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Trade Diversification and Economic Growth of Pakistan

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ABSTRACT

Objective: This paper examines the Verdoorn hypothesis for Pakistan with its trading partners, Bangladesh, India, Indonesia, and Malaysia. Another objective of this paper is to analyse short-run and long-run association between intra-industry trade and its determinants, population growth, free trade agreement, terms of trade and economic growth.

Research Gap: In the Authors' best knowledge, few research papers have analysed the benefits of intra-industry trade and incorporated its determinants for four trading partners countries Bangladesh, India, Indonesia, and Malaysia.

Design/Methodology/Approach: Grubel and Lloyd Index employed to estimate Intra-Industry Trade. The paper also estimates the ARDL cointegration test, with three estimators Pooled Mean Group (PMG), Mean Group (MG), Dynamic Fixed Effect (DFE), and Error Correction Model to find out the short-run and long-run association between intra-industry trade and its factors for Pakistan with its trading Partners by using panel data from 2000 to 2002.

The Main Findings: The Verdoorn Index has been found positive for Pakistan and the ARDL model also found long-run cointegration with the speed of adjustment 1.6014. Population growth and terms of trade are positively associated with intra-industry Trade in the short run but these variables are insignificant with intra-industry trade in the long run for Pakistan. The free trade agreement and real GDP, both, are positively associated long-run and short-run with intra-industry trade.

Theoretical / Practical Implications of the Findings: The policymakers should diversify Pakistan's international trade and improve infrastructure to reduce transport costs and other costs to expand economic growth.

Originality/Value: Some research papers have analysed IIT for Pakistan but these research papers do not consider the impact of these determinants on Intra-industry trade for Pakistan and its trading partners.

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1. Introduction

Asian countries are experiencing intra-regional trade with industrialized countries and these countries are benefitted by global production fragmentation and vertical integration in the production supply chain to extend their trade. The free trade agreements and the multinational corporations have supported this trade and also introduced new technology and capital(Intarakumnerd & Techakanont, 2016). The bilateral and multilateral trade, which is supported by the free trade agreement, also increases intra-industry trade (IIT) in associated countries and provides economies of scale for producers and brings economic efficiency and benefits for both buyers and manufacturers with diversifying products(Varma & Ramakrishnan, 2014).

This trade also increases countries income per capita and reduces poverty(Hesse, 2008). But the skills and technology these multinational corporations provide to developing countries differ from country to country because of limited resources and investment constraints. These countries also lack skills, knowledge, experience, and government support to acquire new technology and most developing countries, especially in South Asia, are labor-intensive and need time and resources to adopt the required skills. This trade also supports inter-firm innovation, but multinational companies are not interested to support its trading partner of developing countries to innovate at the firm level, and small firms, which are lacking investment, technology, high skills labor, are labor-intensive, and have low capacity to meet more demand, exit from the competition. Hence, technological adoption at the inter-firm level is also different in these countries, and foreign direct investment should be welcomed to support inter-firm innovation (Intarakumnerd & Techakanont, 2016).

As the theory indicated that intra-industry trade (IIT) benefits both countries, so, after 1960, the World Trade Organization (WTO) has expanded the intra-trade industry (IIT) within developed and developing countries and spread the international production networks (IPNs). This trade has also fostered the increased division of labor in Asian nations, paving the way for intra-bloc regional trade agreements (RTAs) to encourage commerce in these countries, particularly in East and Southeast Asia (Aggarwal & Chakraborty, 2017).

The South Asian countries of the South Asian Association of Regional Cooperation (SAARC) also made the South Asian Preferential Trade Agreement (SAPTA) in 1995 which later became the South Asian Free Trade Agreement (SAFTA). Under this umbrella, South Asian countries have not taken advantage more and IIT is low in these countries. India has also entered into other trade agreements for example, with Sri Lanka (India-Sri Lanka Free Trade Agreement) and the Southeast Asian Nations (ASEAN), has benefited from IIT over the years by reducing tariffs Aggarwal & Chakraborty, 2017; Varma & Ramakrishnan, 2014). As compared to Bangladesh and Pakistan, India is a gigantic economy in South Asia having more population, land, and size of economy and yet, it is the 2nd largest country in the global population. It also has good trade relations with Bangladesh, but it does not have good trade relations with Pakistan because of the political situation (Islam, 2018).

Many studies suggest industrial structure, patterns requirements, and size of economies as crucial variables for country-level effects, product diversification, trade volume, distance and market size, geographical situations, human capital, and economies of scale are considered the main industry-level effects. Trade liberalization, and industrial policy are also important factors to diversify the products of the country(Cadot et al., 2011). The theory also suggests other important variables which are labor costs, transport costs, and trade barriers. Studies also suggest if IIT is more diversified, the labor cost is more adjusted in vertical IIT as compared to horizontal diversified IIT (Sohn & Zhang, 2006).

The Southeast Asian Countries have an advantage in IIT over inter-industry trade and factors like economic size gain positive trade for these countries. The trade also fosters the size of GDP, geographic closeness, resemblance in the aggregate GDP, and GDP per capita. The IIT is also strong for these countries in product diversification and supply chain of the manufacturing sectors because of economic integration with geographic closeness, same economic size, and level of development. The economy of scale also plays an important role to get benefits from this trade. However, these South Asian Association Regional Countries (SAARC) have a low economic base and investment and have structural rigidities because of political issues, so, they have low levels of industrialization and IIT (Kabir Hassan, 2001; Salim et al., 2018).

Studies have estimated IIT by different techniques. Intarakumnerd and Techakanont (2016) used the Grubel-Lloyd (G-L) index to analyze trade patterns and IIT in the automobile industry. The study observed that the industry's technological upgradation needs a company plan and association with other actors in the national innovation system. Sohn and Zhang (2006) measured the IIT with the same Index and ran the OLS regression on horizontal IIT and vertical IIT, overall IIT, per capita GDP, GDP relative size effects, and FDI for East Asian countries from 1990-2000. This study shows that income difference has a negative

association with horizontal intra-industry trade (IIT) and a positive association with vertical intra-industry trade (IIT); FDI, across country correlation with horizontal IIT, is positive and its association with vertical IIT is negative (Fukao et al., 2003). The same approach was adopted by Thorpe & Zhang (2005) and they incorporated variables in their study GDP per capita, GDP relative size effects, dissimilarities in income per capita, the trading countries' distance, exchange rate, trade orientation, and trade imbalance. The research investigates that the association of IIT with market size, exchange rate depreciation, and income per capita is positive and its association with the trading partners' distance or geographic location is negative (Hesse, 2008). Phan and Jeong, (2014) establishes the relationship between ASEAN6 countries and Korea to examine the factors and pattern of IIT by using a similar Index and panel-pooled OLS. They show that FDI and income level are positively associated with IIT whereas dissimilarities in factor endowments and IIT have a negative correlation. The size of the market, differences in income, and factor endowments are important to justify IIT. Bagchi and Bhattacharyya (2019) also used this index for India and its trading associates, then separated intra-industry Trade as horizontal and vertical IIT. It measures that economic development and IIT are positively associated with India. The horizontal IIT and vertical IIT are also positively associated with economic development. The South Asian Free Trade Area (SAFTA) and relative factor endowments positively encourage horizontal IIT. The tariff does not decrease the size of horizontal IIT while relative depreciation of the real exchange rate raises India's imports, and this real exchange rate declines progress in vertical IIT and total IIT. Geographical dissimilarity has also negative impacts on all forms of IIT. Furthermore, declining of trade barriers stimulates the overall IIT but multinational companies' behavior seeking market in domestic companies discourages IIT (Aggarwal & Chakraborty, 2017, 2022; Veeramani, 2009).

India also has a comparative advantage in trade over Bangladesh, but both nations' degree of IIT is relatively low (Islam, 2018). However, if Bangladesh spreads its exports and invests in product diversification, it can lessen its trade deficit (Sushil & Shahid, 2014).

Saparamadu and Weerasinghe (2021) estimated the factors of IIT for Sri Lanka and its South Asian partners; India, Pakistan, and Bangladesh from the period of 1992 to 2017. This study adopts the gravitation model and analyzed the same Index for IIT and runs a random effect panel regression model to show that economies of scale and market size have a positive association with IIT in this region. However, differences in per capita Gross National Income are inversely linked to IIT. Tariff rates and IIT are also inversely connected.

Sawyer et al., (2010) and Ando (2006) used other techniques to capture IIT and estimate the multilateral trade-weighted Index and decomposition threshold method. They also modeled factors of IIT through the Tobit regression model for Asian countries. These studies explore that Asian industrialized countries are more diversified and these countries' research & development, trade openness, and exports are positively associated with IIT, whereas distance among these countries and economic size have a negative effect on IIT. Within Asian countries, Standard International Trade Classification (SITC) categories have an influence on IIT for the ASEAN unrestricted trade zone while primary products have an influence on IIT in central and South Asian Countries. Chin et al., (2016) calculated the parallel method, decomposition threshold, to assess the IIT and run the Autoregressive Distribution Lag Model (ARDL) to establish the relationship between real GDP difference and FDI with IIT in the short-run as well as in the long-run for Singapore and Malaysia. The research paper elaborated that real GDP difference has an impact on IIT in the short run as well as in the long run for Malaysia and Singapore but foreign direct investment inflows has short-run impact on IIT. Consequently, vertical IIT benefits both countries to cooperate with each other, and their regional economic partnership will enhance trade(M. Y. Chin et al., 2020; Jambol & Wana Ismail, 2013). On the other hand, East Asian countries do not have an advantage in vertical product trade diversification though these countries have increased vertical IIT. This vertical IIT primarily increases because to the rise in huge vertical transactions in machinery parts and elements (Ando, 2006; Sawyer et al., 2010).

IIT was also estimated through Grubel and Lloyd Index (G-L) employing 31 years of Pakistan's data of its eleven trading partners. The Gravity model and OLS panel data technique were used to gauge IIT determinants. The research findings of this paper were that economic size is positively associated with IIT but the difference in GDP has a negative association with IIT. Similarly, the difference in per capita adversely impacts IIT when consumers' preferences change based on taste. Furthermore, the small space of Pakistan and its trading associates reduces transportation cost as well as other costs and it also increases trade volume. The exchange rate affects negatively Pakistan's bilateral trade. The study also suggests that Pakistan's trade has expanded in the past three decades by trading with Singapore, India, and Malaysia (Zaheer et al., 2013). Other studies also posit a negative association between the per capita income gap and IIT. Studies find that the income per person of partner countries does not provide fruitful results and only increases import bills with low export volume, so it brings persistent trade deficit and declines the size of IIT. Studies also find an uncertain relationship between FDI and IIT (Akram & Mahmood, 2012; Shahbaz et al., 2012; Shahbaz & Leitão, 2011). Researchers also confirm that market size and differences in human capital expand IIT but difference in market size declines IIT (Fontagné et al., 2005). Some research papers find a positive association between the difference in per person and dissimilarity in the size of the market with IIT (Rashid et al., 2022).

Bashir et al., (2016) establishes an association for Pakistan between Intra Industry Trade (IIT), gross capital formation, government expenditure, real GDP, and FDI for short-run as well as long run by using the Autoregressive Distribution Lag (ARDL) model. This study proposes a long-run association for Intra Industry Trade (IIT) with real gross capital formation and real government expenditure, but the country's terms of trade has decreased owing to real GDP and FDI.

This intra-industry plays an important role in the diversification of the product and inthe import-substitution strategy. The supply chain analysis is necessary to reduce the cost of production and to reduce the burden on one sector. The product diversification will also increase economic growth, and financial reserves through trade surplus, and make Pakistan competitive in the international market. The policy guidance of this intra-industry trade will encourage policymakers to make policy for small and medium enterprises to align forward and backward links and to support diversification, technology, skilled human capital, and research and innovation for Pakistan. In the Authors' best knowledge, few research papers in the literature have analysed the benefits of IIT and incorporated its determinants for its four trading partners countries Bangladesh, India, Indonesia, and Malaysia. This paper attempts to establish IIT for Pakistan with its trading associates. The study will also find determinants of intra-industry trade to increase intra-industry trade. The remainder of the study is presented as: Section 2 describes the methodology, section 3 analysis the results, section 4 explains the discussion, and Section 5 concludes the results.

1.1. Research Questions

The research questions of the study are: does the Verdoorn hypothesis exist or does Pakistan have an intra-industry trade advantage? What trade liberalization and free trade agreements have an impact on intra-industry trade for Pakistan? What other determinants have an impact on the intra-trade industry for Pakistan?

The hypotheses of the study are Verdoorn hypothesis does not exist for Pakistan or Pakistan has an inter-industry industry advantage. Free trade agreement does not have a positive impact on the intra-trade industry for Pakistan terms other determinants of intra-industry trade do not have any impact on Pakistan.

2. Methodology & Data source

This study employs variables, import, and export of different products of five nations in two digits from the intra-trade industry chapters 84, 85, and 87 of the World Bank's World Integrated Trade Solution (WITS). These partner countries are Pakistan, Malaysia, Indonesia, India, and Bangladesh. The study also includes one dummy variable, which is a free trade agreement, and it spans the years 2000 to 2022. The population growth rate and economic growth rate are used in the study, and data is derived from the Pakistan Economic Survey.

The Panel Auto Regressive Distribution Lag (ARDL) model will be used to determine short-run and long-run correlations between IIT, trade openness, trade agreements, population growth rate, and economic growth. Three estimators will be used in the model: pooled mean group (PMG), mean group (MG), and dynamic fixed effect (DFE). To examine the conditions of the Panel ARDL Model, the research will also test the 'Panel unit Root Test' of Lin & Chi (LLC), Im, Pesaran and Shin (IPS), ADF Fisher Chi-square (ADF Fisher), and PP-Fisher unit root (A. Levin, Lin, & James Chu, 2002; Macdonald, 1996; Ramirez & Sharma, 2008; Westerlund & Breitung, 2013)(A. Levin, Lin, & James Chu, 2002; Macdonald, 1996; Ramirez & Sharma, 2008; Westerlund & Breitung, 2013). The study will also estimate Intra intra-industry trade (IIT) by using the Grubel and Lloyd Index (Grubel & Lloyd, 1971).

2.1. Model of the Study

2.1.1. Grubel and Lloyd Index

This research paper adopted the Grubel and Lloyd Index to gauge Intra Industry Trade (IIT) for Pakistan with its partners (Grubel & Lloyd, 1971). The methodology of the index is as under:

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

If IIT is 1 then we will conclude that Pakistan has a comparative advantage in IIT else is 0, we will conclude it has an inter-industry trade advantage.

2.1.2. Panel Auto Regressive Distribution Lag (ARDL) Model

This study also incorporates the Panel Auto Regressive Distribution Lag (ARDL) model to examine -short-run and long-run and the relationship between IIT, trade openness, trade agreement Population growth rate, and Economic Growth. The Model Methodology is as follows:

$$LIIT_{ti} = B_0 + \beta_1 LPOPG_{ti} + \beta_2 LTOT_{ti} + \beta_3 LDTAG_{ti} + \beta_4 LGDP + \mu_{ti} \quad (2)$$

POPG is yearly growth in population; TOT is trade openness, and it is calculated by export and import as a percent of GDP, DTAG is defined as the dummy variable of trade agreement among Pakistan and its trading partners and RGDP is real GDP growth.

Pesaran et al., 1996) explains the ARDL (p, q) as under:

$$Y_{it} = \sum_{j=1}^{p} \emptyset_{i,j} Y_{i,t-j} + \sum_{j=0}^{q} \gamma_{i,j} X_{i,t-j} + \varphi_i + \varepsilon_{it} \quad (3)$$

Here, i=1,2, . . ., N signifies nations; t=1, ...T implies time; j shows lags; Xi,t suggests explanatory variables and φ_i indicates precise fixed consequences of each country. Equation (4) posits the long-run dynamic parameters and adjustments parameters:

$$\Delta Y_{it} = \delta_i (Y_{i,t-1} - \vartheta_i X_{i,t)} + \sum_{j=1}^{p-1} \emptyset'_{i,j} \Delta Y_{i,i-j} + \sum_{j=0}^{q-1} \gamma'_{i,j} \Delta X_{i,t-j} + \varphi_i + \varepsilon_{it} \quad (4)$$

The speed of adjustment throughout the long run is revealed by δ_i. Here δ_i reveals the speed of adjustment during the long-run. The equilibrium in the long-run can be calculated by ϑ_i that points out the association in $Y_{i,t}$ and $X_{i,t}$. $\emptyset'_{i,j}$ and $\gamma'_{i,j}$ shows short-run association between IIT with its past years and IIT and explanatory variables. If δ_i has a negative sign and is found significant, it establishes that $Y_{i,t}$ and $X_{i,t}$ has long-run cointegration. The mean group, introduced by (Pesaran & Shin, 1995), the pooled mean group introduced by (Pesaran et al., 1999), and the dynamic fixed effect estimator will be adopted to measure the equation.

2.1.3. The pooled mean group estimator

The pooled mean group estimator compares each country's heterogeneous short-run parameters, with intercepts, along the course of equilibrium over the long-term values and error variation, and bounds long-run parameters to be uniform for all nations. This estimator also explains the connection between predictor

variables and outcome variables for equilibrium in the long-run that it is the same from nation to nation, and short-run coefficients are country-unique due to internal and external shocks. This strategy necessitates some validity, reliability, and efficacy.

2.1.4. The Mean Group Estimator

The Mean Group evaluates different regressions for each nation, computing values as constant means of the calculated parameters for each country. It imposes no limits and allows parameters to diverge and have heterogeneity in the long-term and short term. However, an adequately long time series aspect of the statistics is required for the technique's consistency and validity (Zardoub, 2021).

2.1.5 The dynamic fixed effect estimator

This estimator requires long-term and short-term coefficients, error variances, and adjustment coefficient speed to be consistent across nations. However, it necessitates a diverse intercept of every country. This estimator can measure intra-group association with standard error (Blackburne & Frank, 2007).

2.2. Diagnostic Tests

2.2.1. Panel Unit Root

Lin & Chi (LLC), Im, Pesaran, and Shin (IPS), ADF Fisher Chi-square (ADF Fisher), and PP-Fisher unit root are used in this study for panel data. These unit root tests are described below:

2.2.2. Levin, Lin & Chi (LLC)

The Levin, Lin & Chi (LLC) equation is under:

$$\Delta Y_{i,t=ai+pYi,t-1+} \sum_{k-1}^{n} \emptyset k \Delta Yi, t-k+\delta it+\theta t+\mu it \quad (4)$$

It was the initial development of panel unit-root tests by Levin, A., et al. (1992) and later with Chu as co-author (Levin, A., Lin, & Chu, 2002). Levin and Lin used a test that was essentially an extension of the DF test.

2.2.3. Im, Pesaran and Shin (IPS)

Im et al. (2003) expanded the LL test by permitting variation in the coefficient of the Yi,t-1 variables and providing a fundamental testing process based on the average of the individual unit-root test results (Zardoub, 2021).

The IPS test allows for split computations for each I segment, enabling different specifications of the parametric values, error-term variance, and lag durations. (Pesaran et al., 1997) Pesaran and Shin's (1997) used the model as:

$$Y_{i,t=ai+pYi,t-1+} \sum_{k-1}^{n} \emptyset k \Delta Yi, t-k+\delta it+\mu it \quad (5)$$

2.2.4. ADF Fisher and Philips-Perron (PP) Chi-square

The tests that were explained by Maddala and Wu (1999) and Choi (2001), offer an alternate method for deriving tests from Fisher's (1932) findings that integrate the values of p from separate unit root tests, as with the IPS. It is an X2 test process for every cross-section unit that is predicated on the p result from any particular ADF unit root test. Using pi to define the likelihood values (p values), we get:

$$-2 \sum_{i=1}^{N} \log(p_i) \rightarrow x^2 \quad (6)$$

Furthermore, Choi (2001) implies:

$$Z = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \emptyset^{-1}(p_i) \rightarrow N(0,1) \quad (7)$$

In this situation, $\emptyset^{-1}$ represents the inverse of the normal cumulative distribution function. The asymptotic X2 and standard normal values are reported using the ADF and PP single-unit root tests. The following theories are being considered: $H_0: b_i = 0$ unitroot; $H_1: b_i < 0$ stationarity.

Exogenous regressors, individual intercepts, and trend variables can be included or excluded.

3. Results

3.1. Descriptive Statistics

The descriptive statistics in Table 1suggests that there is a large variation between minimum and maximum values in the intra-trade industry and the maximum value of this variable is 0.42 percent while the minimum value is 0.05 percent. The population growth has also found more variation in maximum and minimum values and maximum value is 3.09 percent while minimum growth is found 0.64 percent. The terms of trade maximum value is 39.87 percent and the minimum value is 30.1 percent. The dummy variable for trade agreement is 0 and 1 while GDP growth ranges from -5.83 percent growth to 9.05 percent growth.

Table 1: Descriptive Statistics: Mean, Median, Standard Deviation

Descriptive Statistics	Mean	Median	Maximum	Minimum	Std. Dev.
IIT	0.28	0.32	0.42	0.05	0.1
POPG	1.52	1.37	3.09	0.64	0.49
TOT	35.53	37.38	39.87	30.1	3.66
DTAG	0.43	0.98	1.000000	0.000000	0.60
GDP	5.18	5.46	9.05	-5.83	2.44

Source: Authors' Estimation

The standard deviation is found minimum for intra-trade industry and dummy variable of trade agreement that is0.1 percent and 0.60 percent.

3.2. Panel Unit Root Test

The outcomes of the panel unit root test are discussed in Table 2a and Table 2b. It shows that the inter-trade industry variable is significant on the level while this variable is non-stationary at first difference. Population growth is also significant on the level and it is insignificant on the first difference. The dummy variable of the trade agreement is insignificant on the level while it significant at first difference. All unit root test results are significant for terms of trade at the level and two test results also show the significance of terms of trade at first difference. The test result also reveals that GDP growth is significant at first difference. So, according to the panel unit root test, the panel ARDL model is used to establish a long-run relationship among variables.

Table 2a: Panel Unit Root Test

		Level			
		With Intercept		**With Trend & Intercept**	
Variables		**Statistic**	**P-Values**	**Statistic**	**P-Values**
LIIT	LLC	-2.53	0.04	-0.59	0.65
	IPS	-3.45	-0.02	-0.23	0.89
	ADF	11.32	0.08	7.23	0.43
	PP-Fisher Chi-square	19.21	0.000	25.32	0.00
LPOPG	LLC	0.74	0.83	-3.12**	0.06
	IPS	3.43	0.39	-6.35***	0.00
	ADF	0.13	0.75	24.31***	0.002
	PP-Fisher Chi-square	1.78	0.54	5.32	0.06
LDTAG	LLC	-0.61	0.72	0.34	0.53
	IPS	0.41	0.64	0.63	0.71
	ADF	1.22	0.51	1.23	0.66
	PP-Fisher Chi-square	1.43	0.64	1.72	0.69
LTOT	LLC	-0.38	0.78	-3.13	0.08
	IPS	-0.73	0.48	-4.41	0.05
	ADF	8.21	0.26	16.13	0.03

	PP-Fisher Chi-square	4.12	0.21	2.11	0.41
LGDP	LLC	-3.32	0.00	1.21	0.38
	IPS	0.21	0.83	1.23	0.27
	ADF	1.67	0.15	1.56	0.21
	PP-Fisher Chi-square	1.93	0.18	1.97	0.11

Source: Authors' Estimation

Table 2b: Panel Unit Root Test

		First Difference			
		With Intercept		With Trend & Intercept	
Variables		**Statistic**	**P-Values**	**Statistic**	**P-Values**
IIT	LLC	-1.32	0.43	-1.11	0.59
	IPS	-1.14	0.62	-0.53	0.85
	ADF	7.48	0.24	6.59	0.46
	Fisher Chi-square	3.30	0.33	2.68***	0.41
POPG	LLC	-1.11	0.31	-0.61	0.92
	IPS	-2.21	0.26	1.57	0.48
	ADF	0.56	0.91	9.23	0.63
	Fisher Chi-square	11.33	0.77	21.23	0.53
DTAG	LLC	-1.50	0.17	-4.02	0.03
	IPS	-0.28	0.73	-0.43	0.88
	ADF	0.02	0.98	21.73	0.08
	Fisher Chi-square	7.15	0.55	24.27	0.00
TOT	LLC	-2.11	0.08	0.43	0.75
	IPS	-1.61	0.09	0.38	0.86
	ADF	8.12	0.34	13.41	0.17
	Fisher Chi-square	23.36*	0.04	19.31	0.08
GDP	LLC	-5.43	0.02	-8.21	0.00
	IPS	-8.74	0.06	-9.12	0.04
	ADF	19.32	0.00	27.81	0.00
	Fisher Chi-square	16.32	0.06	17.64	0.03

Source: Authors' Estimation

Intra-trade Index of Table 3 indicates that most values are more than 0 and suggests that Pakistan has an intra-trade industry advantage by trading with Bangladesh, India, Indonesia, and Malaysia and the Verdoorn Index is valid in Pakistan's case.

Table 3: Intra-trade index

Years	**PC**	**IIT**	**PC**	**IIT**	**PC**	**IIT**
2000	84	0.59	85	0.32	87	0.43
2001	84	0.20	85	0.38	87	0.36
2002	84	0.29	85	0.49	87	0.23
2003	84	0.15	85	0.18	87	0.11
2004	84	0.43	85	0.32	87	0.40
2005	84	0.54	85	0.51	87	0.43
2006	84	0.34	85	0.39	87	0.49
2007	84	0.23	85	0.28	87	0.18
2008	84	0.28	85	0.35	87	0.34
2009	84	0.45	85	0.49	87	0.43
2010	84	0.32	85	0.53	87	0.58
2011	84	0.63	85	0.41	87	0.46
2012	84	0.35	85	0.31	87	0.45
2013	84	0.15	85	0.45	87	0.58
2014	84	0.31	85	0.63	87	0.52
2015	84	0.43	85	0.30	87	0.60
2016	84	0.32	85	0.31	87	0.25
2017	84	0.23	85	0.25	87	0.28
2018	84	0.31	85	0.39	87	0.34
2019	84	0.29	85	0.21	87	0.32
2020	84	0.43	85	0.54	87	0.51

2021	84	0.32	85	0.28	87	0.29
2022	84	0.11	85	0.07	87	0.06

Source: Authors' Estimation

The study next chooses the optimal lags selection for the ARDL MG, PMG, and DFE models and the most recurring lags of each variable and for overall countries based on the AIC criterion (See Table 4). The ARDL (1, 1, 2, 0, 1) is used. After lag selection, the cointegration test is estimated to establish dependent and predictor variables cointegration.

Table 4: Optimal Lag Selection

Variables	**Countries**				
	Bangladesh	**India**	**Indonesia**	**Malaysia**	**Pakistan**
			ARDL (p, q, q, q)		
Ln(IIT)	1	1	3	1	1
Ln(POPG)	1	1	2	0	1
Ln(DTAG)	2	1	2	1	2
Ln(TOT)	2	2	0	0	0
Ln(GDP)	2	2	1	1	1

Source: Authors' Estimation

Table 5 summarises the test findings and it reveals that all statistics are greater than 1.96 in absolute value and are significant. As a result, we believe that cointegration exists between outcome and explanatory variables.

Table 5: Cointegration Test

Test stats	**Panels**	**Group**
v	1.69	
Rho	-3.94	-2.43
T	-6.12	-7.75
ADF	-5.43	-6.12

Source: Authors' Estimation

The study also estimates the short-run and long-run relationship between Population growth, trade agreement, terms of trade, GDP growth, and intra-industry with three estimators, MG, PMG, and DFE (See Table 6). There is a long-run relationship between variables, and error correction supports that the speed of adjustment is statistically significant and negative at a 1% level of significance. The error correction model implies the intra-industry trade when diverts from its equilibrium level, it will be adjusted by 1.6014 percent in the long-run.

Table 6: ARDL MODEL MG, PMG, and DFE Long-run and Short-run Coefficients

Intra-trade Industry (dependent Variable)			
Variables	**MG**	**PMG**	**DFE**
Long-run coefficients			
Ln(POPG)	0.015 (0.192)	0.012 (0.3012)	0.0191 (0.2314)
Ln(DTAG)	1.031*** (0.06)	1.144*** (0.07)	1.1721*** (0.08)
Ln(TOT)	0.022(0.232)	0.028(0.361)	0.18(0.432)
Ln(GDP)	2.12**(0.033)	1.76**(0.023)	1.45**(0.018)
Hausman test	1.50 (0.4102)	0.23(0.9323)	
ECM	-1.5231*	-1.6014*	-1.5701*
Phi	(0.0000)	(0.0000)	(0.0000
Shortrun coefficients			
Dln(POPG)	3.79* (0.002)	3.40* (0.007)	2.59* (0.001)
DLn(DTAG)	4.12* (0.003)	4.17* (0.001)	3.90* (0.005)
DLn(TOT)	2.12** (0.05)	2.01** (0.07)	3.1* (0.004)
DLn(GDP)	4.12* (0.008)	3.61* (0.005)	3.34* (0.000)
Constant	1.322 (0.3843)	2.323* (0.001)	1.501* (0.000)

Source: Authors' Estimation

Note: *, ** and *** indicates the significance at 1%, 5% and 10%

3. Result Discussion

This paper sought to establish the Verdoorn hypothesis or Intra-Industry Trade of Pakistan and its trading rivals Malaysia, Indonesia, India, and Bangladesh from 2000 to 2022. The study also identified factors of intra-industry trade in promoting economic growth. The study also adds to the literature, as just a few research publications have assessed this association. The IIT was estimated by the Grubel and Lloyd Index and, panel ARDL model with three estimators. In this study, the Mean Group (MG), Pooled Mean Group (PMG), and Dynamic Fixed Effect (DFE) models were employed to evaluate the short-run and long-run effects of population growth, economic growth, trade conditions, and free trade agreements on Pakistan's IIT with its trading partners. The Verdoorn Index is present for Pakistan and it suggests that Pakistan has an intra-trade industry (IIT) advantage over Bangladesh, India, Indonesia, and Malaysia

The ARDL MG, PMG, and DFE models have confirmed long-run cointegration among IIT, population growth, economic growth, trade terms, and free trade agreements with the speed of adjustment of error correction model 1.6014 percent. The Hausman test favours the PMG estimators for estimating variables' long-run and short-run association. According to this model, there will be a significant positive link between population growth and IIT in the short-term but an insignificant connection of these factors in the long run. Findings also suggested in the short-run, population growth will pressure Pakistan to import goods for domestic consumption while it also exerts pressure on exports to develop domestic production. The finding is consistent with the theory of trade (Lehmijoki & Palokangas, 2009, 2010; Zhang & Wan, 2017). The result is also compatible with several empirical studies since Pakistan is dependent on the export of primary goods, therefore in the short-run, the size of the population grows with the expansion of primary goods exports, but in the long-run, it decreases. In addition, even if the long-run population growth coefficient remains positive, the result is result (Gries & Grundmann, 2014).

The free trade agreement is significantly associated with the intra-industry trade index in the short-term and long-term. These outcomes have also been supported by previous research (Aggarwal & Chakraborty, 2017; Bagchi & Bhattacharyya, 2019; Aggarwal & Chakraborty, 2022; Ramakrishnan & Varma, 2014; Sawyer et al., 2010). However, there is a positive significant association between terms of trade and intra-industry trade index in the short-run, but this association is insignificant in the long run. The terms of trade strengthen the exchange rate and also boosts economic activity and increases Pakistan’s IIT. This finding is consistent with the outcomes of (Bagchi & Bhattacharyya, 2019).

Furthermore, with IIT, the real GDP growth is statistically positive and significant in both the short-run and long-run. The GDP growth improves economic activity and domestic output, hence, is encouraging both sides of the trade of Pakistan for import and export. This explanation is similar to past studies (Rasekhi & Ramezani, 2017; Saparamadu & Weerasinghe, 2021; Shahbaz & Leitão, 2011; Thorpe & Zhang, 2005; Zardoub, 2021).

In short, the study found a short-run positive association between IIT and population growth, free trade agreement, terms of trade, and economic growth for Pakistan. However, the long-run positive association confirmed between IIT and free trade agreement, as well as IIT and economic growth. The results indicate that Pakistan has an intra-industry trade advantage, and it may grow its trade by trading its partners.

4. Conclusion & Policy Recommendation

This paper investigated the presence of the Verdoorn hypothesis for Pakistan with its trading partners Malaysia, Indonesia, India, and Bangladesh from 2000 to 2022. It also evaluates the ARDL cointegration test, PMG model, and Error Correction Model. Results found the presence of the Verdoorn Index for Pakistan. There is a long-run association between IIT and free trade agreement, and IIT and economic growth. The population growth and terms of trade are not long-run determinants of IIT for Pakistan. Conversely, the short-run relationship between was estimated in terms of trade, and population growth with IIT. The short-run association was also analysed for a free trade agreement and economic growth with IIT.

For policy implications, Pakistan should diversify its products to get benefits from intra-industry trade and does not solely focus on primary products and one sector like textile. The divergence in the short-run and the long-run expands its trade with these trading partners and will promote economic growth and development in the long-run. The government should improve infrastructure to reduce the cost of production and increase trade.

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