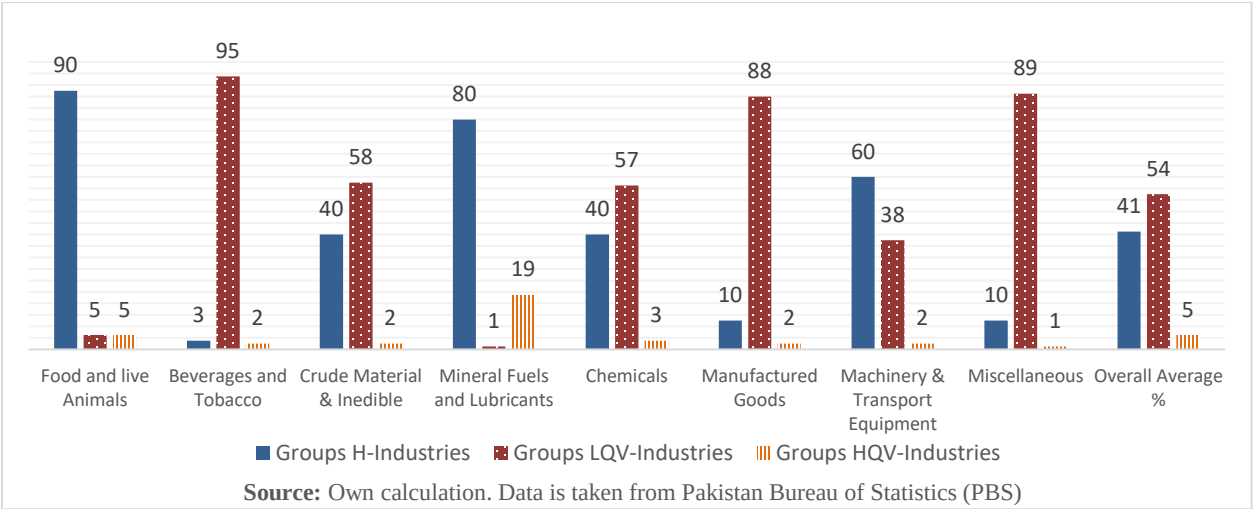
Level of Horizontal and Vertical (HQ & LQ) Industries in Time 2009-2019 decade 3

Product-wise in the category of "Beverages and Tobacco", "Crude Material & Inedible", "Manufactured Goods", "Chemicals and Miscellaneous" LQVIIT is found to be highest 95%, 58%, 57%, 88% and 89.00% respectively and in the category of "Food and live animals", and "Mineral Fuels & Lubricants" LQVIIT is found to be 5.00% and 1.00% lowest respectively. These values are depicted in Table 7 and Figure 5.

Table 7: Share of Horizontal and Vertical (HQ, LQ) Industries, Decade 3

1-Digit Industries	Horizontal Intra-Industries	Vertical Intra-Industries	
	H-Industries	LQV-Industries	HQV-Industries
Food and live Animals	90.00%	5.00%	5.00%
Beverages and Tobacco	3.00%	95.00%	2.00%
Crude Material & Inedible	40.00%	58.00%	2.00%
Mineral Fuels and Lubricants	80.00%	1.00%	19.00%
Chemicals	40.00%	57.00%	3.00%
Manufactured Goods	10.00%	88.00%	2.00%
Machinery & Transport Equipment	60.00%	38.00%	2.00%
Miscellaneous	10.00%	89.00%	1.00%
Overall Average %	41%	54%	05%

Source: Authors' estimations and data is collected from SBP and PBS



Source: Own calculation. Data is taken from Pakistan Bureau of Statistics (PBS)

Figure 5: Share of Horizontal and Vertical (HQ, LQ) Industries, Decade 3

Concluding Remarks and Comparison of Three Decades

In Figure 6 trends of industries classified under horizontal and vertical (LQ& HQ) IIT over time have been depicted. LQ vertical industries are reported with an increasing trend in time (1989-2018) i.e. the number of LQ vertical industries is increasing over time in Pakistan. It eventually means that LQVIIT is also increasing over time in Pakistan. HQ vertical industries are showing a decreasing trend, which simply means, HQVIIT in getting lower in Pakistan over time. However, horizontal industries are reported with an almost constant trend. These values are depicted in Table 8 and Figure 6.

Table 8: Share of Horizontal and Vertical (HQ, LQ) Industries of three decades.

Decade/ Industry Type	H-Industries	LQV-Industries	HQV-Industries
Decade 1	39%	47%	13%
Decade 2	44%	24%	32%
Decade 3	41%	54%	5%
Average	41%	42%	17%

Source: Authors' estimations and data is collected from SBP and PBS

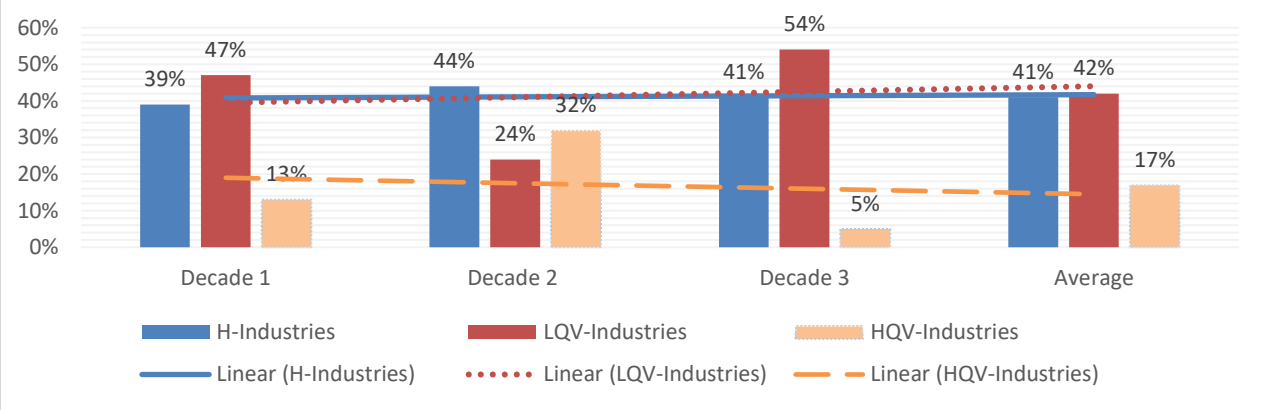


Figure 6: Share of Horizontal and Vertical (HQ, LQ) Industries of three decades.

Trend, Level & Dominance of Horizontal and Vertical (HQ & LQ) IIT Commodity Wise Over Time (1989-2018)

Data used in this study indicates that the category of "Food and Live Animals", "Mineral Fuels and Lubricants", "Machinery and Transport Equipment" is dominated by HIIT. LQ vertical IIT has shown an increasing trend in the category of "Beverages and Tobacco", "Crude Material & Inedible", "Chemicals", "Manufacturing Goods", and "Miscellaneous". Industries classified under HQ vertical IIT are very low in Pakistan, but they have shown an upward trend in the category of Minerals Fuels & Lubricants, "Manufacturing Goods" and Machinery. None of the 1-digit industry is dominated by HQ vertical IIT. Therefore, as concluding remarks we can say that this analysis reported that LQVIIT is the dominant form of IIT in total IIT of Pakistan. All the facts and figures are depicted in the Figure 7.

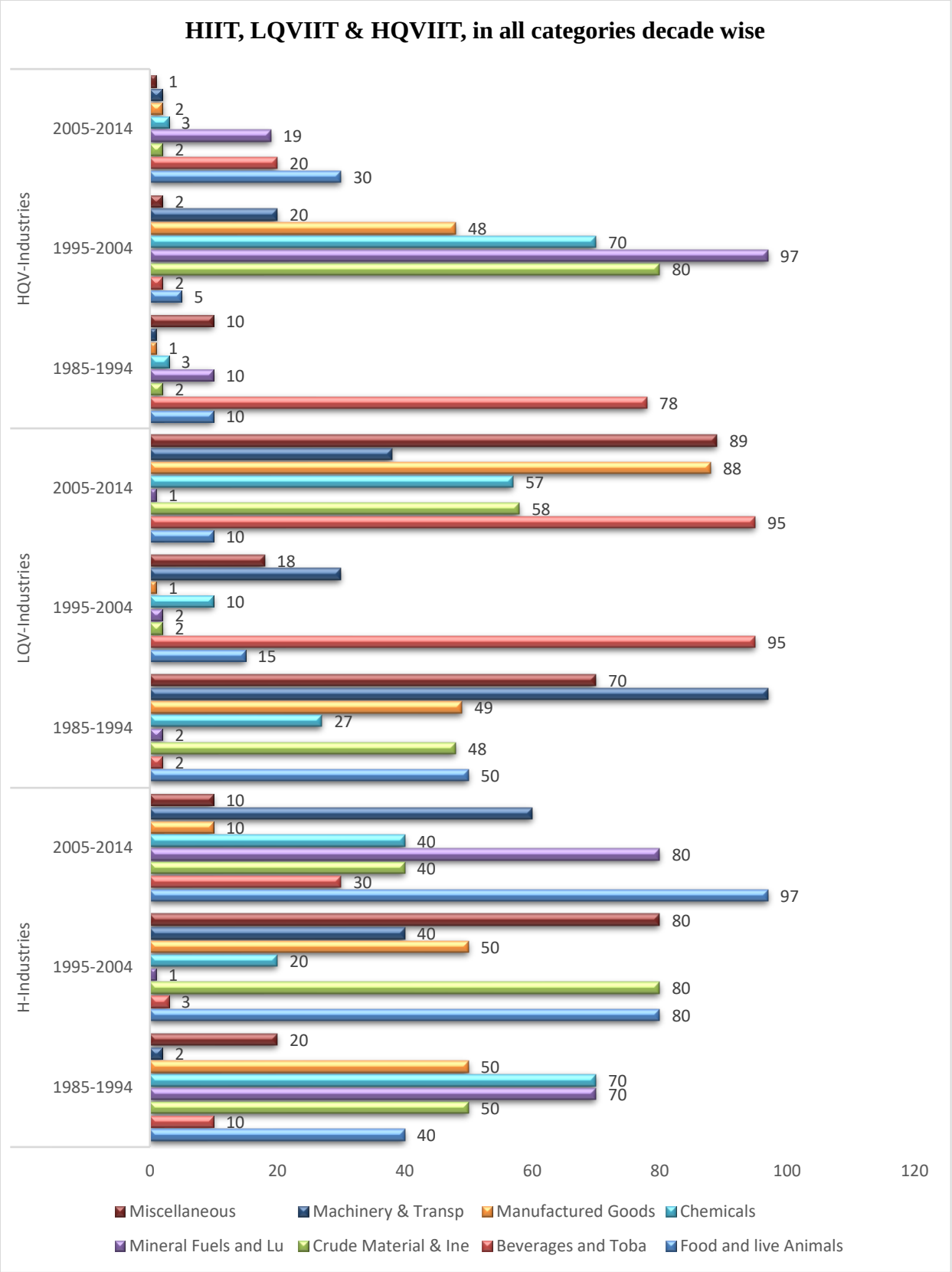


Figure 7: Plots of HIIT, LQVIIT & HQVIIT, decade wise in all categories

IIT of Pakistan with Selected Developing and Developed Countries.

At the 1-digit aggregation level of SITC, IIT has been calculated for forty-three years from 1976 to 2018. Twelve countries (China, Malaysia, UAE, India, Turkey, Iran, Germany, Japan, UK, US, Canada & Australia) have been divided into two groups (1st group of developing countries & 2nd group of developed countries). In each group, six countries have been placed. These 12 countries are considered as the major trading countries of Pakistan in the developing and developed world. In 43 years from 1976 to 2018, Pakistan IIT with the group of developing countries is found to be 23.39% and with the group of developed countries, it is reported as 22.54%. Pakistan has the most IIT 23.39% with developing countries. Therefore, our estimation results are consistent with the literature (IIT between developing countries is more of horizontal nature (HIIT) and IIT between developing and developed is more of vertical nature (Falvey, 1981).

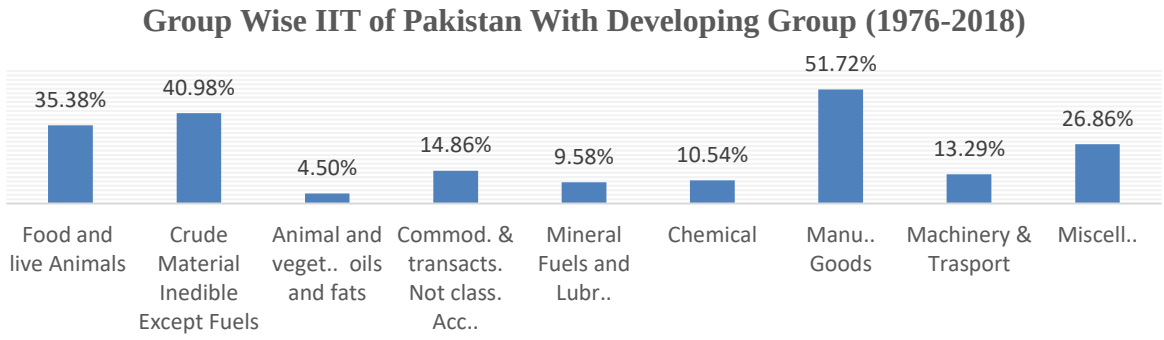
Table 9: IIT of Pakistan with selected developing and developed countries (1976-2018)

Groups & Country		Food and live Animals	Crude Material Inedible	Animal and veget.	Commod. & transacts	Mineral Fuels	Chemical	Manu. Goods	Machinery & Trasport	Miscell.	All Groups
Developing	CHINA	70.00	90.00	0.23	0.34	30.00	0.32	99.21	0.34	0.45	32.30
	MALAYSIA	44.98	2.32	0.72	25.76	0.76	4.76	79.87	4.87	76.98	26.78
	UAE	9.03	41.86	13.95	30.23	4.65	23.25	23.35	25.58	6.97	21.78
	INDIA	34.89	23.87	0.56	11.98	16.55	11.76	46.90	2.35	46.54	21.71
	TURKEY	27.90	55.81	2.23	13.95	4.65	20.93	21.87	11.62	23.25	20.22
	IRAN	25.50	32.00	9.30	6.90	0.87	2.23	39.34	34.98	6.98	17.57
All Countries		35.38	40.98	4.50	14.86	9.58	10.54	51.72	13.29	26.86	23.39
Developed	GERMANY	58.09	76.87	2.45	27.66	2.32	0.54	83.72	0.76	32.55	31.66
	JAPAN	32.55	72.09	2.32	18.60	32.25	0.32	74.42	0.23	51.16	31.55
	UK	16.21	51.61	6.97	46.51	11.62	0.32	41.86	0.43	51.16	25.19
	US	44.18	23.25	0.32	37.20	4.63	6.97	27.90	0.32	2.32	16.34
	CANADA	25.58	2.32	4.65	39.53	0.43	13.95	51.67	0.43	2.32	15.60
	AUSTRALIA	25.65	11.76	4.60	37.20	0.65	0.89	51.17	0.65	2.23	14.89
All Countries		33.71	39.65	3.55	34.45	8.65	3.83	55.04	0.47	23.62	22.54

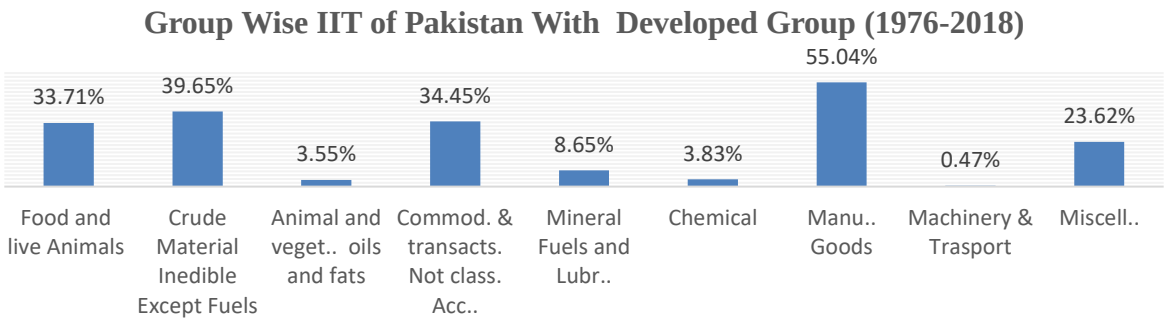
Source: Authors' estimations and data is collected from SBP and PBS

In the group of developing countries, commodity wise in the category of "Manufacturing Goods" Pakistan IIT is reported highest 51% while country-wise in the category of "Manufacturing Goods" China and Turkey reported 99.2% and 21.8% highest level, and the lowest level of IIT respectively. Category of "Animals, vegetable oils and fats" reported the lowest level of IIT i.e. 4.50%. IIT of Pakistan is found to be most with China, Malaysia, and UAE with the IIT level of 32%, 26%, and 21.78% respectively. IIT of Pakistan with India, Turkey, and Iran is reported 21%, 20%, and 17% respectively.

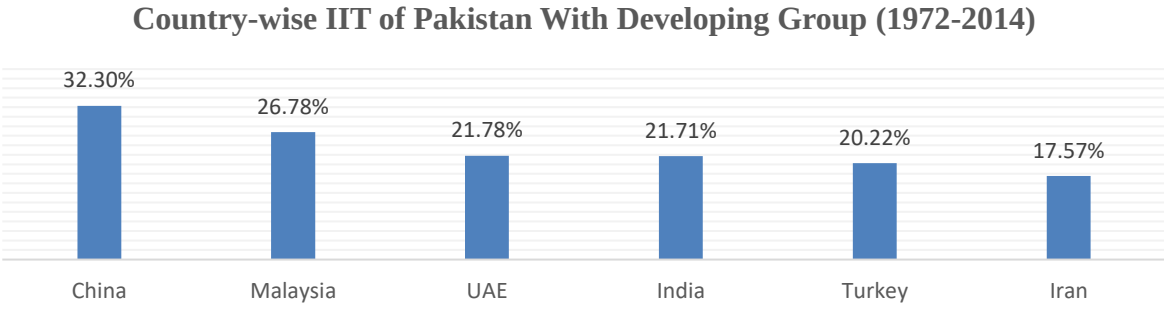
In the group of developed countries, in the category of "Manufacturing Good" Pakistan IIT is found to be the highest 55.04% commodity wise. On the other hand, country-wise in the category of "Manufacturing Goods" Germany and the US reported 83.72% and 27.90% highest and lowest level of IIT respectively. The lowest level of IIT 0.47% is reported in the category of "Machinery and Transport Equipment". Moreover, IIT of Pakistan is found to be most with Germany, Japan, and the UK and the level of IIT with these countries is 31.66%, 31.55%, and 25.19% respectively. These Values are depicted in the following table and bar graphs.



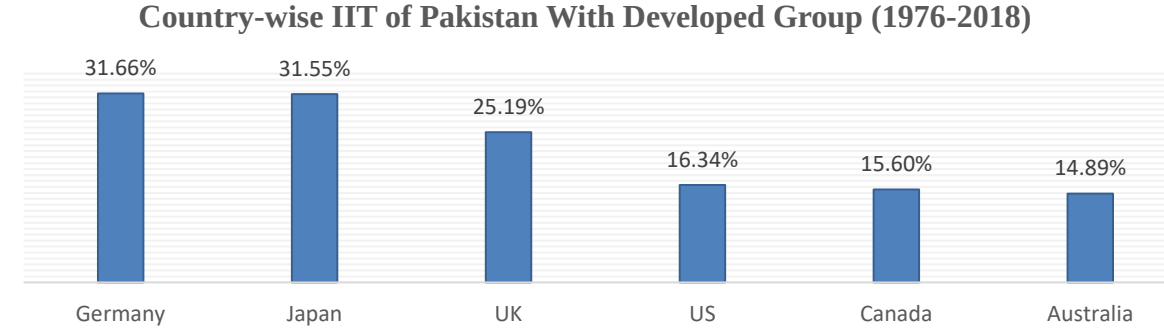
Source: Own calculation. Data is taken from UN COMTRADE



Source: Own calculation. Data is taken from UN COMTRADE



Source: Own calculation. Data is taken from UN COMTRADE



Source: Own calculation. Data is taken from UN COMTRADE

Figure 8: IIT of Pakistan with selected developing and developed countries, Group and Country-wise (1976-2018)

Deciding Factors of IIT

Estimation shows that in the groups of developed and developing countries in the "Manufacturing Goods" industry Pakistan's IIT is found to be highest. Therefore, country-specific determinants of IIT between Pakistan and her developed and developing major trading countries at the 1-digit industry level of SITC will be examined.

Data for estimations have been collected from World Development Indicator (WDI) from 2004 to 2018. A set of panel-data with two dimensions, time and countries has been used for estimations. Two augmented gravity models are estimated using STATA. The following augmented gravity model (discussed in methodology equation 10) has been estimated for both groups of developed and developing countries to examine the determinants of IIT.

$$lnIIT_{khft} = \alpha_0 + \beta_1 lnAGDP_{hft} - \beta_2 lnDPCGDP_{hft} - \beta_3 lnDHCAP_{hft} - \beta_4 lnDGDP_{hft} - \beta_5 lnWDIST_{hf} + u_{hft} \quad (11)$$

Estimations and Results

Two Random Effects (RE) models have been estimated to analyze the deciding factors of IIT. The results of Hausman tests, RE models, BP test, Pesaran test, and F-test for two models of developed and developing countries have been stated in Table 10.

Table 10: Results of two RE models at the 1-digit level of SITC

Variables	Model One (For Developing Countries)			Model Two (For Developed Countries)		
	Coefficient	*Z-Stat*	*P-Value*	*Coefficient*	*Z-Stat*	*P-Value*
AGDP	1.3038	5.14	0.000	3.6022	3.37	0.001
DPCGDP	-0.1086	-3.95	0.000	-0.2241	-1.85	0.080
DHCAP	0.2335	1.98	0.042	0.0273	0.46	0.644
DGDP	-0.8302	-4.15	0.000	-2.1481	-2.33	0.020
WDIST	-0.0466	-0.78	0.437	-1.5517	-9.62	0.000
CONSTANT	-8.1312	-3.55	0.000	-22.9473	-5.53	0.000
BPLM Test			0.000			0.000
Hausman Test			0.882			0.607
Pesaran CD Test			0.873			0.389
F-Test			0.000			0.000
R^2	*Within*	*Between*	*Overall*	*Within*	*Between*	*Overall*
	0.0179	0.6335	0.3521	0.1622	0.8379	0.6321

Source: Authors' calculations. Data is taken from WDI & WITS (UN COMTRADE)

All variables except distance in the first model for developing countries and differences in human capital in the second for developed countries are statistically significant. Signs and coefficient of all the variables are as expected. AGDP measures the market size, and it has a significant positive impact on IIT in both models. The opening of international trade makes the market size larger. The increase in the market size enables the producers to produce more and get the benefits of economies of scale. EOS in production lesson the cost of production and increases the opportunities for firms to maximize their profit. Therefore, as the market size increases, IIT will also increase. The impact of AGDP on IIT is in line with the previous findings of Balassa (1979), and Krugman (1985).

The impact of variable DPCGDP is found with a significant negative impact on IIT in all models. The difference in per-capita GDP is a proxy used for consumer's preferences/tastes. Therefore, if the individual's tastes/preferences become different in both the trading countries, then the people shall start demanding goods of different attributes. Hence, the possibility of bilateral IIT between trading countries

will be lessened. The results of this study regarding DPCGDP are in line with the previous studies of Linder (1961).

In this study difference in human capital endowment (DHCAP) is reported with a significant positive impact on IIT in the first model (for developing countries) and a positive insignificant influence on IIT in the second model (for developed countries). So, the result for the 1st model (for developing countries) is consistent with the finding of Turkcan (2005). However, it has been shown that 88% of Pakistan's trade-in "Manufacturing Goods" industry is of LQ vertical IIT (LQVIIT). That means the higher the difference in factor endowments the higher will be the VIIT. Therefore, our finding supports the positive impact of human capital differences on IIT. On the other hand, the IIT between developing and developed economies is of the vertical type. The difference in the market's size of the two economies shows their ability to produce different goods. If the difference in the market size of Pakistan and her trading country is higher, the IIT between them will be less. DGDP is highly significant and with a negative sign in all models. Hence, the results are from the previous studies of Turkcan (2005), and Greenaway et al. (1994).

Interestingly distance is not explaining IIT of Pakistan in the 1st model (for developing trading countries). The distance variable (WDIST) has an insignificant negative influence on the IIT in the first model, but a negative significant influence on the IIT in the second model. It confirms that distance does not affect the IIT of Pakistan to its developing trading countries at one-digit analysis. It has been depicted that IIT of Pakistan is found to be the 2nd most 31.4 percent with Malaysia from 2008-2018, and the distance between Pakistan and Malaysia is highest (4509 Km) in the group of developing countries. On the other hand, IIT share of Pakistan is at fourth and fifth (among six developing countries) with its border-sharing trading countries (Iran and India) which is very low.

6. CONCLUSION

The primary aim of this research paper was to decompose IIT of Pakistan into HIIT, LQVIIT & HQVIIT and measuring the IIT of Pakistan with its fifteen major trading countries as well as with the groups of developed and developing major trading countries at the 1-digit industry level of SITC. The secondary objective was to analyze the country-specific determinants of Pakistan's IIT with the groups of major developed and developing trading countries separately. The present study used unit value indices to distinguish industries classified under Horizontal IIT and vertical IIT, GL indices to measure the extent of IIT with fifteen major trading partners, and Augmented Gravity model with panel data techniques to examine the country-specific factor/determinants of IIT of Pakistan with the groups of developed and developing major trading countries.

In the last forty-three years on average, the share of IIT in total trade of Pakistan with the world is 31% in one-digit industries of SITC. Product-wise, in the category of "Food & Live Animals" (99.37%), and "Manufactured Goods" (65.11%), Pakistan's IIT is found to be highest, while in the category of "Animals Vegetables Oils & Fats" (1.87%), and "Machinery & Transport Equipment" (0.23%) Pakistan's IIT is found to be lowest. In the last two decades, an increasing trend has been noticed in IIT of Pakistan, i.e., a positive change of 7%, as the share of Pakistan's IIT in total trade was 27% in the second decade while 34% in the last decade.

It can be concluded that, in Pakistan industries classified under HIIT dominate the industries classified under VIIT, while the industries classified under LQVIIT dominate the industries classified under HQVIIT, in given years (1976-2018). In Pakistan, the highest number of horizontal industries have been found in the category of "Food and live animals" (69.19%), and "Manufacturing Goods" (43.19). In contrast, the maximum number of LQ vertical industries have been noticed in the category of "Beverages & Tobacco" (61.37%), and "Machinery & Transport Equipment" (61.37%) while the HQ vertical industries are in

maximum number in the group of "Mineral Fuels & Lubricants" (31.82) and Chemicals (27.27) from 1972 through 2014.

Interestingly, In the last three decades, LQV industries have shown an increasing trend while HQV industries have shown a decreasing trend and horizontal industries have been reported with a constant trend. Besides, in the last decade (2009-2018) Pakistan's IIT is dominated by LQV industries (54%), however, the share of horizontal industries was 41% while HQV industries are estimated only 17% in total one-digit industries of SITC.

IIT of Pakistan is more with developing nations rather than with developed countries in the period of 1976-2018. In the group of developing countries, country-wise, IIT of Pakistan is found to be most with China (32.30%), Malaysia (26.78%), UAE (21.78%), India (21.71%), Turkey (20.22%), Iran (17.57%), Saudi Arabia (16.61%), Afghanistan (13.93%) and Kuwait (8.9%). However, category wise in the group of developing countries, Pakistan's IIT is highest in the category of "Manufacturing Good" (51.72%) while lowest in "Animals and Vegetable Oil" (4.50%). In the group of developed countries, country-wise, IIT of Pakistan is found to be most with Germany (31.66%), Japan (31.55%), UK (25.19%), US (16.34%), Canada (15.60%), and Australia (14.89%). However, category wise in the group of developed countries, Pakistan's IIT is highest in the category of "Manufacturing Good" (55.04%) while lowest in "Machinery and Transport" (0.47%).

Based on the findings of the random effect model, on the on hand, in the group of developing countries, country-specific variables, i.e., market size, and the difference in human capital has a positive significant impact on IIT, while the difference in consumer preferences, and the difference in market size, has a negative and highly significant impact on IIT, however, interestingly distance variable is statistically insignificant and failed in influencing IIT of Pakistan with developing countries. On the other hand, in the group of developed countries, the result of all the variables are as expected. However, the variable of 'difference in human capital' is insignificant and failed in explaining IIT of Pakistan with developed countries.

Since the share of IIT in total trade of Pakistan is growing sharply over time, hence, trade policymakers may encourage EOS, product innovation, and capital improvement which are the basis of IIT (HIIT& VIIT). However, to accelerate the extent, and share of IIT of Pakistan with the developed and developing world, policymakers may specifically pay special attention to the significant determinants and encourage trade with neighboring countries.

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