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The Role of Industry Attributes in Determining the Pattern of U.S.-Canada Intra-Industry Trade in 1997

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ABSTRACT:

Trade flow patterns associated with U.S.- Canada bilateral trade by industry groups are investigated (Food and live animal products, Manufacturing products, Chemical products, and Machinery and transportation products). The analysis uses the OECD data for 1997 U.S.-Canada bilateral trade flows combined with the U.S. industry characteristics data from the U.S. Economic Census. Levels of intra-industry trade, measured by the Grubel Lloyd Index, were regressed on a number of industry characteristics using OLS techniques. Empirical results indicate that selected measures of product differentiation, market power, and market structure are important influences upon U.S.-Canada bilateral trade in the selected industries. Finally, the empirical results indicate U.S.-Canada bilateral trade exhibits both inter- and intra-industry trade patterns.

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1. Introduction

In February 1989, the U.S.-Canada Free Trade Agreement (FTA) went into effect. The treaty's goal was the elimination all tariffs on U.S. and Canadian goods, and substantially reducing other barriers to trade over a 10-year period. On January 1, 1994, the North America Free Trade Area (NAFTA) agreement between the United States, Canada, and Mexico went into effect.

There is a general consensus among economists that these North American trade agreements have contributed to the United States and Canada developing the world's largest bilateral trading relationship in the world. During the period from 1989 to 2001, bilateral trade between the United States and Canada increased 146% (from 154 billion dollars to 380 billion dollars) whereas U.S. trade with other OECD countries increased at a much lower pace (figure 1).[3] In 2001, U.S.-Canada bilateral trade accounted for 20.4% of total U.S. trade.

NAFTA has also fostered expansion of bilateral trade between the United States and Mexico since its inception, increasing bilateral trade by 742% (from 28 billon dollars to 232 billion dollars). As a consequence of bilateral trade expansion Mexico has surpassed Japan to become the United States second most important bilateral trading partner in 1999.

[3] Unless otherwise noted, all data reported in this thesis are OECD data, ITCS (International Trade by Commodity Statistics), SITC/CTCI Revision 3,1999 and 2002, 1989-2001.

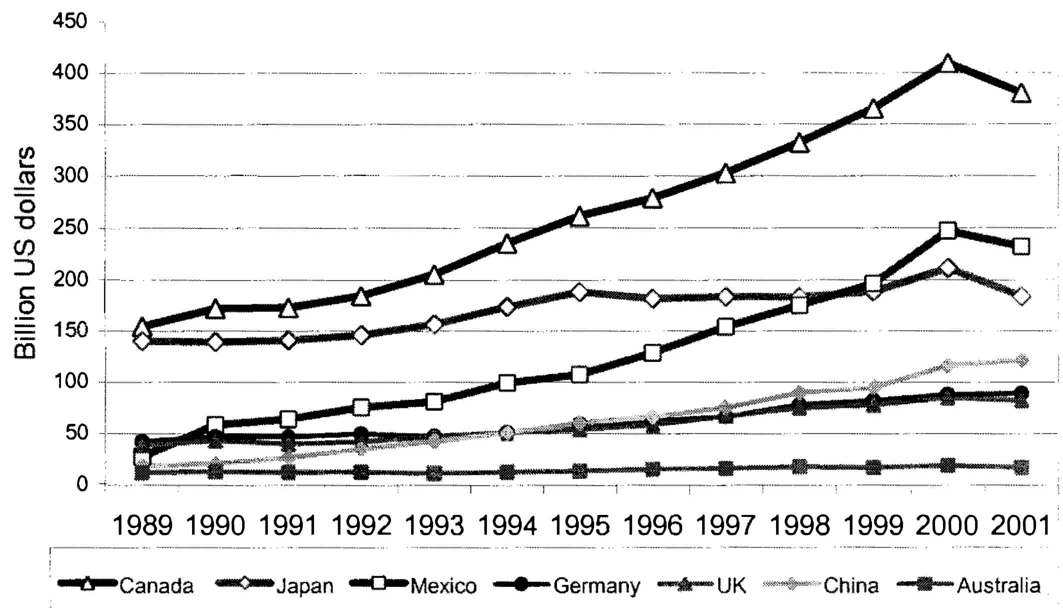

Figure 1. US Trade with Major Trading Partners (1989-2001)

As in the case of other free trade area accords entered into by other countries around the world, economists expect that trade between the United States and Canada will not only expand, but the trade pattern will shift toward intra-industry trade (IIT) as "new trade theory" predicts. Intra-industry trade refers to the simultaneous import and export of products within the same industry. This view is in contrast to "traditional trade theory" which predicts that the removal of trade barriers between countries will cause a country to shift resources from import-competing industries to export industries where the country has a comparative advantage. Resource relocation based on comparative advantage will result in increased one-way trade flow, which is referred to as inter-industry trade. The objective of this paper is to analyze the U.S.-Canada bilateral trade pattern in 1997, for a selected set of industries in four diverse product groups, to determine the nature of, and influences upon U.S.-Canadian trade-flows.

2. Literature Review

The literature discussing the IIT trade pattern phenomenon focuses on country differences or industry characteristics as possible alternative explanations. Frankle (1943) observed a correspondence between the import and export of products within the same commodity group and a country's level of international trade. Verdoon (1960) reported that specialization accompanied by increased intra-block trade of the Benelux Union was within rather than between the different product categories. Michaely (1962) noted that the compositions of commodities traded among high-level income countries showed considerable similarity while the opposite held true for less developed countries. Balassa (1963) reported that much of the trade increase in manufacturing products among EEC countries occurred within rather than between commodity groups. These studies indicated that a reduction in trade barriers among trading partners fosters economic integration and increased specialization within industries.

A number of authors have argued that empirical evidence of intra-industry specialization presented in the literature is difficult to explain with classical trade theory (Lancaster 1980, Balassa and Bauwens 1988, Krugman and Obstfeld 1991). A substantial body of theoretical literature has emerged that attempts to explain increased intra-industry trade (IIT) as the result of market structure and industry attributes. Gray (1973), Gray and Martin (1980), and Helpman and Krugman (1985) have explained the IIT phenomenon by incorporating imperfect competition into international trade models. Product differentiation plays a pivotal role in this literature, as it results from imperfect competition and encourages firms to exploit economies of scale. Recently Davis (1995) has advanced the proposition that both intra- and inter-industry trade can occur under perfect competition and constant returns to scale when a country has a technical advantage in producing a product while its trading partner can produce a close substitute product requiring different factor intensity.

A number of researchers such as Galvelin and Lundberg (1983), Loertsher and Wolter (1980),), Toh (1983) and Pagoulatos and Sorensen (1975) empirically tested theoretical hypotheses proposed by the authors of these new international trade models and investigated the determinants of IIT between countries and across selected industries. Finger and DeRosa (1979) estimated trade overlaps of 14 major industrialized countries for the two periods, 1961 to 1963 and 1974 to 1976, and found an upward trend of IIT, particularly in manufactured products. Greenway, Hine, and Milner (1995) focus on product differentiation and how it affects IIT. Specifically, they explore the role vertical and horizontal product differentiation on market structure, firm behavior, and the trade pattern[4]. These empirical studies rely upon the empirical measure of IIT developed by Grubel and Lloyd (1971). In their seminal study, Grubel and Lloyd, proposed and calculated an IIT index for 163 products at the 3-digit SITC level for 10 industrialized countries. The index they proposed is the most commonly used empirical measure of IIT and is referred to as the GL index:

$$(1) \qquad B_i = 1 - \frac{|X_i - M_i|}{(X_i + M_i)} \, ,$$

Where B_i is the Grubel and Lloyd index value, unadjusted for trade imbalances, and X_i and M_i denote export and import values for industry i. Grubel and Lloyd noted that in the case of total trade imbalance, the GL index would be biased downward. In order to adjust the trade imbalance, Grubel and Lloyd proposed the trade balance-adjusted GL index:

[4] The linkage between bilateral intra-industry trade (vertical vs. horizontal) and the type of product differentiation occurring within an industry is also investigated in Greenway, Milner, and Elliott (1999).

$$(2) \qquad B_{ijk} = 1 - \frac{\left| \frac{X_{ijk}}{X_{jk}} - \frac{M_{ijk}}{M_{jk}} \right|}{\frac{X_{ijk}}{X_{jk}} + \frac{M_{ijk}}{M_{jk}}},$$

Where:

B_{ijk}	=	The GL index for trade between countries j and k, adjusted for total trade imbalance, for industry i (IITINDEX).
X_{ijk}	=	Exports of industry i from country j to country k.
M_{ijk}	=	Imports of industry i into country j from country k.
X_{jk}	=	Total exports of all products from country j to country k.
M_{jk}	=	Total imports of all products into country j from country k.

If an industry's exports from a country equal the industry's imports into the country, the GL index attains a maximum value of 1, indicating a case of an extreme intra-industry trade (two-way trade). On the other hand, if the industry has only exports from the country or only imports into the country, the GL index attains a minimum value of zero, indicating a case of an extreme inter-industry trade (one-way trade). In most cases, however, the calculated GL index values are between these two extremes.

3. Data and Methodology

The goal of our empirical analysis is to determine if the U.S.-Canada bilateral trade pattern, in selected industries, is influenced by industry characteristics such as: the extent of product differentiation; the degree of market (pricing) power; and the degree of oligopoly market structure. Specifically, the following five hypotheses are made concerning the determinants of the U.S.- Canada IIT for the selected industries: 1) a natural resource intensive industry will exhibit a lower level of IIT than non-resource intensive industries[5]; 2) The level of IIT is

[5] Agriculture and Chemical product categories are assumed to be more resource intensive than manufacturing product categories.

expected to be lower in industries where firms exhibit market power resulting from technical advantage or resource endowment advantage; 3) The level of IIT is expected to be higher in industries exhibiting oligopoly market structure; 4) The level of IIT is expected to be higher in industries with higher degrees of product differentiation; and 5) The greater the level of product category aggregation, the higher the level of IIT.

In order to investigate the pattern and determinants of U.S.-Canada bilateral trade for selected industries across the four product categories selected (food, live animal, beverage, and tobacco products, manufacturing products, machinery and transportation products, and chemical products), the empirical analysis requires two types of data; trade flow data, and industry characteristics data.

Bilateral trade flow data for 1997 were obtained from the Organization for Economic Cooperation and Development (OECD). The OECD data is based on Standard Industrial Trade Classification, SITC (Revision 3, 1999). The industry characteristics data, however, were obtained from the U. S. Economic Census and are based on the North American Industrial Classification System (NAICS). Since the two classification systems are different, the first challenge was to establish a concordance between the SITC product classification system and the NAICS industry classification system. After a careful review, 76 products in SITC classification at the 3- and 4-digit level were identified as closely matching 76 industries in the NAICS classification system (Table 1). Accordingly, these 76 industries were included in the empirical analysis.

The levels of U.S.-Canada IIT were measured by the GL Index adjusted for trade imbalance using equation 2 (IITINDEX). The computed IITINDEX series showed varying degrees of IIT among different industries. For example, industries such as electrical apparatus for line telephony or telegram (SITC 7641) had a higher level of IIT relative to other industries included in the study. On the other hand, industrial categories such as "mixes and doughs" for the preparation of bakers' ware (SITC 0485), nitrogen mineral and fertilizer (SITC 5621), and phosphate mineral and fertilizer (SITC 5622) were identified as being dominated by one-way trade. IIT summary statistics were calculated according to product categories to determine if the level of IIT varied across categories (Table 2). Statistical tests were conducted to determine if the level of and variability in IIT within a product category varies across product categories (hyp.1). Given the small sample size, nonparametric hypotheses testing procedures were used. The statistical results indicate that there is no statistical evidence in support of the hypotheses that the average level of IIT or variability in IIT within a product category varies significantly across product categories.[6] This result is surprising given the popular view that IIT is more prevalent in manufacturing industries relative to agricultural or resource intensive industries.

Data for basic industry characteristics, such as value-added, total value of shipment, number of employees, firm concentration ratios, etc., were collected from the U.S. Economic Census. Empirical work discussed in the literature review suggested that the level of IIT between U.S. and Canada should be: 1) higher in industries with higher levels of product differentiation, 2) lower in industries with technical or resource endowment advantages, and 3) higher in industries with a higher level of market concentration. Based on the literature review and the availability of data, a number of measures of industry characteristics were developed which can be potentially helpful in empirical testing of these hypotheses. These measures (variables) and

[6] The nonparametric test for location used was the Kruskal-Wallis Test. The nonparametric test for variability was the Siegl-Tukey Scores Test. The null hypothesis for both test was: there was no difference across product categories. The p-values for tests were .31 and .53, respectively.

their relation to the specific hypotheses are summarized in Table 3. A brief discussion of these measures in relation to the specific hypotheses follows.

Industries producing highly differentiated products tend to be characterized as having relatively high advertising cost. The advertisement expense per dollar of shipment (ADVERT) is included in the analysis to capture the degree of product differentiation within an industry. This variable is expected to have a positive association with the level of IIT.[7]

In numerous IIT studies[8], various value-added measures have been used as a proxy for an "economies of scale" effect, along with variables such as average size of plant (in terms of production or employment), and the share of the labor force employed in large size plants (e.g. more than 500 employees). Economies of scale proxies have had mixed success and their lack of empirical success has been criticized in the literature (Davis 1995). For example, value-added per establishment was used as a proxy for economies of scale in production in empirical work by Loertscher and Wolter 1980. Their counter intuitive empirical result and their subsequent *ex* post justification have received critical attention in the literature. We follow Davis's suggestion and assume that industrial characteristics such as value-added reflect the degree of technical advantage a particular industry has in production. Technical advantage bestows upon an industry a comparative advantage allowing firms in an industry to extract economic rents that show-up in value-added estimates reported in the data. Economies of scale could be that technical component that enhances value-added in relation to total value of shipment, if economies of scale results in greater product standardization and lower average cost.

[7] Advertising expenses were employed as an explanatory variable in papers by Caves and Khalilzedeh-Shirazi (1977), and Pugel (1978).

[8] See Greenway, Milner, and Elliot (1999), Galvelin and Lundberg (1983), Finger and DeRosa (1973).

Oligopoly market structure is another important determinant of the level of IIT. In a study by Toh (1982) world market share[9] of U.S. exports in each industry was used as a proxy for the international oligopolistic rivalry. U.S. industries with a higher world market share are expected to have high entry barriers to foreign companies and, therefore, to have lower degrees of IIT in these industries. Given the nature of U.S. and Canadian bilateral trade, we decided to follow the approach used by Harrigan (1994) who focused on market concentration to explain trade volume. We estimate market concentration by dividing total value of shipment of the four largest firms by the total value of shipment for the 20 largest firms in an industry. This proxy (ICR) for market structure approaches one if the market is highly concentrated and zero if the market exhibits minimal concentration. It is assumed that the level of market concentration is positively related to the level of IIT, based on "stylized facts" provided by Schmalensee (1989). Schmalensee's "stylized facts 6.1 and 6.2" (1989,p.992) offers justification for the relationship between market concentration and minimum efficient scale of plant.

Ordinary Least Square (OLS) regression analysis was selected as the statistical procedure. The general form of linear regression equation is as follows.

$$(3) \qquad Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_i X_i + \ldots + \mu$$

Where Y is the dependant variable; β_i and X_i are the parameters and independent variables, respectively; and μ is the error term, $\mu \sim (0, \sigma^2)$. The analysis assumes the usual assumptions underlying the OLS analysis.

[9] The U.S. International Trade Commission defines the world export market share as the value of U.S. exports in industry i divided by the value of the world exports in the industry. Further, the commission defines the world exports as the sum of exports from the United States, the United Kingdom, Sweden, Germany, the Netherlands, Belgium, Italy, France, and Japan (USITC, 2001).

4 Empirical Results

The empirical procedure was conducted by regressing the IIT-INDEX over four independent variables: ADVERT, VALADD, THREEDIG, and ICR. Regression diagnostics did not reveal any serious econometric problem.[10] The regression estimates for the model are reported in Table 3.

The model has reasonable explanatory power (R-square 0.22, adjusted R-square 0.18) relative to other IIT empirical studies[11]. All four explanatory variables are statistically significant.[12]

The advertisement variable is a proxy measure for product differentiation and is statistically significant at the 5% level with the expected positive sign. This result is consistent with the theoretical literature that suggests that the level of horizontal IIT is positively related to brand differentiation. However, our result appears to be more robust than results reported in previous empirical studies.[13] We argue that in the case of U.S.-Canada trade, the effect of advertisement seems to flow across national borders as both countries share the same language and have similar cultural and social structures and is consistent with increased product differentiation and IIT.

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[10] Regression diagnostics were conducted and it was determined that multicollinearity and heteroscedasticity were not present.

[11] Given that this model is a cross-sectional estimate, this equation seems to provide a reasonable fit to the data relative to previous studies. In most IIT empirical studies, the explanation power (R-square) is not impressively high. For example, the R-square in the Loertscher and Wolter (1980) models were 0.072 and 0.070; in Pagoulatos and Sorensen (1975) models were 0.360 and 0.400, in Toh (1983) models ranged from 0.256 to 0.331.

[12] All hypotheses test were conducted as one tail test given the *a priory* nature of the relationships discussed.

[13] Caves and Khalilzedeh-Shirazi (1977), and Pugel (1978) find a negative relationship between advertising and IIT. Pagoulatos and Sorensen (1975) argue against the use of advertising expenditures due to the difficulty of finding reliable data.

The value-added variable is statistically significant, with a negative sign. The negative sign contradicts the hypothesis that higher value-added is expected to be associated with economies of scale and higher levels of product differentiation. The alternative explanation is that value-added measures the degree of comparative advantage due to a technical advantage as suggested by Davis 1995.

The aggregation proxy variable is a dummy variable testing if IIT is significantly different between three and four digit product categories. The dummy variable was statistically significant at the 1% level with the expected positive sign. This indicates that aggregation does have an impact on the measurement level of IIT for the product groups selected in this study.

To test the effect of oligopoly market structure (market concentration) on the level of IIT, ICR has the expected positive sign and is statistically significant at the 1% level. This result confirms the hypothesis that the higher the degree of market concentration is associated with a higher level of IIT. Davis (1994) found that market concentration has a positive and significant relationship with volume of trade. Davis concluded this result suggests that there is an economies of scale effect that is consistent with the monopolistic competition explanation for IIT. Given the "stylized facts" provided by Schmalensee (1989) concerning the relationship between market concentration and minimum efficient scale of plant, one could argue that our market structure proxy provides empirical support the economies of scale hypothesis in the IIT literature.

5. Summary and Conclusions

U.S.-Canada bilateral trade patterns were investigated across in four product groups; 1) Food and live animals products including beverages and tobacco, 2) Manufactured products, 3)

Machinery and transportation products, and 4) Chemical products, are investigated. The empirical analysis relied upon OECD data for 1997 U.S.-Canada bilateral trade flows combined with the U.S. industry characteristic data from the U.S. Economic Census.

The first challenge was to identify a concordance between the two data sets. After a careful review, 76 products in the SITC classification at the 3- and 4-digit level (in OECD data) were identified that matched closely with 76 industries in the NAICS classification (in U.S. Economic Census data).

Estimates of IIT at the three and four-digit level, as measured by the adjusted GL Index, were regressed on a number of industry characteristics using the OLS technique. Empirical results indicate that selected measures of product differentiation, market power due to technical or resource endowment advantages, and market structure are important industrial attributes effecting U.S.-Canada bilateral trade in the selected industries.

An important insight coming from the empirical evidence presented by this study is that economic forces described and predictions made in both classical and new trade theory seem to be present in the U.S.-Canada trade pattern across industries. The value of the new NAIC classification system for U.S. industries also becomes apparent in this study as it allowed new explanatory variables, based on industrial characteristics, to be constructed and used in testing existing IIT hypotheses.

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Table 1. Matching Industry Classification.

No.	NAICS	Definition		SITC	Definition
		<u>**Food and Live Animals**</u>			
1	3112A	Flour milling		0461	Flour of wheat or of meslin
2	3112B	Industry series, rice milling		042	Rice
3	3112C	Malt manufacturing		0482	Malt, whether or not roasted
4	3112H	Breakfast cereal manufacturing		0481	Cereal grains, wroked jor prepared, n.e.s.
5	3113D	Chocolate and confectionery manufacturing from cocoa beans		073	Chocolate, food preparations with cocoa, n.e.s.
6	3114A	Frozen, fruit, juice and vegetable manufacturing		059	Fruit and vegetable juices, unfermented, no spirit
7	3115B	Creamy butter manufacturing		023	Butter and other fats and oils derived from milk
8	3115C	Cheese and curd		024	Cheese and curd
9	3116D	Poultry manufacturing		0174	Meat, offal of poultry, prepared or preserved, n.e.s.
10	3118E	Flour mixes and dough manufacturing from purchased flour		0485	Mixes & doughs for the preparation of bakers' ware
11	3118F	Dry pasta manufacturing		0483	Macaroni, spaghettis and similar products
12	3119C	Coffee and tea manufacturing		071	coffee and coffee substitute
			+	074	Tea and mate
		<u>**Beverage and Tobacco**</u>			
1	3122A	Tobacco stemming and redrying		121	Tobacco, unmanufactured; tobacco refuse
2	3122B	Cigarette manufacturing		1222	Cigarettes containing tobacco
3	3122C	Other tobacco product manufacturing		1223	Other manufactured tobacco; extracts and essences
		<u>**Chemical and Related Products, n.e.s.**</u>			
1	3253A	Nitrogenous fertilizer manufacturing		5621	Mineral or chemical fertilizer, nitrogenous
2	3253B	Phosphatic fertilizer manufacturing		5622	Mineral or chemical fertilizers, phosphatic
3	3254B	Pharmaceutical preparation manufacturing		541	Medicinal and pharmaceutical products, excluding 542
			+	542	Medicaments (incl. Veterinary medicaments)
4	3256A	Soap and other detergent manufacturing		5541	Soaps, organic surface-active products mixed or not
5	3256B	Polish and other sanitation goods manufacturing		5543	Polishes & creams, scouring powers, sim.(excluding 5983)
6	3259A	Printing ink manufacturing		5332	Printing ink

(Continued)

Table 1. Matching Industry Classification (continued) .

No.	NAICS	Definition		SITC	Definition
		Manufacturing Goods			
1	3141A	Carpet and rug mills		6592	Carpets & other textile floor coverings, knotted
			+	6594	Carpets & other textile floor coverings, tuffed
			+	6595	Carpets & other textile floor coverings, woven, n.e.s.
			+	6596	Carpets & other textile floor coverings, n.e.s
2	3221C	Newsprint mills		6411	Newsprint in rolls or sheets
3	3222G	Coated and laminated paper manufacturing		6413	Paper & paper board, coated, graphic purp. (excluding 892)
			+	6417	Paper, paperboard, coated with plas. (excluding 892, n.e.s.)
4	3222M	Envelop manufacturing		64221	Envelopes
5	3262A	Tire manufacturing		625	Rubber tyres, tyre treads or flaps & inner tubes
6	3272B	Other pressed and blown glass and glassware manufacturing		6641	Glass in the mass, balls, rods or laminated glass
7	3272C	Glass container manufacturing		6651	Containers, glass, for conveyance, packing of goods
8	3272D	Glass product manufacturing made of purchased glass		6652	Glassware for domestic use (excluding 66511,66592,66593)
9	3273A	Flat glass manufacturing		6643	Drawn & brown glass, in sheets, not worked, abs., ref.
			+	6644	Float glass, surface ground, polished glass, sheets
			+	6645	Cast glass & rolled glass, in sheets or profiles
			+	6647	Safety glass of toughened or laminated glass
			+	6648	Glass mirrors, whether or not framed
10	3314A	Primary smelting and refining of nonferrous (except copper & aluminum)		6821	Copper, refined or not; anodes; copper al. unwrought
11	3314C	Copper rolling, drawing, and extruding		6823	Copper bars, rods and profiles
			+	6825	Copper plates, sheer & strip, thickness > 0.15 mm
			+	6827	Copper tubes, pipes, & tubes or pipe fittings
12	3314D	Copper wire (Except mechanical)		6824	Copper wire
13	3315D	Aluminum die-casting foundries		6842	Aluminum & Aluminum & aluminum alloys, worked
14	3315G	Copper foundries (except die-casting foundries)		682	Copper
15	3322A	Cutlery and flatware (except precious manufacturing)		696	Cutlery
16	3322D	Kitchen utensils, pot, and pan manufacturing		697	Household equipment of base metal, n.e.s.
17	3327C	Bolt, nut, screw, rivet and washer manufacturing		694	Nails, screws, nuts, blots, rivets & the like, of metal

(Continued)

Table 1. Matching Industry Classification (continued) .

No.	NAICS	Definition		SITC	Definition
		Machinery and Transport Equipment			
1	3329E	Ball and roller bearing manufacturing		746	Ball or roller bearings
2	3331A	Farm machinery and equipment manufacturing		721	agricultural machinery (excluding tractors) & parts
3	3332C	Paper industry machinery		725	Pulp mill, making or finishing paper machinery
4	3332D	Textile machinery manufacturing		7243	Sewing machines (excluding 72681); parts and furniture
			+	7244	Machines for extruding, drawing, etc., textile material
			+	7245	Weaving, knitting, tufting, preparing yarns machines
			+	7246	Auxiliary for 7244 through 72453; parts, accessories
			+	7247	Machinery for. washing, cleaning, etc., textile articles
5	3332E	Printing machinery and equipment manufacturing		7263	Machine for print components; blocks, plates, etc.
			+	7265	Offset printing machinery
			+	7266	Other printing machinery
6	3332F	Food product machinery manufacturing		727	Food processing machines (excluding domestic)
7	3333C	Office machine manufacturing		751	Office machines
8	3334C	Heating equipment (except warm air furnaces) manufg.		7412	Furnace burners for fuel or gas; mechanical stokers
9	3334D	Air-conditioning and warm air heating equip. & commercial		7414	Refrigerating, freezing equipment (excluding household)
		and industry refrigeration equipment manufacturing	+	7415	Air conditioning machines with motor-driven fan
			+	7418	Other machinery involving a change of temperature
10	3335B	Machine tool (metal cutting types) manufacturing		731	Machine-tools by removing material
11	3335C	Machine tool (metal forming types) manufacturing		733	Machine-tools for working metal, excluding removing mate.
12	3339N	Scale and balance (except laboratory)		7453	Weighing machinery (excluding sensitive<5cg); parts
13	3342A	telephone apparatus manufacturing		7641	Electrical apparatus for line telephony or teleg.
		Radio and television broadcasting and wireless			
14	3342B	communications		7643	Transmission apparatus for radio-broadcasting, etc.
		equipment manaufactring	+	7648	Telecommunication equipment
15	3343A	Audio and video equipment manufacturing		761	Television receivers, whether or not combined
			+	762	Radio-broadcast receivers, whether or not combined
			+	763	Sound recorders or reproducers; television record
16	3344A	Electron tube manufacturing		7761	Television picture tubes, cathode ray
17	3344C	Semiconductor and related device manufacturing		7763	Diodes, transistors & similar semiconductor devices
18	3345A	Electromedical & electrotherapeutic apparatus manufactg.		7741	Electro-diagnostic apparatus (excluding radiological)

(Continued)

Table 1. Matching Industry Classification (continued).

No.	NAICS	Definition		SITC	Definition
		Machinery and Transport Equipment (continued)			
19	3352D	Household refrigerator and home freezer manufacturing		7752	Household type refrigerators and food freezers
20	3352E	Household laundry equipment		7751	Household type laundry equipment
21	3353B	Motor and generator manufacturing		714	Engines & motors, non-electric; parts, n.e.s.
			+	716	Rotating electric plant & parts thereof, n.e.s.
22	3361A	Automobile manufacturing		7812	Motor vehicles for the transport of persons
23	3361B	Light truck and utility vehicle manufacturing		7821	Motor vehicles for the transport of goods
24	3361C	Heavy duty truck manufacturing		7832	Road tractors for semi-trailers
25	3362B	Truck trailer manufacturing		7862	Trailer and semi-trailer for transport of goods
26	3362D	Travel trailer and camper manufacturing		7861	Trailers & semi-trailers for camping or housing
27	3363B	Gasoline engine and engine parts manufacturing		713	Internal combustion piston engines, parts, n.e.s.
28	3365A	Railroad rolling stock manufacturing		7911	Locomotives powered electrically (external, accumu.)
			+	7912	Other rail locomotives; locomotive tenders
			+	7916	Railway or tramway freight, with motor, wei<2000kg
			+	7917	Special purpose railway coaches, not self-propelled
			+	7918	Railway or tramway freight & maintenance
		Miscellaneous Manufactured Articles			
1	3259D	Photographic film, paper, plate, and chemical manufactng.		882	Cinematographic & photographic supplies
2	3333D	Optical instrument and lens manufacturing		871	Optical instruments & apparatus, n.e.s.
3	3345E	Totalizing fluid meters and calculating device manufactng.		8842	Drawing, checking, calculate., etc., instruments, n.e.s.
			+	8843	apparatus & instruments or measuring liquid, gases
4	3345I	Watch, clock, and part manufacturing		8853	Watches, case partly or wholly of precious metal
			+	8854	Wrist watches & other watches, excluding 8853
			+	8857	Clocks
5	3346C	Magnetic and optical recording media manufacturing		8984	Magnetic tapes for sound recording or similar
			+	8986	Magnetic tapes, recorded
6	3379A	Mattress manufacturing		8212	Mattress supports; articles of bedding or similar
7	3391D	Dental equipment and supplies manufacturing		8721	Dental instruments & appliances, n.e.s.
8	3399A	Jewelry (except costume manufacturing		8973	Jewelry of gold, silver, platinum & similar wares
9	3399D	Costume jewelry and novelty manufacturing		8972	Imitation jewelry
10	3399E	Sporting and athletic goods manufacturing		8947	Sports goods
11	3399N	Musical instrument manufacturing		8981	Piano & other string musical instruments
			+	8982	Musical instruments (excluding string musical instruments)
			+	8989	Parts & accessories of musical instruments

Table 2. Descriptive Statistics of IIT Index for Selected Products Groups, 1997

Product Groups	No. of Industry	Mean	Std Dev	Minimum	Maximum
Agricultural Products	15	0.499	0.350	0.000	0.993
Manufacturing Products	27	0.459	0.333	0.006	0.896
Machinery and Transportation Products	28	0.435	0.332	0.007	0.989
Chemical Products	6	0.242	0.286	0.000	0.645

Calculated from OECD Statistics, SITC Revision 3, 1999 data.

Table 3. Variables Measuring Industry Characteristics and their Hypothesized Relationship with Intra-Industry Trade.

Hypothesis	Variables	Definitions	Hypothesized Relationship
Product Differentiation	ADVERT	The advertisement expenses per dollar of shipment.	Positive
Market Power as a result of technical or resource endowment advantage	VALADD	Value-added per dollar of shipment.	Negative
Oligopoly Market Structure/Economies of Scale Effect	ICR	Market share of 4 largest firms divided by market share of 20 largest firms	Positive
Aggregation Dummy Variable	THREEDIG	Dummy variable THREEDIG=1 if industry is three digit SITC category, zero otherwise	Positive

Table 4. Regression Results

	Parameter Estimate		Standard Error	t-value	Pr > | t |	Variance Inflation
Dependent Variable: IITINDEX						
INTERCEPT	0.05		0.152	0.38	0.70	0
ADVERT	2.99	**	1.60	1.87	0.033	1.04
VALADD	-0.05	*	0.033	-1.54	0.0635	1.04
ICR	0.51	**	0.22	2.24	0.014	1.06
THREEDIG	0.27	***	0.076	3.65	0.001	1.06
F value			**5.16**		**Pr > F**	**0.001**
R-Square			**0.225**		**Error DF**	**71**
Adjusted R-Square			**0.181**			

* Significant at 10% level. ** Significant at 5% level.
*** Significant at 1% level

Table 3. Variables Measuring Industry Characteristics and their Hypothesized Relationship with Intra-Industry Trade.

Hypothesis	Variables	Definitions	Hypothesized Relationship
Product Differentiation	ADVERT	The advertisement expenses per dollar of shipment.	Positive
Tech. or Resource Advantage	VALADD	Value-added per dollar of shipment.	Negative
Market Structure/ Economies of Scale	ICR	Market share of 4 largest firms divided by market share of 20 largest firms.	Positive
Aggregation Dummy	THREEDIG	THREEDIG=1 if industry is a 3-digit SITC, else zero.	Positive