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International Cooperation and Intra-industrial Transactions***

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The paper examines theoretically the empirical observation of increasing levels of intra-industrial trade flows. The relationship between intra-industrial trade and consumer preferences in addition to product differentiation advanced by internationally active firms are discussed within the framework of a simple model of international trade in differentiated goods. In an international free trade scenario, ranking high in product differentiation and monopolistic market structures, the intensity of international trade activities steadily rises as the structure of consumer preferences exhibits demand pattern similarity; export and import levels rise simultaneously. Intra-industrial commodity exchanges as well as investment cross-haulings of multinational enterprises prove to be important vehicles of international cooperation among nation.

I. Introduction

Casual observation of the international exchange of goods discloses the empirical reality that the import and export commodity structures among industrialized nations are becoming increasingly similar.[1] Important export branches of individual countries are simultaneously significant import branches. The phenomenon of an increased intra-industrial exchange of goods is founded on the supply side of international markets through product differentiation as well as on the demand side of these markets through consumer wishes for product diversity, in contrast to traditional comparative advantage

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1. see Balassa (1986), Greenway, Milner (1986).

trade theories.[2] The origin of an increasing international intra-industrial exchange of goods among industiral countries evolves largely out of their similar levels of development as inherent in their standards of living.[3]

The political economical implications of intra-industrial commodity trade flows are far-reaching. The rising intensity of international trade flows—given that imports may rise quicker than exports—should not be judged alone simply from the perspective of international market segment distributions of egoistic countries. Intra-industrial trade rather expresses an intensive specialization effect within the various branches of the economy combined with an increasing expansion of the differentiated product sortiments of multinational firms.[4]

The approach focalized here allows one to examine theoretically the empirical observation of increasing levels of intra-industrial trade flows. The relationship between intra-industrial trade and consumer preferences in addition to product differentiation advanced by internationally active firms are discussed within the framework of a simple model of international trade in differentiated goods. It is demonstrated that in an international free trade scenario ranking high in product differentiation and monopolistic market structures the intensity of international trade activites steadily rises as the structure of consumer preferences exhibits demand pattern similarity; export and import levels rise simultaneously.

II. A Simple Trade Model With Differentiated Products

For simplicity, assume that the economy of a nation consists of two commodity producing sectors.[5] The agrarian sector Y produces a homogeneous good, food, whereas the manufacturing sector X is the supplier of differentiated goods to prices $p_1,\ldots,P_n$. Each consumer possesses a preference for some ideal differentiated good in the sense that individuals regard themselves to be better off when they can consume a differentiated good which exactly fits their view of the ideal design for that class of products than when they do not. An individual thus decides to purchase one unit of his ideal good, given that it is available; if the market price of the good does not exceed the consumer's

2. see e.g. Broll and Gilroy (1986)

3. Compare e.g. Greenaway (1983); Siebert (1986).

4. see Helpman (1984), Borner (1986), Broll and Gilroy (1985a), (1985b), Gilroy/Broll (1987), Gilroy (1989).

5. see Economides (1984).

subjective reservation price (β), he is willing to pay for one unit. If the market price of a consumer's ideal variety happens to be greater than β no transaction occurs.[6] The product space is such that there exists a one-to-one correspondence between the continuum of varieties and a circumference of a circle with radius $1/2\pi$.

Consumers are respectively distributed along the product circle with regard to their most-preferred specification of brand. The domestic population density, according to the peaks of the utility function, is ψ, the foreign being ψ^*. The market demand function facing a firm j is then simply the sum of demand over the firm specific market width interval [$\underline{z}$, $\bar{z}$]. The relevant demand function Dj (·) of a firm j producing a differntiated product x_j is thus.

$$D_j(\cdot)=[\bar{z}-\underline{z}]\cdot\psi\,.^{7} \tag{1}$$

Differentiated products are produced under a non-convex technology. Dual to the production function of firm j the cost function $C(D_j)=F+c\cdot D_j$may be derived, exhibiting constant marginal costs c. It is assumed that such a similar cost function is applicable to all firms in the manufacturing sector. The firm's goal is to maximize its profit function π_j:

$$\max_{pj}\ \pi_j(\cdot)=(P_j-c)\cdot D_j-F\,. \tag{2}$$

The profit function of a firm j is concave; that is for given product varieties $(x_1,\ldots,x_n)$ there exists an optimal price $\tilde{p}_j$, as long as neighboring firms $(j-1\,;\,j+1)$ have positive market shares. It can be shown that there exists a non-cooperative Nash-equilibrium (compare Friedman [1977]). In such an international symmetrical trade equilibrium all firms are equispaced and the profit maximizing price is derived as $\tilde{P}_j=c+1/(n+n^*)$; with $H\equiv 1/(n+n^*)$ representing the well-known Herfindahl-Hirschman-Index of supplier concentration.

The integrated market consists of $(n+n^*)$ firms which supply exactly $(n+n^*)$ product varieties, since it would not be profitable enough for a firm to offer the same variety which already is available in the market. In the following section the individual

6. The consumer's (indirect) utility function (when he consumes the variety x_j) $u(\cdot)=y-p_j+[\beta+(\alpha-x_j)^2]$; y is income and α is the ideal product; the part [·] of the utility function has a single peak at $\alpha=x_j$.

7. $\bar{z}(\underline{z})$ are the marginal consumers of the firm j; we have

$$\bar{z}=[\frac{\tilde{p}-p_j}{\bar{x}-x_j}+\bar{x}+x_j]/2 \text{ and } \underline{z}=[\frac{p_j-p}{x_j-\underline{x}}+x_j+\underline{x}]/2$$

and aggregate export functions will be derived.

III. Export Activity and Demand Pattern Similarity

The export activity of a domestic firm j is defined through its foreign demand within the interval $[\underline{z}, \bar{z}]$. A representative export supply function for an individual firm j is derived as:

$$EX_j=[\bar{z}-\underline{z}]\ \psi^*/2=\frac{\psi^*}{2}\cdot\left[\bar{x}-\underline{x}+\frac{\bar{p}-p_j}{\bar{x}-x_j}-\frac{p_j-\underline{p}}{x_j-\underline{x}}\right] \tag{3}$$

in which $\bar{x}$ and $\underline{x}$ designate the neighboring firms varieties and $\bar{p}$, $\underline{p}$ the respective prices of these brands. Evaluated for a symmetrical aggregate trade equilibrium for n domestic firms it follows:[8]

$$EX=n\cdot EX_j=\frac{n\psi^*}{(n+n^*)} \tag{4}$$

Accordingly, the foreign aggregate export function is derived as,

$$EX^*=n^*EX_j^*=n^*\cdot\psi/(n+n^*) \tag{5}$$

It is now possible to analyze the export supply functions of an economy, given that certain presumptions are made with regard to the distribution of consumer preferences along the product circle. Our objective is to demonstrate that similarity in demand preference structures generates higher volumes of trade. To demonstrate this effect we apply the Edgeworth-Box instrument in which world factor allocations (labour and capital) are plotted.[9]

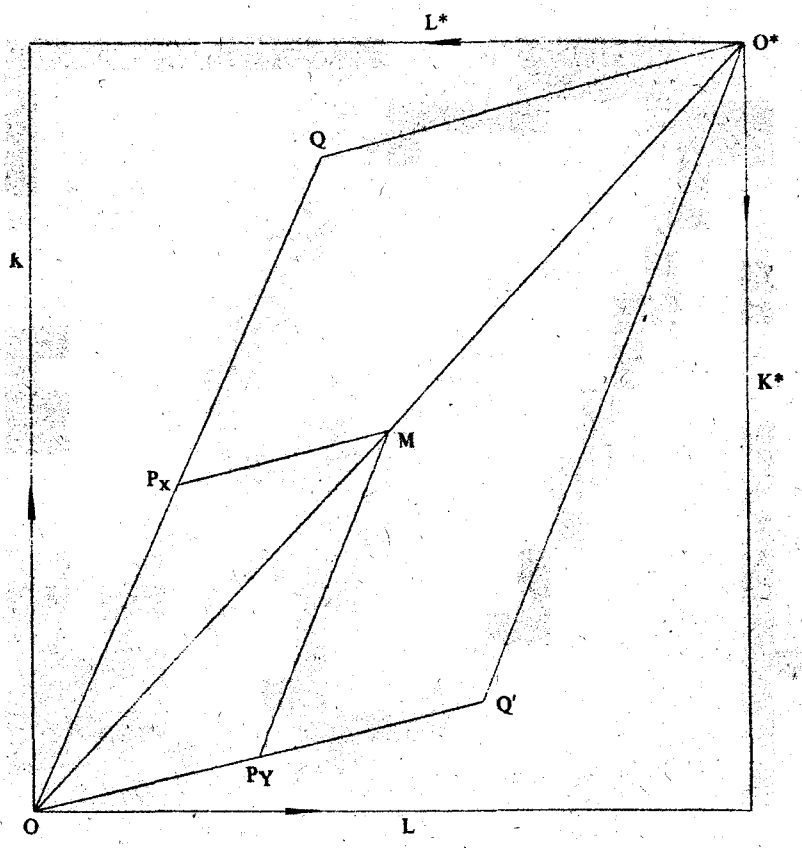
Both economies possess the production factors capital and labour (K, L). According to the assumption that the technology for both sectors is identical in both countries, the relative and absolute factor allocations are also equivalent, i.e. the world may be characterized by the factor allocation point M in Figure 1.

8. Symmetry in location we have $(\bar{x}-\underline{x})=\frac{2}{(n+n^*)}$ and $p_j=\bar{p}=\underline{p}=\tilde{p}$ for all j.

9. For a detailed application of the factor allocation box in models of international trade theory see Dixit and Norman (1980) and more recently Helpman and Krugman (1985).

With regard to Fig. 1, both countries are identical in all respects with exception of distribution of preferences for varieties of differentiated products.This has direct implications

Figure 1 : The Factor Allocation Box and Factor Price Equalization Set OQO^*Q'.



for the international pattern of trade : factor markets are characterized by factor price equalization ; the international distribution of income is identical ($GDP=GDP^*$) ; no intersectoral trade occurs ; and the international exchange of goods is limited to transaction in differentiated products between the sectors X and X^*.[10]

For example, applying the following specific forms of the distribution functions for ideal product varieties (see Economides [1984]) :

$$g(\alpha)\equiv\bar{X}+a\cdot\cos(2\pi n\alpha)\,, \qquad (6)$$
$$g^*(\alpha)=\bar{X}+a\cdot\cos(2\pi n\alpha+\pi)\,.$$

10. The line segment OP_X in Fig.1 represents the domestic capacity of differentiated goods foreign capacity of differentiated goods is equal to the line segment P_XQ.

The foreign distribution for ideal products differs only in the cosine term. The cosine terms possess a phase difference of π, so that peaks of $g(\alpha)$ coincide with the troughs of $g^*(\alpha)$ and conversely.

The export supply functions may now be examined with the aid of these distribution functions. It follows for the domestic export function e.g. that

$$EX=\frac{n}{(n+n^*)}[\bar{X}+a\cdot\cos(2\pi n^*\alpha+\pi)] \tag{7}$$

and for the foreign export supply function that

$$EX^*=\frac{n^*}{(n+n^*)}[\bar{X}+a\cdot\cos(2\pi n\alpha)] \tag{8}$$

What reaction occurs concerning the volume of trade as represented by the sum of exports for both countries given increasing or decreasing divergences regarding the distribution of consumer preferences?

The Linder-Hypothesis, in attempting to answer the question, postulates that economies of scale are an important catalyst combined with the preference similarity view of trade in differentiated goods. Linder (1961) argues that initially industries expand to satisfy domestic consumer demand, and export once the home market is large enough to permit the industry to achieve economies of scale and competitive unit costs.[11] Since the products were orginally intended for the preferences and income levels of the domestic market, exports will flow to countries with a similar demand pattern as intrinsic to their standard of living. Increasing equivalence of international consumer preferences generates a higher volume of international trade.

In the present framework the voulme of trade (T) is defined as:

$$T=\widetilde{EX}+\widetilde{EX}^*=\widetilde{P}\cdot\bar{X}-\frac{a\cdot(n^2+n^{*2})}{(n+n^*)} \tag{9}$$

whereas "~" represents export values and the parameter "a" may be interpreted as the degree of preference similarity. Valuing the volume of trade at its equilibrium level for identical preference structures of countries i.e. $a\to o$, the voumes of trade will

11. Compare e.g. Hood and Young (1979), p.141. The Linder approach is similar to that adopted in export base theories of growth. See further the interesting applied Linder/Hufbauer Approach article of Kellman/Cahn/and Glass(1986) in this journal.

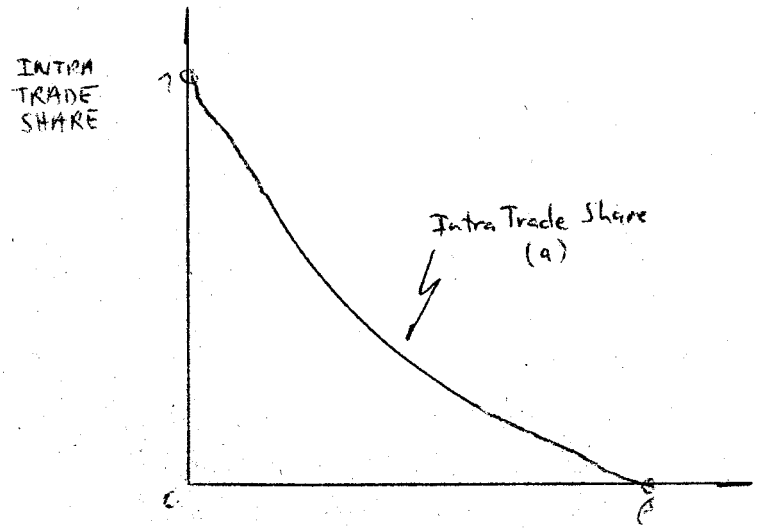
be maximal. Differences in consumers' preferences lead to lower volume of trade.

The intra-industrial trade volume indices INTRA is defined given balanced trade as

$$INTRA = 2 \cdot \min[\widetilde{EX}\,;\ \widetilde{EX}^*] \tag{10}$$

The intra-industrial trade volume obtains a maximum when the parameter "a" of consumer preference diversity converges towards zero (INTRA(a), with ∂ INTRA (a)/∂ a$<$0). The international division of labor is especially intensive for the monopolistic competition sectors, given that domestic and foreign consumers possess relatively similar preferences for differentiated products(compare Figure 2).

Figure 2 Differences in Consumer Preferences and Intra-Industrial Trade Volume



Similarity in international demand patterns elicits a trade expansion in which the volume of exports and imports simultaneously grow. This effect is an important characteristic of the rising levels of intra-industrial trade flows (compare e.g. caves and Jones[1985], chapter 9; Broll/Gilroy [1985a]).

IV. Summary

It has been demonstrated in an international trade model with differentiated products and non-convex technologies that international demand pattern similarity as expressed through consumer preferences is an important aspect in explaining the increasing empirical intensity of international intra-industry trade flows. As may be observed from the export-equations above, the degree of international demand pattern similarity is expressed in the parameter "a" and the phase difference π. Both parameters lead to the same result, namely that similarity in consumer preference structures between countries induces higher trade volumes, which increase the levels of international cooperation among nations. Polachek(1980) has empirically observed for example that there exists a strong negatively correlated relationship between international trade and conflict ; rising intensive trade relationships as expressed in high transactional levels of intra-industrial transactions lower the potential for conflict among nations. As such intra-industrial commodity exchanges as well as investment cross-haulings of multinational enterprises are an important instrument leading to a better understanding among nations.[12]

The policy implications are evident : an increase in the international division of labour according to the intra-trade scenario does not imply that nations have to negatively compete for high export quotas, rather their international interdependence is highly beneficial for both world and domestic economic development. The international division of labour must not thus be a zero-sum game in which one land wines at the expense of another. It is much more the case that additional international transactions occur within industrial sectors which lead to a more favorable economic development beneficial to all concerned. (Siebert 1986).

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12. Compare further Frey (1984).

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