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Intra-industry trade: Revisiting theory and literature survey

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Abstract. Early references to intra-industry trade were mostly ignored for many years. It was only in the past two decades that intra-industry trade has received significant attention and has become a leading area for international economists. It has become increasingly common in recent decades due to the growth of international trade, globalization, and the integration of economies. Intra-industry trade can benefit countries by allowing them to specialize in their areas of comparative advantage and to access a wider range of products and services at lower prices. However, it can also pose challenges for some industries and workers who may face increased competition from foreign producers. The purpose of this paper is to review the extensive literature on intra-industry trade, assess the accomplishments of researchers in this area and predict future research directions. The paper evaluates intra-industry trade as a research program and assesses whether it can continue to advance in the future. To organize the paper, the authors evaluate current perspectives in four distinct areas: theory, measurement, empirical evidence, and policy aspects.

Keywords. Intra-industry trade; Imperfect competition; Classical theories of trade.

JEL. F11; F12; F13.

1. Introduction

The concept of trade between industries was first mentioned by Hilgerdt (1935) and Ohlin (1933). However, the focus of trade theorists after the war was on refining the Heckscher-Ohlin-Samuelson (H-O-S) model, and there was a lack of evidence for intra-industry trade, which led to these early references being largely ignored for many years. It wasn't until the last two decades that intra-industry trade received significant attention and became a frontier area for international economists. The aim of this paper is to review the extensive literature on intra-industry trade, assess the achievements of researchers in this field, identify unresolved issues, and predict future research focus. This paper evaluates intra-industry trade as a research program and considers whether it can continue to progress in the future.

The literature on intra-industry trade has developed in various directions, often leading to disjointed strands of research. To add structure to this paper, we will evaluate current perspectives in four distinct areas: theory, measurement, empirical evidence, and policy aspects. By doing so, we aim to provide a more focused assessment of the current perspectives and a comprehensive review of the entire literature.

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2. Historical perspective

The focus on intra-industry trade may have been accidental, as it stemmed from early research in the 1960s by economists interested in the effects of the European Economic Community's formation on trade patterns. The conventional wisdom suggested that inter-industry specialization would follow trade liberalization, but the early studies by Dreze (1961), Verdoorn (1960), and Balassa (1965) found evidence of increasing intra-industry specialization instead. This led to a lot of documentary work aimed at establishing the extent of the phenomenon in different countries at different points in time. The documentary work culminated in the publication of Grubel & Lloyd (1975) detailed evidence of intra-industry trade at the third digit of the Standard International Trade Classification for all major industrialized countries. Despite this publication, Blair's description of administered prices as "a phenomenon in search of a theory" could still apply to intra-industry trade. The decade since Grubel and Lloyd's publication has seen a vast literature on the subject, with theoretical work becoming especially fashionable due to influential publications in the late 1970s. Interest in econometric investigation has also increased, but the methodological difficulties of testing particular models and the exacting data requirements associated with cross-section analysis have limited its proliferation. An econometric literature has emerged, as has a literature on "measurement," but several fundamental measurement problems remain unresolved. Finally, as models of intra-industry trade proliferated and evidence of its existence accumulated, many analysts turned to questions regarding the policy significance of the phenomenon. The gains from trade and the impact of commercial policy intervention have been extensively explored in recent years.

3. Current perspectives

3.1. On theories of intra-industry trade

There has been significant advancement in the modeling of intra-industry trade beyond the basic models of Gray (1973) and Grubel & Lloyd (1975), which were considered primitive. Intra-industry trade is generally associated with imperfectly competitive product markets where there are diverse consumer preferences, increasing returns, and/or segmented markets. This extension of the analysis of imperfectly competitive product markets from a closed-economy to an open-economy setting has led to a plethora of models of intra-industry trade. These models can be divided into two categories based on large number cases and small number cases. Large number cases assume free entry into the market and diverse consumer preferences, while small number cases deal with oligopolistic competition. While the models differ in their treatment of conjectural variation, product type, and entry conditions, there is some agreement that preference diversity and decreasing production costs are crucial factors in the emergence of intra-industry trade. Moreover, these models have provided a rigorous theoretical foundation for the intuition that scale economies and preference diversity are related to the explanation of intra-industry trade, and these factors can be embedded in both general and partial equilibrium models.

3.2. On the measurement of intra-industry trade

Over the past 25 years, research on intra-industry trade measurement has been ongoing, while theories on the subject have only gained significant attention in the last 6-7 years. Various measures of intra-industry trade and inter-industry specialization have been proposed and refined, with the Grubel-Lloyd index being the most widely used measure of intra-industry trade. However, there is no clear favorite index for measuring intra-industry specialization. Two specific issues related to measurement have received academic interest: (i) whether and how to adjust for aggregate payments imbalance, and (ii) the identification and adjustment for categorical aggregation. Adjusting for aggregate payments imbalance is not universally accepted, and adjusting for categorical aggregation is the more significant problem. There is no single level of aggregation that corresponds ideally to the industry level, and grouping activities within a particular statistical category inaccurately can result in misleading indications of actual intra-industry trade. Despite this, some progress has been made in exploring the properties of popular indices and resolving some of their shortcomings, including attempts to regroup industrial data and proposing an adjusted Grubel-Lloyd measure to deal with categorical aggregation.

4. On the empirical analysis of intra-industry trade

The literature on empirical analysis can be categorized into two types: documentary studies and explanatory studies (Caves, 1981; Lundberg, 1982; Manrique, 1987; Clark, 1993; Veeramani, 2001, 2002, 2007, 2009; Aggarwal & Chakraborty, 2017, 2019, 2020a). Documentary studies report intra-industry trade results for a given country or countries at a particular time while explanatory studies try to explain the observed country or industry differences in intra-industry trade using an econometric approach (Clark, 2010; Dennis & Shepherd, 2011; Yoshida, 2013; Banik & Das, 2014; Aggarwal & Chakraborty, 2020b, 2020c, 2021, 2022). Although documentary studies are relatively straightforward, measurement difficulties still exist. However, they provide a vast data bank of evidence on recorded intra-industry trade and information on the features of the phenomenon that allow for the identification of "stylized facts." These include the direct relationship between the growth of per capita income and intra-industry trade, higher levels of intra-industry trade in developed market economies, and the prevalence of intra-industry trade in manufactures compared to non-manufactures. Econometric analysis of this issue is challenging because of methodological and practical difficulties. Nonetheless, a few studies have been published that test hypotheses related to industry and country characteristics, which consistently indicate that taste similarity, product differentiation, decreasing costs, and market concentration are deterministically related to intra-industry trade (Bano, 2014; Singh, 2014; Doruk, 2015; Aggarwal, 2016, 2017a, 2017b, 2020, 2023a, 2023b, 2023c, 2023d). The literature now provides a more complete comprehension of the factors that explain intra-industry trade than it did a decade ago (Roy, 2017; Feng, 2018; Hoang, 2019; Aggarwal *et al.*, 2021, 2022, 2023a, 2023b). The major empirical papers on intra-industry trade are summarized in Table 1.

Journal of Economics Bibliography

Table 1. Literature on Intra-Industry Trade

Year	Author	Objective	Dataset	Dependent Variable	Explanatory Variable	Estimation Technique
1980	R. Loertscher & F. Wolter	Analyze the country and industry-specific determinants of intra-industry trade in OECD countries	Dataset: 1971 – 1973	IIT	Product differentiation, Scale economies, Transaction costs, Level of aggregation, Distance, Product group, Development stage differential, Average Market size, Market size differential, Custom union dummy, Language group dummy, Border trade dummy	OLS
1981	R.E. Caves	Analyze the determinants of IIT in USA	Dataset: 1953 – 1970	IIT	Product heterogeneity, Standard deviation of rates of profit, R&D, Ratio of market planning to total costs, Ratio of selling-related costs to total costs, Advertisement expenditure, FDI, Cost disadvantage ratio, Scale economies, Distance, Average trade weighted tariff, Minimum efficient plant scale	PCA, OLS, Logit
1982	L. Lundberg	Analyze the determinants of IIT in Swedish Manufacturing industries	Dataset: 1970 – 1977 on the 4 digit-level of ISIC	IIT	Share of wage costs in value added, Average wage, R&D, Energy intensity, Share of technical personnel in labour force, Share of sales personnel in labour force, Share of labour force employed in big plants	OLS
1987	G.G. Manrique	Examine pattern of trade between US and 7 NICs	Dataset: 1965-1976	IIT	Tariff, Product heterogeneity, Four-firm concentration ratio, Product differentiation, Scale economies, R&D, Average wage	OLS,
1989	Y.S. Lee	Identify the determinants of IIT among the Pacific Basin countries	Dataset: 1970, 1980	IIT, HIIT, VIIT	Difference in per capital income, Difference of capital-labour ratio, Effective tariff rates, Distance, FDI, Product differentiation, Economies of scale, R&D	Logit
1990	J.H. Bergstrand	Identify the determinants of IIT in select SITC industry groups of OECD countries	Dataset: 1976	IIT	Average GDP, Average per capita GDP, Average tariff level, Capital-labour endowment ratio, Adjacency dummy	WLS, Logit
1993	D.P. Clark	Investigate the industry-specific determinants of IIT in US	Dataset: 1980, 1984, 1986	IIT	Minimum efficient scale, Advertising-to-sales ratio, Consumer goods ratio, Capital-to-labour ratio, Sectoral dispersion index, Inventory ratio, Number of tariff-line level products, Value of industry shipments, Four-firm concentration ratio, Ad-valorem tariff rate, Non-tariff barrier	OLS
1993	K.S. Hughes	Identify key determinants of IIT for the largest OECD economies	Dataset: 1980-1987 at 4 digit data based on ISIC	IIT, LIIT	Product heterogeneity, Five-firm concentration ratio, R&D, Share of technical personnel in total employment, Share of operative staff in total employment, Scale economies	OLS, Fixed-effects
1994	P. Chow, M. Kellman & Y. Shachmurove	Examines the intra-industry trade of the four East Asian Newly Industrialized Countries (Hong Kong, Singapore, South Korea and Taiwan) with European markets, Japan and the United States	Dataset: 1965-1990	IIT	Product differentiation, Scale economies, GNP, Influence of MNCs, Income similarity	OLS
1994	J.G. Hirschberg, I.M. Sheldon & J.R. Dayton	Analyze the determinants of IIT in food processing sector for a sample of 30 countries	Dataset: 1964-1985	IIT	GDP per capita, GDP Size, Exchange Rate, Distance, Border, FTA	Tobit
1995	P.K.M. Tharakan & B. Kerstens	Analyse the nature of IIT in toy industry in EC countries	Dataset: 1970-1987	IIT	FDI, Average weighted tariff, Similarity of income distribution in the countries, Propensity of product to be vertically differentiated, Propensity of product to be horizontally differentiated, Country dummy	Logit
1999	L. Nilsson	Examines country determinants of the EU countries IIT with the developing countries	Dataset: 1980-1992 at the	IIT	Absolute difference in GNP per capita, Average GNP per capita, Absolute difference in GNP, Average GNP, Distance, Binary variable for NIC countries	OLS, Non-linear least squares

Journal of Economics Bibliography

Year	Author(s)	Abstract	Dataset	Country	Variables	Method
2001	C. Veeramani	Analyze intensity of IIT across countries and sections to understand trade liberalization on IIT	SITC 4 digit level Dataset: 1987-88, 1994-95 and 1998-99	IIT	Per capita income difference, Technology gap, Human capital endowment difference, Income distribution similarity, Market size, Market size difference, level of trade restriction, Inward FDI	Probit and Tobit regression
2002	C. Veeramani	Analyze trends and country-specific factors affecting India's IIT	Dataset: 1988, 1995, 2000	IIT	Per capita income difference, Differences in the pattern of income distribution, Market size, Distance, Categorical aggregation	OLS, Tobit
2003	M.A. Cole & R.J.R. Elliott	Examine the impact of environmental regulations on trade patterns	Dataset: 1995	IIT	Difference of capital-labour ratio, Difference of fertile land-to-labour ratio, Difference in per capital income, Stringency of environment regulations, Border dummy	Panel regression, Two stage least-squares, OLS, Fixed-effects
2004	S. Banerjee & R. Bhattacharyya	Explore the relationship between IIT and the level of economic development of India	Dataset: 1971-2000	IIT	Size of manufacturing sector, Capital-labour ratio, GNP per capita, Tariffs, FDI	OLS, Granger causality
2004	H. Lee & C. Sohn	Analyze the nature of MIIT in South Korea	Dataset: 1991-2001	IIT	GDP, Per capita GDP, Distance, Trade Openness, Difference in GDP, Difference in per capita GDP	Nonlinear-least-squares estimation of logistic function
2005	D. Chakraborty & P. Chakraborty	Assess India's export performance and attempts to analyse various features of India's export basket	Dataset: 1994-2002	Exports	GDP, Index of industrial production, Competitiveness of Indian exports	Log linear method
2005	R. Bhattacharyya	Analyze the pattern of IIT in Republic of Korea	Dataset: 1963-1995	IIT, VIIT, HIIT	GDP, Manufacturing as a proportion of GDP, Capital-output ratio, Final consumption expenditure of households, Total trade volume, Foreign investment, Custom's duty as a proportion of import value	Granger causality
2006	J.H. Bergstrand & P. Egger	Analyze the determinants of IIT in the explicit presence of trade costs	Dataset: 1990-2000	IIT	Similarity in GDP, Bilateral sum of GDP, Difference in bilateral labour ratio, Bilateral homogeneous transport costs, Difference in differentiated and homogeneous goods transport costs	OLS
2007	C. Veeramani	Analyze the industry-specific determinants of IIT in Indian manufacturing industries	Dataset: 1994-95, 1998-99 and 2005-06	IIT	Product differentiation, Minimum efficient plant scale, Industrial concentration, FDI, Ratio of gross value added to value of output, Industry group dummies	Tobit
2007	Y. Xing	Analyze the dynamic changes of China's IIT with Sino-US countries	Dataset: 1990-2004	IIT	FDI, Difference in GDP, Trade balance, Trade openness	Fixed-effects, Random-effects
2008	L.G. Burange & S.J. Chaddha	Growth in India's IIT with respect to different economies	Dataset: 1987-2006	IIT	Exports and Imports	ACGR
2009	D. Bernatonyte	Investigates the extent of IIT between Lithuania and the EU and its role in export specialization	Dataset: 2001-2007	IIT	Exports and Imports	OLS
2009	C. Veeramani	Analyze the effects of trade barriers and multinationals on the intensity of IIT in a panel of Indian manufacturing	Dataset: 1988 - 1999	IIT	Trade barrier, Product differentiation, Involvement of multinationals in the domestic industry, Minimum efficient scale, Sector dummy	Random-effects
2010	K. Türkcan & A. Ates	To examine patterns of trade in US auto industry	Dataset: 1989-2006	IIT	Average market size, Difference in market size, Difference in per capita GDP, FDI, Weighted Distance, Exchange Rate	Random-effects, PCSE
2010	W.C. Sawyer, R.L. Sprinkle & K. Tochkov	Examine the level of IIT for 22 countries in East, Southeast, South and Central Asia	Dataset: 2003	IIT	Difference in per capita GDP, Education spending, R&D, FDI, Share of manufactured exports in total merchandise exports, Trade openness, Distance, FTA dummy	Tobit
2010	D.P. Clark	Trade association between scale economies and IIT levels in US	Dataset: 2002	IIT	Minimum efficient scale	Chi-square test of independence

Journal of Economics Bibliography

2011	A. Dennis & B. Shepherd	Analyze the impact of trade facilitation on export diversification	Dataset: 2005	Export Diversification	Entry Cost, Export Cost, Tariff, Distance, GDP per capita	OLS, Tobit, Fixed-effects, Negative binomial model OLS
2011	R. Baldwin & D. Taglioni	Analyze the determinants factors explaining trade in the advanced countries	Dataset: 2000 – 2007	IIT	GDP, Trade costs, Distance, Contiguity, Common Language, Time dummies	
2012	T. Ito & T. Okubo	New aspects of IIT in EU Countries	Dataset: 1988-2010	IIT	Exports and Imports	Descriptive analysis
2012	D. Saslavsky & B. Shepherd	Analyze the importance of LPI on terms of trade in developing countries	Dataset: 2007	Trade Costs	LPI, Distance, Language, Contiguity, Colony, GDP	Poisson and gamma pseudo-maximum likelihood estimation, OLS
2012	M. Shahbaz, N.C. Leitão & M.S. Butt	Analyze the determinants of IIT between Pakistan and its trading partners	Dataset: 1980-2006	Log IIT	Difference in GDP, Lowest value of GDP per capita, Highest value of GDP per capita, Average GDP per capita, Distance, FDI, Trade Imbalance	OLS, Fixed-effects, Random-effects
2013	V. Botrić	Analyze the determinants of IIT between Western Balkan countries and old European Union Member States	Dataset: 2005-2010	IIT	Border, Distance, Export cost, Exporttime, GDP per capita, Gross fixed capital, Employment	Panel GLS method
2013	Y. Yoshida	International fragmentation and Vertical Specialization in Asia	Dataset: 1988-2006	IIT	GDP, prefecture GDP, difference in GDP per capita, prefecture intensive margin, prefecture extensive margin	Fixed-effects, Random-effects
2014	N. Banik & K.C. Das	Examine the effect of IIT on location substitution effect in China	Dataset: 2000-2009	Total value of final manufacture deexports	Primary, intermediate and machinery imports, GDP	GMM, Two stage least-squares
2014	R. Puertas, L. Martí & L. García	Examine the relative importance of logistic performance in export competitiveness in EU	Dataset: 2005 – 2010	Exports	LPI, Product competitiveness, Tariff	Two - Stage Heckman model
2014	P. Varma & A. Ramakrishnan	Analyze the structure and determinants of trade in agri-food products between India and members of its FTA	Dataset: 2003-2011 at 4 digit level of HS Classification	IIT	Difference in per capita GDP, Average GDP, Difference in GDP, Difference in Agricultural land, Distance, Difference in population, FTA dummy	OLS, Tobit, Log likelihood
2014	S. Bano	Investigate trade intensities between New Zealand and China	Dataset: 1980-2012	Export Intensity Index and Import Intensity Index	Exports, Imports, World exports, World imports	Trade Reciprocity Index
2014	S. Kumar & S. Ahmed	Deeper trade integration between India and Bangladesh	Dataset: 1975-2010	IIT	Exports and Imports	Descriptive analysis
2014	M.L. Singh	Relationship of IIT between India and ASEAN	Dataset: 1997-2010	IIT	Institution proxied by OMI, lag(OMI)	PCA, VECM, Cointegration
2015	Ö.T. Doruk	Analyze the effect of R&D expenditure on IIT in Turkey	Dataset: 1990 - 2010	IIT	R&D	GMM, Panel Unit Root Test
2015	S. Kumar & S. Ahmed	Examine the determinants of export and import flows of countries in the South Asia	Dataset: 1985-2011	IIT	GDP, Population, Tariff, Distance, Relative factor endowments, SAFTA dummy, Border Dummy, Language dummy	OLS, Random-effects
2015	S. Marius-Răzvan, & S. Camelia	Examine the determinants of IIT in the motor vehicle parts and accessories sector from Romania	Dataset: 1995 - 2012	IIT	GDP per capita, Relative country size, R&D, Difference in physical capital endowments, lagged (IIT)	Panel GMM
2016	J. Lapinska	Country specific determinants of intra – industry exchange between Poland and its EU trading partners	Dataset: 2002-2011	IIT	Difference in GDP, FDI, Share of processed products in total trade volume, Degree of trade imbalance, Language, Distance, GDP	Pooled OLS, Fixed-effects, Random-effects
2016	G. Kaur, J.K. Dhami, & V. Sarin	To study the impact of BIMSTEC on India and Thailand trade relations	Time Series Data: 1997-2014	IIT	Exports and Imports	Percentage share of imports and exports

Journal of Economics Bibliography

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2017	S. Aggarwal & D. Chakraborty	Examine the patterns and determinants of aggregate bilateral IIT between India and major trading partners	Dataset: 2001-2015	IIT	Difference in GDP per capita, Difference in capital-labour ratio, Weighted distance, interaction term of LPI, Border dummy, Language Dummy, FTA dummy	FGLS
2017	L.G. Burange, P. Thakur & H.K. Kelkar	Investigate a causal relationship between FDI and IIT in the manufacturing sector of India	Dataset: 1992-2013	IIT, FDI	IIT, FDI	Granger Causality, VECM, Cointegration OLS
2017	K. Hayakawa, T. Ito & T. Okubo	Investigate the attributes of country-pairs that affect IIT stability	Dataset: 1994-2010	IIT	GDP, Per capita GDP, Language, Distance	OLS
2017	J. Roy	Analyse the impact of trade intensity and IIT on environmental quality	Dataset: 2000 – 2005	IIT	Difference in per capita GDP, Difference in capital-labour ratio, Distance, Language, Contiguity	OLS
2018	X. Feng	Explores the effect of IIT in skill premium in China's manufacturing	Dataset: 2001 – 2008	Skill Premium	IIT, Output, Capital, Skill intensity	OLS, Fixed-effects
2019	V. Hoang	Investigate Vietnam agricultural IIT and trade dynamics	Dataset: 1997 - 2014	IIT	Exports, Imports, Trade Balance	OLS
2019	S. Aggarwal & D. Chakraborty	Examine the patterns and determinants of India's bilateral IIT in seven sectors with major trading partners	Dataset: 2001-2015	IIT	Difference in per capita GDP, Difference in capital-labour ratio, Weighted distance, LPI, Tariffline, ALP, Border dummy, Language dummy, FTA dummy, FTA*LPI	FGLS
2020	S. Aggarwal & D. Chakraborty	To identify the factors influencing labour market dynamics	Dataset: 2001-2015	MIIT	Relative growth rate of a sector, trade openness, wage rate, productivity, skilled to unskilled ratio	GMM
2020	S. Aggarwal & D. Chakraborty	To identify the determinants of India's VIIT in a panel data framework by considering both country and sector specific variables	Dataset: 2001-2015	VIIT	LPI, Tariff, capital to labour ratio, FDI, R&D, concentration ratio, skilled to unskilled workers ratio	Aquino
2022	S. Aggarwal, S. Mondal & D. Chakraborty	Identify factors that determine the efficiency levels of IIT	Dataset: 2001-2015	IIT	FDI, DVA, domestic capital, skilled ratio	Likelihood Ratio Test
2022	S. Aggarwal, D. Chakraborty & N. Banik	Identify factors that influence India's bilateral aggregate IIT index in a panel data framework	Dataset: 2001-2019	IIT	DPCGDP, D(K/L), WDIST, LPI, Border, Language, Tariffline, RTA	GLC
2023	S. Aggarwal	To identify the dependencies of the sectors among each other in United States	Dataset: 2002-2021	Exports and Imports	Reexports	Clustering
2023	S. Aggarwal	To identify the determinants of intra-industry trade for a developing economy	Dataset: 2001-2019	LIIT	WDIST, Border, Capital to Labour ratio, LPI, Language, Distance	PCSE
2023	S. Aggarwal	To identify the anomalies in the intra-industry pattern of trade	Dataset: 1992-2022	Exports of goods and services	Import of goods and services	Anomaly Detection

5. Policy-issues

Intra-industry trade presents intriguing policy questions, as discussed in Giersch (1979). Three questions in particular arise: what are the gains from intra-industry trade, and how do they differ from those of inter-industry trade? Is adjustment to trade expansion smoother in intra-industry trade than in inter-industry trade? And if trade flows are restricted using tariffs or subsidies, how do price-output effects compare to those in inter-industry trade? The gains from intra-industry trade differ from those of inter-industry trade, with the former relying heavily on increased product variety and the latter on exploitation of scale economies. The magnitude of gains depends on various factors, including product variety, transport costs, and the procompetitive effects of domestic markets. While some argue that

S. Aggarwal, JEB, 10(1-2), 2023, p.1-12.

Journal of Economics Bibliography

adjustment to trade expansion is smoother in intra-industry trade due to greater similarity in factor input ratios, empirical support for this proposition is limited. Most research on policy issues has focused on examining the impact of commercial policy interventions, but results are highly sensitive to model-specific assumptions. Nonetheless, the theory of optimal intervention remains useful in evaluating policy interventions. Despite the complexities involved, progress has been made in understanding the impact of policy intervention in markets with characteristics frequently observed in the real world.

Progress in resolving policy issues related to trade and industrial interventions is largely dependent on advancements in theory, measurement, and empirical analysis. The development of theoretical models will lead the way in further examining the effects of trade and industrial interventions. This will result in the distillation of general principles, rather than analyzing intermediate cases that do not rely on fully segmented or integrated markets. Since arguments for intervention often rely on explicit asymmetries, analyzing the nature of these asymmetries would help in developing a comprehensive policy framework. The question of adjustment is also a significant policy issue that requires further theoretical and empirical analysis. The gains from trade and costs of protection question need more clarification, and both partial and general equilibrium analysis could be deployed to comment on this. The structure of protection is also an important issue that needs exploration, especially with regards to the effective protection concept in the context of intra-industry trade.

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