

INTRA – INDUSTRY TRADE – DO WE REALLY KNOW WHAT IT IS ?

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I analyse controversies around definitions of economic terms on the example of intra-industry trade defined as a simultaneous export and import of goods produced in the same industries. I prove that different streams of exchange are described as intra-industry trade both in international trade theories and in empirical tests as well. In both contexts at least few different definitions of goods similarity and – as a result – different definitions of an industry are used. As a consequence, it is difficult to set up an unique list of factors intensifying (constraining) the intra-industry trade. Such approach results also in general problems with measuring volume of this trade. Consequently, meaningful international comparisons of intra – industry trade's intensity become almost impossible.

Intra – industry trade seems to be not specific enough to be the subject of a scientific discussion. There is a possibility that its participants do not exactly know what they are discussing about. Despite the huge literature available I am not sure whether it is reasonable to work with such a broad term as intra – industry trade. Constraining the definition of intra – industry trade seems to be more promising. The question is, which way should it go.

For the purpose of proving my thesis I shortly analyse chosen models of intra – industry trade. I show how they differ both in utility and production functions. I present also a selection of empirical works on intra – industry trade. Especially, I pay attention to the real data used to replace the model variables. In my opinion, only relatively few empirical works are aimed at testing the intra – industry trade theories. The majority provides tests on models created by the authors themselves. The authors only seldom refer to the existing approaches and do not work with the already defined frameworks. They often use economic terms without taking into consideration the definitions worked out by their predecessors. Nevertheless, I start with defining similarity of goods. This definition is crucial for eliminating incorrectness in aggregation of goods and creating framework for analysis of intra – industry trade.

1. Aggregation problems

Since 60s. of the XX century economists have been analysing simultaneous export and import of similar goods produced in the same industry and define such exchange as intra – industry trade. The existence of this trade, especially in bilateral exchange between countries

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with similar economic structures (e.g. similar relative factor endowments, incomes *per capita* and consumers' behaviour) seemed to contradict the traditional theoretical approach to international trade. Its basic idea is the existence of countries' comparative advantages resulting in exchange of the physically different goods produced in different industries (inter – industry trade). Since then models have been constructed and tested empirically but in my opinion, the work is not finished yet. There are still many controversies around this type of trade.

The first objection against intra – industry trade was formulated as early as in the 70s. Many theorists have seen intra – industry trade as a result of an incorrect aggregation of goods into product groups called “industries” (e.g. Finger, 1975, 581-588; Lipsey, 1976, 313-314). Their main argument was that by aggregating goods into industries different definitions of goods' similarity are applied. And some streams of exchange treated as intra – industry did not fit in with any similarity definition.

Specifically, there are three meanings of the goods' similarity developed (Grubel, Lloyd [1975, 35]):

1. similarity of production process makes goods similar,
2. similarity of assignment makes goods similar,
3. simultaneous similarity both of production process and assignment makes goods similar.

Depending on the similarity definition applied, theorists construct different models of intra – industry exchange and analyse different factors decisive for beneficial trade. As I will show, these definitions fit in with the theories of intra – industry trade quite well (with one exception). However, if applied to statistical data, they sometimes fail.

The product group 3 contains goods, similarity of which is the most comprehensively defined one. However, the trouble with group 3 is that its goods are relatively rare in the real life. Additionally, even this definition can give raise to some questions when applied to the differentiated goods. Especially, a problem arises when we analyse differentiated goods. It is controversial whether a car like *Peugeot* is similar to *Volkswagen*, even if both are produced with relatively similar technologies and production factors. Both are used for similar purposes, but it doesn't mean that consumers view them as perfect substitutes. Different sorts of vodka may be better examples of the nearest substitutes. However many consumers are not indifferent between *Absolut* and *Wyborowa* at all.

The problem becomes even more acute if we consider product groups 1 and 2 as well. The international trade classification SITC (especially in its most aggregated form on the 1 – digit level) seems to be placed somewhere between product groups 1 and 2. It consists of

food, beverages and tobacco but also raw materials, chemicals and manufactures. Even on the higher levels of disaggregation the problem of differences between goods in one group does not disappear¹. E.g. Pomfret [1991, 77] writes about SITC 793 (ships and boats) containing both kayaks and supertankers. This problem arises also by use of other statistical classifications. Bergstrand [1982, 45] reports about US Standard Industrial Classification and its product group SIC 363 containing such household appliances as stoves, freezers and washing machines. These goods are produced with the different techniques and are not close substitutes to each other.

2. Problems with the theoretical framework of intra – industry trade

In fact, many theorists apply in their models the most complete definition of the goods' similarity appealing to the product group 3. E.g. goods traded in the framework of Brander [1981] or Brander, Krugman [1983] are physically identical. Consumer's demand in both trading countries is described with the same linear function. The goods are produced by the local monopolies with identical production functions with intra – firm increasing returns to scale (in fact, Brander and Brander, Krugman do not even describe the production function but only the total cost function with the fixed and the marginal cost components).

Also monopolistic competition in the Krugman's setting (1980) analyses goods from the group 3. The firms within the industry face the same costs. They are operating on the negatively sloped average cost curve (exactly as in Brander and Brander, Krugman the goods are produced with the intra – firm increasing returns to scale). The assignment of the goods is set by the consumers' love of variety (preferences as in Dixit – Stiglitz [1977]). All Krugman's consumers want to have as many varieties as possible. Every variety is also a perfect substitute of any other. The consumers' preferences can be visualised as the utility

$$U = \sum_{i=1}^n v(c_i),$$

function of the representative consumer:

with $v(c_i)$ – utility from consuming $c_i > 0$ units of variety i ($v(c_i) > 0$; $v'(c_i) > 0$; $v''(c_i) < 0$).

In equilibrium (with a given budget constraint) everyone is buying the same amount of every variety.

However, there are many theorists who also treat an exchange of goods from the groups 1 and 2 as intra – industry trade as well (as it was proposed in the 70s. in e.g. Grubel and Lloyd [1975, 35]). E.g. Lancaster's [1980] and Helpman's [1980] models of monopolistic

¹ Grubel and Lloyd (1975, 72) see the 3 – digit SITC statistics as the most closely corresponding with the concept of “an industry” used conventionally in economic analysis.

competition analyse production similarly as the mentioned approaches of Brander [1981] and Krugman [1980]. In this context, goods are similar, because their production technologies are similar. However, their approach to consumers' behaviour differs from the previously mentioned settings. Lancaster as well as Helpman analyses a market with differentiated goods and consumers strongly biased toward one special characteristic of them. Everyone has one ideal variety, which is worth more than any other variety. All consumers' optimal varieties are uniformly distributed among the possible varieties. The utility function can be visualised as:

$$U(x, y, v) = u \left[\frac{x(v)}{h(v)}; y \right],$$

where $h(v) \geq 1$ – compensation function (compensating the consumers, whose ideal variety is not available, for buying the less than optimal one), v – the distance between the available variety and the ideal one (with the increase of the distance varieties become more imperfect substitutes; this is why the bigger distance between the available variety and the ideal one, the higher compensation necessary), x – quantity of the differentiated good consumed, y – quantity of the homogenous product.

From the consumer's point of view the varieties are not necessary close substitutes. How close substitutes they in fact are, it depends upon the distance between the analysed variety and the ideal one. Dobbs [2000, 240] suggests even that in reality, firms are likely to face competition only from their nearest neighbours. So, goods with relatively big differences in characteristics can be seen as products of different industries (Dobbs [2000, 240, Fig. 15.3]). The question is then, to what extent Lancaster's firms belong to the one industry.

As far as the consumer's preferences are concerned, the setting of Eaton and Kierzkowski [1982] is similar to Lancaster's approach [1980]. The consumers observe different characteristics of varieties and strictly prefer one of them. However, Eaton and Kierzkowski do not adopt Lancaster's uniform distribution of consumers among the varieties. On the contrary, they assume that there are only a few types of consumers in the society (in the most popular version of the model, there are two types of consumers). It means, there are only few (e.g. two) ideal varieties. The authors do not explain, why the consumers behave like this, but Greenaway and Milner [1986, 38] see the possible reason in the appearance of the bandwagon effect (known from Leibenstein [1950]). It can result from e.g. tradition or fashion. Every firm in the industry is confronted with the same linear total cost function (intra – firm increasing returns to scale). However, the rules of market entrance are different than by other authors. There are no barriers of entry, but the enterprises are moving in a sequence and not simultaneously. At the beginning there is only one firm in the industry and it chooses its

characteristics produced first. The second one knows what its predecessor has done and decides, whether to enter the market and if yes – what characteristics to produce. As a result, there are not more producers than the ideal varieties. In the case of two ideal varieties, there are at most two firms in the industry. The market is oligopolistic.

Falvey and Kierzkowski (1987) put things in a very different way. They analyse an international exchange of goods differing in quality. They describe quality differences between varieties using as its proxy different proportions of production factors employed. The quantity of capital is a quality index: the higher the amount of capital, the higher the quality of goods. The technology of Falvey and Kierzkowski allows for production of different quality goods with a different capital amount. Specifically, their average cost function (AC) is described as follows:

$$AC_i(\rho) = w_i + \rho \cdot r_i,$$

with i – country in which a differentiated good is produced, w_i – wage rate in country i (Falvey and Kierzkowski assume that only one unit labour is used per one unit of product, regardless of its quality), r_i – capital rate in country i , ρ - amount of capital used in production of the chosen variety (quality index).

In the Falvey and Kierzkowski setting, the unit cost increases with the quality of the variety produced. Because the producers treat this market as perfectly competitive, their average cost equates the price of the good. Consequently, the price of the differentiated good is increasing with its quality.

The consumers have identical preferences. The most desirable for all of them is a variety with the highest quality. They have different incomes. This explains why only the richest can afford the highest quality. Other consumers buy the variety with the highest financially available quality (the one that has the highest acceptable level of price).

International exchange of goods in the Falvey – Kierzkowski setting is based on the Heckscher – Ohlin theory. The labour abundant countries produce and export the labour – intensive, low – quality varieties and the capital abundant countries export capital – intensive (high – quality) varieties. If in both countries there are consumers with different incomes, the countries can trade their own varieties for these produced by the partner. However, Falvey [1981, 496] defines an industry as a group of goods produced with the same amount of immobile capital (in this context exactly as in the cited Falvey's and Kierzkowski's model also mobile labour is used). Looking at the exchange of goods differing in quality, he would see this rather as inter – and not intra – industry trade.

Gabszewicz, Shaked, Sutton and Thisse [1981] present similar characteristics of demand as Falvey and Kierzkowski do. In their models, the characteristics of technology are not important for occurrence of intra – industry trade. In the simplest version, technology is fully neglected: the authors assume that the total cost of production is equal to zero. In their other settings, there are either non – zero fixed costs increasing with the quality of goods or the non – zero fixed costs increasing with the quality of goods and non – zero variable costs, the same for every quality. The non- – zero fixed costs make up a quality index because they represent expenditures on research and development necessary for achieving the desired quality. Also in these settings all consumers want to have the highest quality, but because of different incomes only the richest can afford it. The intra – industry trade appears if there are different income groups in both countries and varieties with different quality are produced in every country.

From this short presentation we can conclude, that the demand and the supply conditions are different in the above – cited theoretical models. Consequently, there are different reasons for intra – industry trade and different conditions for its intensification. E.g. reasons for intra – industry trade can be the strategic reactions to competitor's behaviour (Brander; Brander, Krugman) as well as the existence of consumer's love for variety combined with intra – firm increasing returns to scale (Krugman). Testing these theoretical models alone can bring different results as far as characteristics of the trade streams and the participants of such exchange are concerned. However, all these trade streams have a joint name: intra – industry trade. But this is not the end of the story about the theories of intra – industry trade. There is one more theoretical way to analyse this phenomenon. It differs from the others so much that it is reasonable to discuss it separately. The hero of this story is a production fragmentation.

3. Production fragmentation and intra – industry trade

The next problem of definition and measurement of intra – industry trade arises if we look at the internationally fragmented production with intermediaries and final goods produced in the same industry. This kind of production is often connected with different forms of outward processing and inter – firms co – operation. It can be observed in the activities of vertical multinational enterprises. It results in international trade with intermediaries (e.g. on different levels of manufacturing) and final goods originating in the same production process. Seeing intermediaries as imperfect final goods or as low – quality goods we can treat such an exchange as intra – industry trade. Seeing an exchange of differentiated goods produced in adjacent or complementary production stages as intra –

industry trade was suggested already in Grubel, Lloyd [1975] (see also Hummels, Rapoport, Yi [1998, 80]). Tharakan [1983b, 16] gives a practical example of such trade.

The connection of international production fragmentation with the intra – industry trade has been analysed since the early 80s. of the XX century. This field still is not as deeply explored as the others aimed at explaining intra – industry trade, though with increasing internationalisation of production and expansion of multinational enterprises its importance cannot be neglected. Burda and Dluhosh [2000, 2] state that international trade with final goods is crowded out by an exchange of different types of intermediaries.

The most theoretical models of production fragmentation agree as far as the basic reasons of this process are concerned (see Dixit, Grossman [1981]; Kol, Rayment [1989]; Jones, Kierzkowski [1990, 2001]. The production is aimed at use of comparative advantages present in different locations for minimisation of the total cost. The intermediaries at different levels of manufacturing can have different characteristics. Some of them are e.g. labour whereas the others capital – intensive. It is reasonable, that they are produced in different locations in different countries. As a result, they can be (even many times) exported and imported to/from the same country (or even to the different plants of the same multinational firm - then we do have intra – firm trade).

The problem is, whether goods exchanged because of the production fragmentation fit in with any similarity definition cited above. Sometimes they do not. One specific part o a car even if it is produced within the car industry can be produced with a different technology than the whole car. And clearly, the first one is not a perfect substitute of the last one. As a consequence, even if during the production process the intermediate goods do not leave one industry it may be not appropriate to define such streams of trade as intra – industry. On the other hand, this type of trade is important, especially in the North – South economic relations. Will resigning on this type of trade reduce importance of all remaining streams to a marginal phenomenon?

4. Intra – industry trade and empirical works

Let us look now at the empirical works. In my opinion, there are many problems with them. Firstly, it is difficult to translate the theoretical models into the available empirical data. The authors have to find appropriate proxies substituting variables. Often it is controversial whether the chosen proxies are appropriate. On the other hand there are many data used in the researches, which are differently interpreted. E.g. values of GDP and GDP *per capita* are applied differently. Their increase is particularly overinterpreted. Increasing GDP *per capita* is used as proxy for increasing propensity to consume horizontally differentiated products (in

context of Krugman's love for variety and Lancaster's love for characteristics). Such correlation is proved in e.g. Loertscher and Wolter [1980] and Bergstrand [1990, 1221]. On the other hand, higher GDP *per capita* indicates to higher capital/labour ratio in the national factor endowment (so, increasing GDP *per capita* means an increase of K/L – ratio). Bergstrand [1990, 1221] supports this correlation, but the result is less obvious in the economy with many production factors and presence of non- – tradable goods (as show Hummels, Levinsohn [1993, 12]). Additionally, an increase in differences in GDP *per capita* can be a proof for international differences in the level of development (for the U.S. trade supported in Durkin, Krygier [1998, 293]). So, in the last example, the high GDP *per capita* is interpreted (indirectly) as a high level of development. These correlations are proofs for – at least partly – very different things ranging from consumers' behaviour to proportions of factor endowments and general level of development. As Bergstrand [1990, 1223] states, the differentiated product does not need to be capital – intensive (and the homogenous one – labour – intensive). What matters is consumers' propensity to buy a good. As the differentiated goods are more luxury goods than the homogenous ones, an increase in GDP *per capita* is accompanied by an increase in the share of differentiated goods in overall expenditures.

On the other hand, many tests are not based on any theoretical settings and are rather mixtures of many approaches (eclectic approach). So, in my opinion, the empirical fund does not ease controversies arising from different theoretical settings but it does the opposite – it strengthens them!

4. Conclusions

I am aware that economic models simplify the complicated reality and for sake of explaining one aspect they have to omit many others. But I think that the primary goal of a scientist is to explain and not to confuse. Analysing the huge literature about intra – industry trade I am not sure, whether this is true for the research made in this field. Envisaging such difficulties, it may be reasonable to resign from such a broad term as the intra – industry trade and to reserve this name for a more specific trade or to substitute it with some other. Or maybe, the broad term intra – industry trade should stay, but it should be complemented with more specific terms used then for empirical research. In fact, this is already happening. Much work is done for separating horizontal and vertical intra – industry trade. The first one is defined as an exchange of similar goods from one industry differing in other than quality characteristics important for consumers (e.g. colour). The second one is an exchange of similar goods from one industry differing in quality (see Abd – el – Rahman [1991], Greenaway, Hine, Milner

[1994a, 95]). Of course, the separation of horizontal and vertical intra – industry trade does not solve all problems. To the contrary, maybe it creates some new ones. For example, it is controversial whether, the colour is not a quality characteristic (think about e.g. wine or cognac). In how far simple price differences signal the sort of product differentiation and not e.g. price policy of the firms (e.g. price discrimination in foreign markets, transfer prices in the multinational enterprises)? But, this is an interesting way to go. Fontagné and Freudenberg [2002, 131] state that horizontal and vertical intra – industry trade have different determinants and consequences. Is it not sufficient condition for separating them?

Another possibility is to disaggregate goods deeper for eliminating arbitrary aggregation of essentially different industries. However, the maximising the level of disaggregation is expensive and probably ineffective. At higher level of disaggregation many trade streams would disappear, as the international trade statistics don't report them below some minimum level (it happens especially in case of small countries)).

Also introducing of new statistical systems is important (e.g. SITC Revision 2 with many components classified as separate product groups; for analysis of this data source see Yeats (2001).

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