

THE INTRA-INDUSTRY STRUCTURE OF THE UNITED STATES' INTERNATIONAL TRADE WITH SELECTED INDUSTRIALIZED AND DEVELOPING NATIONS

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Abstract

This paper uses three-digit Standard International Trade Classification (SITC) 2008 data for 262 commodity groupings and employs the Grubel-Lloyd methodological approach to calculate the ' individual inter and intra-industry trade indexes for commerce between the United States and a group of twenty four countries divided equally between industrialized and developing nations. These trade coefficients, weighted according to each nation's volume of trade with U.S., yield the Grubel-Lloyd indexes for the two categories of countries and serve as the basis for distinguishing the patterns of international trade of the United States in various specific industries and for supporting free trade policies as a means of enhancing consumer welfare and the economic development aspirations of lower income nations.

Key Words: International trade patterns, Intra-Industry trade, Grubel-Lloyd Index, free trade

1. Introduction

During the midst of the Great Depression with record high unemployment rates the Congress of the United States enacted the Smoot-Hawley Tariff Act which raised the average import tax to 59% in 1932 (Salvatore, 159.) This legislation sought to promote spending on domestic goods in order to reduce unemployment but it resulted in increased protectionism as other countries retaliated and ultimately led to a sharp reduction in world trade as total world imports fell from by 67% from early 1932 late 1933 (League of Nations, 1934.) Even though there has been a gradual liberalization of trade restriction since then, the calls for a renewal of protectionism to stimulate domestic employment grow stronger during economic downturns. In today's era of globalization and with the world economy struggling to recover from the deepest recession since the 1930s the specter of anti-free trade policies looms large.

Using 2008 Standard International Trade Classification (SITC) data, disaggregated to the third SITC digit (262 industry categories), this paper employs the Gruber-Lloyd methodological approach to identify the Intra-Industry (two-way commerce in the same product categories) as well as the Inter-Industry (two-way commerce in different product categories) structure of the international trade of the United States and selected advanced / industrialized and developing nations. Part two reviews the relevant international trade theories and empirical studies on intra-industry trade. The methodological model, the hypotheses to be tested and the empirical estimations are presented in the subsequent sections and, finally, the paper closes with a discussion of the conclusions, policy implications and suggestions for further research.

2. Review of the Literature

According to the factor proportions theory or Heckscher- Ohlin (H-O) model of international trade, capital abundant countries would export goods whose production requires intensive use of capital and import commodities whose production processes utilize labor intensively (Ohlin, 1935.) Based on this theoretical framework, one would expect that the greater share of world trade would take place between industrial, capital-abundant nations and non- industrial, developing, labor/land abundant countries.

Given its assumption of homogenous production functions across international borders, the H-O model predicts that much of the world trade would be inter- industry trade involving the exchange of goods in different industries and between countries in different stages of economic development. For example, a capital abundant country like the United States would be expected to export capital intensive manufactured goods such as agricultural machinery and be expected to import labor intensive commodities, like hand-made shoes, from developing nations such a Bolivia.

In reality, actual trade data contradict these H-O model predictions on two accounts. First, the “Leontief Paradox” contradicts the prediction of the capital/labor content of United States exports and imports. Using data for 1947 and covering 200 industries, Wasily Leontief found that, paradoxically and contrary to the theory’s prediction, U.S. exports were more labor intensive than its imports even though the United States is considered to be a capital- abundant country. He also found a high capital intensity in U.S. imports from abroad (Leontief, 1956).

Second, actual world trade patterns differ from those predicted by the factor proportions model in that, at the close of the twentieth century, commerce between industrial and non-industrial countries, involving the exchange of manufactures for primary products, accounted for only about one-third of global trade. At the same time, industrial countries generated close to 75% of all exports with two-thirds of those exports being shipped to other industrial trading partners (Root, 1990).

Efforts to formulate a theoretical explanation for industrial country’s trade among themselves can be traced to the pioneering work of Grubel and Lloyd. Their index, which bears their name, is the most widely used methodological approach to quantify the degree of intra- industry trade between trading nations. In short, exchange in products in the same industry is based on similarities in industrial development, stage of economic development, and level of income between the trading countries. Product differentiation and internal economies of scale are other factors that have been identified as important determinants of intra- industry trade. Numerous empirical studies have been published on the quantification of intra-industry trade for different regions/countries. In 1978, using 1978 data Aquino measured the ratio of intra-industry trade in manufacturing for Brazil and Mexico, he estimated Mexico’s intra- industry trade ratio to be 36.6% in 1978 in the manufacturing sector.

Balassa (1979) used data for 1974 to compute intra- industry trade indexes for several Latin American countries including Mexico, as did Havrylyshyn and Civan (1983), using 1978 data. Balassa’s estimate for Mexico’s intra-industry trade ratio was 34.3% and Havrylyshyn’s and Civan’s result was 31.9% for the manufacturing sector. With the establishment of the North American Free Trade Agreement, some studies have focused on the measurement of United States- Mexico intra-industry trade. Hart and McDonald have done so for the 1962 to 1987 period. Gonzalez and Velez (1993) have computed estimations of United States- Mexico intra- industry trade during 1961 to 1991 period. Hart and McDonald’s estimate of the United States- Mexico intra- industry trade index was 34% while Gonzalez and Velez’s estimate was 51.8%.

3. Methodology

The methodological framework for this empirical work is based on Grumble and Lloyd’s approach to measure the degree of intra-industry trade. Under such approach the intra-industry trade index (or the percentage of the trade involving products in the same industry) is given by:

$$\text{Grubel-Lloyd Intra-Industry Trade Index} = 1 - \{ |X - M| / (X + M) \}.$$

The term $\{ |X - M| / (X + M) \}$ represents inter-industry trade (exchange of goods in different industries) as a ratio of total trade. Therefore, Intra-Industry Trade Index is equal to 1 minus the inter-industry trade ratio.

As an example suppose that country I’s exports of good A to country II are valued at \$1,000,000 while its imports of A from country II are \$0. The absolute value of the trade difference in good A between the two countries (\$1,000,000) divided by the total trade in good A between the two nations (\$1,000,000) yields an Inter-Industry Trade Ratio of 1 and, since nation I imported zero quantities of good A from its trading partner, the Grubel-Lloyd Intra-Industry Trade Index would be zero ($1 - 1 = 0$.)

Alternatively, if each of the two countries exported to its trading partner \$1,000,000 in goods from industry A, then for either country the net trade difference in industry A trade would be \$0 ($\$1,000,000 - \$1,000,000$) and the inter-industry trade ratio would be zero as well ($\$0 / \$2,000,000$). This situation would yield a Grubel-Lloyd Intra-Industry Trade Index equal to 1 minus 0 or 1 signifying that, in this instance 100% of the trade between country I and country II involves products within the same industry (A.)

The Grubel-Lloyd Intra-Industry trade coefficient is calculated for twenty four nations divided evenly into two groups: industrialized nations and developing countries. Data for 2008 for 262 three digit SITC commodity classes are used to estimate the Grubel-Lloyd Index for each country weighted according to each SITC category’s importance as a fraction of that nation’s total volume of trade with the United States.

Subsequently, the weighted Intra-Industry and Inter-Industry trade coefficients are calculated for the group of industrialized nations and for developing countries as well.

4. Hypotheses to be tested

Based on the estimated Intra and Inter Industry trade coefficients the following three hypotheses are tested:

4.1 Hypothesis I: The international trade between industrialized nations and the United States is primarily of an intra-industry trade nature or, in other words, the Grubel-Lloyd Index of trade between these countries and the United States is higher than 50%.

4.2. Hypothesis II: The international trade between developing nations and the United States is predominantly of an Inter-Industry trade nature or, in other words, the Grubel-Lloyd Index of trade between these countries and the United States is lower than 50%.

4.3. Hypothesis III: More Intra-Industry trade takes place between the United States and other industrialized countries than between the United States and developing nations as indicated by a statistically higher Grubel-Lloyd Index for the U.S. – industrial nations commerce compared to that for the U.S. – developing countries trade.

5. Empirical Results

Table I summarizes that calculations for the Grubel-Lloyd (Intra-Industry) and the

Inter-Industry trade coefficients between the United States and each of twelve industrialized nations using SITC data for 2008. The middle columns contain these coefficients without taking into account the significance (weight) of each nation's trade with the United States as a percentage of last total trade of the U.S. with the group of these twelve countries. The last two columns do take these weights into account in order to construct the weighted Intra and Inter-Industry coefficients of trade between the United States and the industrial nations as a group. Table II presents the same information for trade between the United States and a group of twelve developing countries.

6. Hypotheses Tests

6.1 Hypothesis I: The U.S. – High-Income Countries trade's Grubel-Lloyd Index > 50%.

$H_0: p_1 \leq 0.5$, $H_1: p_1 > 0.5$ where P_1 = Intra – Industry trade coefficient (Grubel-Lloyd Index) between the United States and high-income countries (47%).

$P_1 = 0.47$

$Z_1 = -0.21$ (z computed)

For $\alpha = 0.05$, $Z_{0.95} = 1.65$ (z critical)

Since $z_1 < Z_{0.95}$, ($-0.21 < 1.65$), the H_0 is NOT rejected – The Grubel-Lloyd Index of trade between the group of high-income nations and the United States is LESS than 50% and the trade between these parties is NOT predominantly of an Intra-Industry nature.

6.2 Hypothesis II: The U.S. – Low-Income Countries trade's Grubel-Lloyd Index < 50%.

$H_0: p_2 \leq 0.5$, $H_1: p_2 > 0.5$ where P_2 = Intra – Industry trade coefficient between the United States and the group of low-income countries (17%).

$P_2 = 0.28$

$Z_2 = -1.52$ (Z computed)

For $\alpha = 0.05$, $Z_{0.95} = 1.65$ (z critical)

Since $z_2 < Z_{0.95}$, $-1.52 < 1.65$, the H_0 is NOT rejected – The Grubel-Lloyd Index of trade between the group of low-income nations and the United States is indeed LESS than 50% and the trade between these parties is NOT predominantly of an Intra-Industry nature. Alternatively, the Inter-Industry trade coefficient between these parties is greater than 50% and, therefore, the trade between the group of developing countries and the U.S. is principally across different SITC categories (Inter-Industry trade.)

6.2 Hypothesis III: The U.S. – Developing Countries trade's Grubel-Lloyd Index > The U.S. – Developing Countries trade's Grubel-Lloyd Index.

$H_0 : p_1 - p_2 \leq 0$, $H_1 : p_1 - p_2 > 0$ where p_1 = Intra – Industry trade coefficient (Grubel-Lloyd Index) between the United States and high-income countries (47%) and p_2 = Intra – Industry trade coefficient between the United States and the group of low-income countries (28%).

$$P_1 - P_2 = .47 - .28 = 0.19$$

$$Z_3 = 3.17 \text{ (z computed)}$$

$$\text{For } \alpha = 0.05, Z_{0.95} = 1.65 \text{ (z critical)}$$

Since $z_3 > Z_{0.95}$, (3.17 > 1.65) the H_0 is rejected: the difference in the Grubel – Lloyd Index between the two groups of countries and the United States is NOT zero and, therefore, the degree of Intra-Industry trade between the group of high-income nations and the U.S. is, at the 5% level of significance, statistically greater than the degree of Intra – Industry commerce between the low-income nations as a whole and the United States.

7. Conclusions and policy considerations

As opposed to inter-industry trade, intra-industry international trade involves the importation and exportation of goods in the same industries or product categories. It arises because of similarities in the trading countries' industrial and/or economic development, and level of income. It also arises due to internal economies of scale or due to diverse tastes and preferences of domestic consumers. This study has found that the international trade between the United States and a group of high-income industrialized countries is NOT predominantly of an intra-industry nature, given the estimated Grubel-Lloyd Index of 47%. The fact almost one half of the trade among these nations involves exchange in the same industry categories suggests that there is a high degree of affinity among industrialized, high-income countries' consumers towards consumer products in the same SITC product categories. At the same time, the similarities in the per capita incomes of these nations allow consumers to transform their tastes and preferences into effective demand for these goods. From the supply side perspective, the comparable stages in their economic development and in their technological know-how enables producers in these nations to take advantage of economies of scale by producing these items in quantities beyond those strictly needed to satisfy domestic consumer demand.

In terms of economic policy considerations, the free and unrestricted flow of intra-industry goods across countries raises consumers' welfare by expanding their range of choices beyond those available from purely domestic sources. Additionally, the lower costs of production associated with economies of scale and increased competition also benefits consumers via lower prices and improvements in factors such as customer service and product quality, among others. Moreover, the expansion of markets beyond their domestic frontiers leads to spillover benefits to labor through the creation of direct and indirect jobs.

An example of the loss of consumer welfare resulting from barriers against Intra-Industry would be the scenario in which the United States' trade authorities imposed restrictions on the importation of automobiles manufactured/assembled in other industrial countries such as England, France, Germany, Italy, Japan, Sweden, South Korea, and others. American consumers would see their range of choice substantially diminished and would also end-up paying higher prices for Peugeots, Volkswagens, Volvos, Toyotas, Hyundais, etc. As anticipated in our second hypothesis, our study has found the international trade between the United States and the groups of twelve developing countries involves principally commercial exchange across different industry categories as indicated by the Inter-Industry trade coefficient of 83%. This finding is consistent with the Hecksher-Ohlin model which predicts that nations, such as the United States, whose relatively abundant factor of production is capital, would have a comparative advantage in the production of goods that require a capital-intensive production process. These countries would then be expected to be net exporter of such items and importers of goods whose production requires intensive use of labor.

On the other hand developing/lower income countries, which generally possess a relative abundance of labor, would, according to the H-O model, have a comparative advantage in the production of commodities requiring labor-intensive processes. These nations would then become net exporters of labor based items to capital rich-countries and net importers of capital-intensive goods from them. In the absence of international trade or with impediments to the free flow of labor intensive goods from developing nations, consumers in countries such as the United States would, at best, have to pay higher prices for these items or, at worst, be excluded entirely from their consumption if there are no domestic suppliers. A good example of this would be the detriments suffered by American consumers if the United States imposed trade restrictions against the great variety of flowers grown in Colombia under unique climatic conditions and with labor-intensive cultivation processes.

From the perspective of consumers in developing nations, restrictions on Inter-Industry trade would also adversely affect their welfare as they would experience a decrease in the availability of and/or an increase in the prices of capital/technology-intensive goods produced and exported by industrialized countries. Fewer or more expensive artificial knees or hips, digital cameras, high-definition televisions, etc. would be available to consumers in Colombia, Venezuela, and Chile, among others.

Furthermore, much of the inter-industry trade exports of the United States and other industrialized nations consists of heavy industrial and agricultural machinery, medical diagnostic equipment, and passenger aircraft to name a few. Even though these items are not consumer goods their importation free of restrictions indirectly enhances the welfare of consumers in the developing world since the utilization of these capital goods enhances the production of consumer products such as corn, rice and other staples of their daily diet or the provision of medical or air transportation services in consumer markets.

Our study also found that the degree of Intra-Industry trade between the U.S. and its high-income trading partners exceeds, by a statistically significant margin, that between the United States and the lower-income nations. In the final analysis regardless of whether the international trade of the United States is predominantly of an Intra or Inter-Industry nature and irrespective of whether its trading partners are other high-income, industrialized nations or lower-income, developing countries, consumers on both sides of the exchange would be better-off under a commercial policy of free trade.

The high levels of Inter-Industry trade implies a comparative advantage or a higher degree of competitiveness on the part of one of the trading partners in the industries in question. The research suggests that the United States enjoys a comparative advantage or superior competitiveness in industries such as aircraft and associated equipment production, cereal and cereal preparation, and heavy machinery and transport equipment production (civil engineering equipment and agricultural machinery). To maintain that high degree of competitiveness in those industries in today's very dynamic global economy, the private and public sectors in the United States need to commit significant levels of investment in plant and equipment, research and development, infrastructure, and human capital, including education.

Possible extensions of this research include, aside from the limitations inherent in the lack of readily available statistical data, inquiries as to whether bilateral or multilateral free trade agreements among countries lead to intra-industry trade creation and inter-industry-trade diversion or vice-versa as well as other studies to estimate the Grubel-Lloyd Index of trade among developing nations.

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Table I: Intra and Inter-Industry Trade Coefficients Between the United States and Selected Industrialized Countries

	USA trade In Thousands of Dollars				Weight	Weighted Inter	Weighted Intra
	Exports	Imports	Inter-Industry	Intra-Industry			
Canada	261,149,834	342,915,502	47.04%	52.96%	40.49%	19.05%	21.44%
Japan	65,141,753	143,131,686	68.53%	31.47%	13.96%	9.57%	4.39%
Germany	54,505,256	98,038,611	45.28%	54.72%	10.23%	4.63%	5.60%
United Kingdom	53,599,070	59,547,139	48.85%	51.15%	7.58%	3.70%	3.88%
Korea, Rep.	34,668,671	48,420,229	65.20%	34.80%	5.57%	3.63%	1.94%
France	28,840,097	44,278,207	45.47%	54.53%	4.90%	2.23%	2.67%
Netherlands	39,719,477	21,672,983	58.14%	41.86%	4.12%	2.39%	1.72%
Italy	15,460,836	37,351,054	61.68%	38.32%	3.54%	2.18%	1.36%
Belgium	28,903,482	17,724,372	52.83%	47.17%	3.13%	1.65%	1.47%
Switzerland	22,023,646	17,972,107	62.04%	37.96%	2.68%	1.66%	1.02%
Australia	22,218,649	10,914,294	71.80%	28.20%	2.22%	1.59%	0.63%
Spain	12,189,818	11,457,049	54.38%	45.62%	1.59%	0.86%	0.72%
Total	638,420,589	853,423,233				53.16%	46.84%

Source: (U.S. Census Bureau, n.d)

Table II: Intra and Inter-Industry Trade Coefficients Between the United States and Selected Developing Countries

	USA trade In Thousands of Dollars				Weight	Weighted Inter	Weighted Intra
	Exports	Imports	Inter-Industry	Intra-Industry			
China	69,732,838	355,931,880	84.21%	15.79%	42.49%	35.78%	6.71%
Mexico	151,220,056	218,419,788	54.55%	45.45%	36.90%	20.13%	16.77%
India	17,682,085	26,983,103	70.89%	29.11%	4.46%	3.16%	1.30%
Malaysia	12,949,454	31,453,227	70.63%	29.37%	4.43%	3.13%	1.30%
Colombia	11,438,774	13,832,451	86.10%	13.90%	2.52%	2.17%	0.35%
Indonesia	5,644,478	16,568,693	88.09%	11.91%	2.22%	1.95%	0.26%
Chile	11,857,444	8,980,735	92.26%	7.74%	2.08%	1.92%	0.16%
Vietnam	2,789,449	13,547,103	93.47%	6.53%	1.63%	1.52%	0.11%
Peru	6,182,969	6,072,750	82.44%	17.56%	1.22%	1.01%	0.21%
Dominican Republic	6,594,370	4,066,636	64.50%	35.50%	1.06%	0.69%	0.38%
Costa Rica	5,679,825	4,177,232	77.45%	22.55%	0.98%	0.76%	0.22%
Total	301,771,742	700,033,598				72.22%	27.78%

Source: (U.S. Census Bureau, n.d)