Chapter II

On the Measurement of Intra-Industry Trade

- Introduction
- Theories of Specialization
- Methodology for Measurement
- Determinants of Specialization and Trade
- The Basic Model of Intra-Industry Trade
- The Effect of Trade
- Inter-Industry Trade and Intra-Industry Trade
- Inter-Industry Trade Specialization Indices

Chapter II

On the Measurement of Intra-Industry Trade

2. 1: Introduction

The Phenomenon of intra-industry trade is a prime example of a widely known and accepted empirical regularity in the search for a satisfactory theoretical foundation for many years. For a long time the empirical researchers were therefore clearly ahead of the theoretical researchers. For our purposes, a relevant question peeps into our mind: what is intra-industry trade? It refers to the fact that many countries simultaneously export and import very similar goods and services; intra- industry trade is therefore trade within the same industry or sector. Germany, for example, exports cars to France and simultaneously imports cars from France as well. Why does Germany do this? This question is related with the aspects of a nations demand structure, as well as its supply structure.

The intra- industry trade phenomenon was first noted empirically when a group of European countries formed the European common market(1994) which has now grown into the European Union and currently consists of 25 countries. It was soon realized that intra-industry trade is a general characteristic of international trade flows. Path-breaking empirical research in measuring the size and importance of intra-industry trade was performed by Pietor Verdoorn (1960), Bela Balassa (1966), and Herbert Grubel and Peter Lloyd (1975).

The theories of comparative advantage developed until then, based on Ricardian technology differences or Heckscher-Ohlin factor abundance, cannot explain this type of trade. Both types of models assume that firms in the industry produce identical goods, such that consumers do not distinguish between the goods produced by different firms.

As the costs of trade fall, specialisation becomes more profitable, both inter, and intra-industry trade should increase. Further more, reductions in trade costs due to improvements in communication technology have also led to increase in trade in services such as consultancy advice or financial services often delivered through the internet.

Trade specialization evolves considerably over time thus bringing about different kinds of economic development across countries as well as across region within countries. There are three main stands of literature concerning trade specialization: neo-classical trade theory, new trade theory and new geography theory. Neo-classical trade

theory explains patterns of regional specialization on the basis of comparative advantage resulting from differences in productivity (technology) (Ricardo, 1817) or endowments (Heckscher, 1919-Ohlin, 1933) between countries and regions. The basic characteristics of these models are perfect competition, constant return to scale and homogenous goods. The neoclassical theory envisages that, as factors of production and consumers are scattered across regions, the structure of industrial production will be dispersed geographically. Each region will specialise in the production in which it has a comparative advantage, and in this way, inter-industry specialization is stimulated. Inter-industry trade refers to the simultaneous exchange of goods of different varieties or categories.

During the 1980s, new trade theory models were developed to explain high level of intra-industry trade (IIT) and the large proportion of world trade between very similar countries (Amiti, 1998). IIT is defined as the simultaneous export and import of products, which belong to the same sector (Vollrath, 1991). Intra-industry trade (IIT) is also dubbed "two-way trade". IIT is prevalent in regions and industries where increasing returns to scale in production, monopolistic competition and product differentiation play an important role, although endowments do not differ significantly between them (Erkkila, 1996). The new trade models postulates that increasing returns to scale and trade costs will induce activities to locate in regions with good market access "the Core" away from remote areas "the Periphery". This will translate inter- industry trade across companies, which will concentrate in the production of a unique differentiated product. These two driving forces will continue until all increasing-returns activities are concentrated near the core of the market, thereby, showing that intra-industry trade between the core and the periphery vanishes (Briilhart, 1998). Although, geographical advantage plays a role in the new trade theory, it is however considered an exogenous, as if it was determined by physical rather then economic characteristics.

The new economic geography models indicate instead, that a geographical advantage is endogenous and regional specialization is the result of the spatial pattern of agglomeration of economic activities (Krugman, 1991). Firms locate in an economic centre, which can be considered as it only because other firms locate there. This means that there is a commutative causation process according to which the accesses of new firms in a location make it a more altercative site to additional firms. The cumulative causation process is based on technological externalities (learning by doing and

knowledge spillovers and pecuniary externalities between firms. As long as externalities are localised, also, production is geographically concentrated, and the logic of increasing returns to scale implies that once pattern of industrialization has been established, it will persist over time.

2. 2: Theories of Specialization

Theories of trade specialization can be divided into two schools: neo-classical theory and new trade theory. While the neo-classical theory assumes perfect competitive markets and constant returns to scale, the new trade theory is based on imperfect competition and economies of scale. Now we will discuss the current state of the theories and show the differences between these schools.

Neo- Classical theory or Comparative Advantage approach

The new-classical theory considers location and trade as a function of exogenous characteristics of regions and counties. The underlying characteristics, such as geography, endowments and technology, make space itself uneven (Ottaviano and Puga, 1988). If regions did not present different characteristics, economic activities would spread out evenly in space. If factors of production are assumed internationally immobile and spillovers are absent in the production, and then initial factors endowments and technology differences determine the specialization patterns of the region.

The standard model of comparative advantage considers two counties, two goods and two sectors the labour intensive sector and capital-intensive sector. As factors of production and consumers are scattered across regions, the structure of industrial production will be dispersed geographically. Each region will specialize in the production in which it has a comparative advantage, and in this way inter-industry trade is stimulated Inter-Industry Trade indicates therefore the specialization of regions in different economic activities according to their diverse endowments.

The comparative advantage approach cannot, explain the changing pattern of international trade and location. Growing parts of EU trade concerns similar product within the same industries endowments are very similar which the factors of production are mobile. (Vanables, 1998).

New trade theory

The new trade theory was developed to explain high level of intra-industry trade and large proportion of world trade between similar countries (Amiti, 1998). The new trade theory is characterized by scale economies and imperfectly competitive markets.

Consumer preferences for a large variety of products, increasing returns and pecuniary externalities lead firms to specialize in the production of differentiated goods of the same industry.

A dominant element for the theory is the market size. The existence to scale economics encourages firms to concentrate their production in one country and the presence of trade costs stimulates firms to choose the country that has the largest market for their goods (Amiti, 1988). A country with an unusually high demand for a good becomes an excellent site to locate production, and thus an exporter of that particular good.

Resources and factors of production are mobile between regions and sectors within a country but immobile across nations. This implies two specific developments in the specialization of regions. Firstly, scale economies and trade costs lead firms and workers to locate in few places close to large markets, this will translate in inter-industry specialization between the core regions. Secondly, scale economics will lead intra-industry trade across companies, which will concentrate in the production of a unique differentiated product. These two driving forces will continue until all increasing returns activities are concentrated near the core of the market, thereby, showing that intra-industry trade between the core and the periphery vanishes (Briilhart, 1998).

The new trade theory can explain the formation of cities in the persistence of the one- Periphery pattern. Krugman and Venables (1990) study the importance of imperfect competition for location and conclude that the core has more imperfectly competitive firms than the periphery and that the core's share of world industry is larger than its share of world endowments.

2. 3: Methodology for Measurement

The present study for measuring such trade in regarding the choice of an index for calculation and the choice about the level of aggregation/desegregation at which the volume of intra-industry trade is to be measured. As many indices have proliferated since identification and theorizing of IIT. We have chosen the Grubel-Lloyd uncorrected index of the purpose of actual measurement. The major reasons for such a choice are: (i) the index adequately captures the true essence of intra-industry trade (as the residual component of net exports or imports) with minimum mathematical complexity. (ii) the value of such an index is easy to be interpreted. By manipulating the right hand side of the index we get its value as twice the smaller item amongst export and import divided by

the total trade volume; which means that it is the net contribution of the industry to current account equilibrium (credit as well as debit) a equivalently the degree of self sufficiency of particular industry in international market.

The formula that has been used in the Grubel-Lloyd index (1973) is given by

$$GL(U) = 1 - \frac{\sum_{i=1}^{n} |X_i - M_i|}{\sum_{i=1}^{n} (x_i + M_i)}$$

Where X_i = exports (in value terms) of product group *i*.

M_i = imports (in value terms) of product group *i*.

The above equation gives the aggregate index overall commodities, i = 1, 2, 3.....n. The value of GL (U) ranges from O to if there is no IIT (i.e. one of X_i or M_i is zero) GL (U) takes a value of zero. If all trade is IIT (i.e. $X_i = M_i$), GL (U) takes a value of 1.

Grubel and Lloyd (1975) proposed the following weighted index to arrive at an overall measure of IIT

$$\text{GL (U)} = \frac{\sum_{1=1}^{n} |X_i + M_i| - |X_i - M_i|}{\sum_{1=1}^{n} |X_i + M_i|}$$

2. 4: Determinants of Specialization and Trade

This section describes some specific factors of the level of intra-industry trade.

(i) Country size

The relation between country size and the level of IIT comes from the assumption that larger countries produce a wider range of goods than smaller countries. Suppose the world has only two countries, one of which produces two third of all the different types of goods, and the other produces one third. If preferences are the same across the countries, and people describe all goods equally, then the residents of the larger country will spend one third of their income on imported goods, while there is the smaller country will spend two thirds of their income on imports. The larger country can provide a wider range of goods from domestic production than the smaller one. Through the above example is clearly stylized, the result persists in quite a wide class of theoretical framework. On a global level, supports the argument that world trade should increase as country size becomes more equal for a fixed number of countries (Helpman, 1984). As a proxy for country size this analysis uses the IMF and World Economic Outlook measures of a

country's world output share. These trend to be slow moving; the largest change between 1970 and 2000 has been a 1.8 Percentage point fall in the German share of world output.

(ii) Differing income distributions in countries

Levels of income per head might have a role in explaining trade, as suggested by Linder (1961). He observed that consumers with similar levels of income per head tend to consume similar bundles of goods. Even if consumer's preference for variety is same at different levels of income, budget constraints have an effect on consumption bundles. When income levels are low, consumers concentrate their spending on necessities, such as staple foods and basic clothing. In these sectors, it is not possible for firms to create differentiated products, so there is little scope for intra-industry trade. As income level rises, spending patterns shift towards manufacturing products. These tend to have more sophisticated production processes that allow for product differentiation and many prompt intra-industry trades. Higher incomes, however, also lead to higher expenditure on services, for example eating out restaurants, which tend to be less traded. This shift could have an offsetting effect as income rises.

(iii) Product differentiation

Many varieties of a product exit because producers attempt to distinguish their products in the minds of consumers in order to achieve brand loyalty or because consumers themselves want a broad range of characteristics in a product from which to choose. Thus, U.S. firms may produce large automobiles and non-U.S. producers may produce smaller automobiles. The consequence is that some foreign buyers preferring a large car may purchase U.S. product while some U.S. consumers may purchase a smaller, imported car. Because consumer tastes differ in innumerable ways, more so than the verities of products manufactured by any given country, some intra-industry trade emerges because of differentiation.

(iv) Degree of product aggregation

This explanation rests on the observation that IIT can result merely because of the way of trade data are recorded and analysed. If the category is broad (such as beverage and Tobacco), there will be greater intra-industry trade, than would be the case of a narrower category is examined (such as beverage alone or, even more narrowly, wine of fresh grapes). Suppose a country is exporting beverages and importing tobacco. The broad category of "beverage and tobacco" [a category in the widely used standard International Trade Classification (SITC) system of the United Nations] would show IIT,

but the narrower categories of "beverage" and "tobacco" would not. Some economists think that finding IIT in the real world may be mainly a statistical artifact because of the degree of aggregation used, even through actual calculations use less broad categories than "beverage" and "tobacco". Nevertheless, many trade analysts judge that IIT exists as an economic characteristic of trade and not primarily as a result of using aggregative classification categories.

(v) Dynamic economies of scale

This determinant is related to the product differentiation reason. If IIT has been established in two versions of a product, each producing firm (one in the home country, one in the foreign country) may experience "learning by doing" or what has been called dynamic economies of scale. This means that per unit cost reductions occur because of experience in producing a particular good. Due to these cost reductions, sales of each version of the product may increase over time since one version was an export and the other an import for each country, intra- industry trade is enhanced over time because of this production experience.

(vi) Cost of trade

There are many different ways in which international trade might incur costs over and above those incurred by domestic trade. Such costs included; transport costs and communication costs, imposed tariffs and non- tariff barriers, search costs, the cost of building and maintaining a network of customers, currency exchanges and exchange rate risk. Some of these frictional costs may have fallen over the past 20 years. Transport costs and communication costs may have fallen as technology improves. Tariffs and non-tariff barriers to trade have fallen through successive multilateral and bilateral trade agreements and might continue to do so as part of total agreements such as 'Uruguay Round'. Capital market liberalization may also have reduced the cost of foreign currency transactions and have created by ability to hedge against exchange rate risk.

2. 5: The Basic Model of Intra-Industry Trade

The new trade theory has two main theoretical approaches in modeling and explaining the flows of intra-industry trade. The first is based on trade in differentiated goods in which the market structure is characterized by monopolistic competition with costless entry and the source of comparative advantage is given by exploitation by firms of internal increasing returns to scale. The second type, are models of oligopolistic competition and intra-industry trade in identical products. Trade is driven by firm's entry

strategies in foreign markets. Markets are segmented by the existence of transportation costs. The possibilities for firms of making extra- profits by discriminating prices cure them to sell abroad f.o.b. prices. The dumping practice is the main source for intra - industry trade.

This section describes Krugman's (1979, 1980, 1987) model of intra-industry trade based on increasing returns and monopolistic competition. This model provides a straight way of thinking about the relation between innovation and export specialization in manufactures. This set up follows a general equilibrium framework tat it is described in two steps. The first derives the equilibrium for a closed economy. The second analyses the impact of trade. To highlight the role of technical change in the model, Hicks-neutral technology index was added to the production function.

Close economy equilibrium

On the demand side, the model assumes that consumer preferences for varieties or differentiated goods enter, symmetrically, into the utility function. This ensures a positive consumption for all available varieties. Consumer's maximization problem is given by

$$\text{Max U} = \sum_{i=i} v(c_i) \text{ Subject to } \sum_{i} P_i c_i = 1 \text{.....(1)}$$

$$\text{Where } v' > 0,\ v'' < 0;\ \in_i = -\frac{v^{v'}}{v'' c_i}$$

P_i = Price variety i; c_i = Per-capita consumption of variety i, $v(c_i)$ = indirect utility function.

Because of the additive separable specification of U (c); the elasticity of substitution is equivalent to the demand elasticity that each monopolist faces. In addition, $\in$ is assumed decreasing function of c_i that is assumed a decreasing function of c_i, that is, $\delta\in/\delta c_i < 0$. The first order conditions for the maximum problem (1) have the form

$$P_{i=\lambda}^{-1} v'(c_i) \text{.....(2)}$$

On the supply side, the model assumes that a linear technology with labour as only input, competitive labour market and full employment.

Let $x_i = \beta^{-1}$ [A(t) I_i - α] be the production function of variety x_i.....(3)

Where A (t) = Hicks-neutral technology index, α = sunk R&D costs and β = Permanent associated to marginal cost. Solving l_i gives the amount of labour effectively demand in the production of x_i, it follows that firm *i's* average cost function $C(w,x)/x_i$ is –

$$AVC_i = c/x_i = w.\left\{\frac{\beta}{A(t)} + \frac{\alpha}{A(t).x_i}\right\} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where w = wage rate. Thus, average costs are decreasing in output keeping everything else fixed, and it trends asymptotically to a constant marginal cost to $w_i\beta/A(t)$. Further, changes in technology and increases in the scale of operations give the sources of change of the average cost function, that is

$$\frac{d(AVC_i)}{AVC_i} = \frac{dA}{A} - \phi.\frac{dx_i}{x_i} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

$$\text{Where } \phi = \frac{\alpha.w}{A(t)I_i}$$

The first term of the R.H.S of (5) is the rate of cost diminishing and depicts a downward shift. The second is an induced effect and represents a downward movement along the AVC curves. The source of increasing returns bears on the fixed cost parameters α.

The monopolist's pricing rule with costless entry sets the firm's optimal prices and output. In that sense, final prices are second best prices, enough to cover all fixed costs. It follows that firm's profit maximizing prices, given the technology in equation (3) is equal to

$$P\,(1+1/\in) = w.\,[\beta/A\,(t)] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

The above condition states for the equality between monopolist's marginal revenues and costs.

Solving P in equation (6) and dividing by w yields

$$\frac{P^m}{w} = (\in / \in -1).\beta / A(t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

The firm's optimal price cannot be determined from equation (7) because the elasticity of demand, by assumption in the model, decreases with output. Optimal output will consequently depends on the Zero Profit condition, in particular

$$P.\,x_i - w.\,I_i = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Replacing I_i and solving x_i yields

$$x_i^m = \alpha\,[\,A(t)\,(P/m) - \beta\,]^{-1}$$

Or

$$\frac{P}{w} = \frac{1}{A(t)}\left[\alpha / x_i + \beta\right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

The profit maximizing price schedule (7) along with the Zero profit condition (9) determine the equilibrium for a closed economy. These equations have two important features. First, equation (7) is upward sloped because $\in$ is a decreasing function, by assumption, of the number of varieties. Equation (9) by turn is downward sloped with x_i. The above implies a cross point between the two functions and the existence of an equilibrium. Second, both functions will shift downward if there is a technical change dA/A, which implies lower equilibrium prices *p/w*.

It remains to figure out what is the equilibrium number of firms. Under monopolistic competition there is a unique producer for each variety, Therefore the number of firms are equal to the current number of varieties (if a monopolist produces two or more varieties and the technology is separable, then each production line can be treated as an independent firm). Full employment assumption implies that the labour supply is equal to the demand for labour engaged in the production of all goods, that is

$$L = \sum_{i=1}^{n} I_i \text{.....(10)}$$

Subtracting *Ii* form equation (3) and setting $x = x_i$, for every *i*, yields

$$\eta = \frac{A(t).L}{a.\in} \text{.....(11)}$$

Thus, the equilibrium number of firms or varieties is an increasing function of changes in technology *A(t),* but is decreasing to sunk costs of reach X. The preceding affects summaries the dynamics in the case of a closed economy when technical change is included as structural parameter in the model. Given a market size, technological improvements are welfare enhancing, through lower producer prices and expanded number of varieties, if there are increasing returns in research. Otherwise, the return to research will decrease and firms will not engage in new R & D Projects. Finally, the number of varieties will expand with factor accumulation *dL/L.*

2 .6: The Effect of Trade

A natural extension of this analytical framework is to analyse the effects of trade. In this case, the model assumes symmetric conditions in technology and consumer preferences for the foreign economy, and no transportation costs. Then real wages *w/p*, are the same as before trade. Krugman's model tries to determine whether there are gains from trade under the above conditions. To answer this question it is useful to introduce the national income identity. In particular, economy's national income comes from labour

earnings and will be equal to aggregate output, that is $w.L = P.x$. In per capita terms, this equality becomes $w/p = x/L'$. Total per capita consumption according to equation (1) is equal to aggregate income, it follows that

$$x_i = L.\ c_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

That is, the supply of each variety must be equal to it is per – capita consumption times the labour force.

When two economies with the above features engage in trade, they form an integrated economy with an expanded labour force equal *to* $\overline{L} = L+L^*$ where L^* counts for the labour forces of the foreign country. Similarly, the number of varieties would be given by $n = n+\overline{n}^*$. Firms in turn will face an expanded market and will have the incentive to increase their current scale of operations because there is a demand for all varieties at home and abroad, allowing those to exploit further scale economies. Thus, trade has the same effects as factor accumulation through increases in the labour force. According to equations (9), (11) and (12), trade has three positive effects – (i) increase the production of each variety x_i (ii) lowers the equilibrium prices and (iii) expands the range of varieties. Hence, there is a welfare improvement for both economies due to an increase in choice and higher real wages *(w/p)*.

On the other hand, the model predicts that trade is balanced but its direction – which goods are produced in each economy – is not determined. The number of varieties produced in each economy will depend on the size of labour force.

$$\eta = \frac{A(t).L}{\alpha.\in} \quad \text{And} \quad \eta^* = \frac{A(t).L^*}{\alpha.\in} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

And imports are a constant function of national income

$$M = w.L.\ (L^*/L + L^*)\ and\ M^* = w.L.\ (L/L + L^*)$$

$$\rightarrow M = M^* \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

Where M^* represents foreigner's imports that are equal to home's exports. This completes the characterization for the open economy equilibrium. In sum, increasing returns drives trade.

The next task is to establish the linkage between technical change and intra – industry trade specialization. The key variable for that linkage is the trade of return to research. Let r denotes the rate of return of R&D investments and x - R & D sunk costs become an increasing function of r. Taking the total differential of equation (13), keeping constant the size of labour force L and L^*, yields.

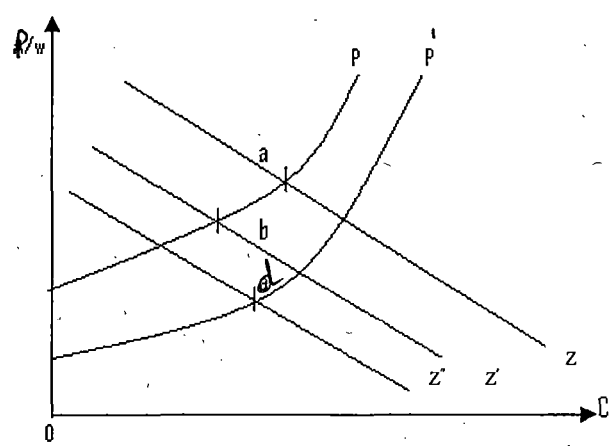
$$\frac{d\eta}{\eta} = \frac{d\eta^*}{\eta} = \frac{dA}{A} - \Phi.\frac{dr}{r} + \sum_{i=1} \lambda_i . \frac{dc_i}{c_i} \text{.....(15)}$$

$$\text{Where } \phi = \frac{\alpha'(r).r}{\alpha(r)}; r_i = \frac{\in'(c_i).c_i}{\in(c_i)}$$

But from equation (12) given L is fixed, it follows *that* $d\,x_i/x_i = dc_i/c_i$.

Equation (15) shows that improvements in technology, the return of innovation and the growth in per capita consumption are the sources of change of the equilibrium number of varieties after trade. When firms face an expanded market due to trade, the rate of return r increases because sales and firm's net cash flow has expanded. This induces firms to undertake new investments industrial designs and research. This process, which takes place across firms, will lead to new cost reducing technologies and the production of new designs. With lower marginal and average costs, producers' price fall, raising real wages and per capita consumption. This, trade under this setting reinforces productivity changes through the expansion of markets.

The above analysis is illustrated in the figure, which draws relative producer price *P/w* against per capita consumption C, of a representative good. Point a, depicts the autarky equilibrium. Trade shifts the zero-profit schedule downwards, because of the expansions in the labour force L. The equilibrium after trade is given by b, at lower point *P/w* and C, because new varieties have already entered in consumer's demand. If technical changes take place due to increase in R& D investments and higher return for research, the new equilibrium is d, at the lower real prices.



2. 7: Inter-Industry Trade and Intra-Industry Trade

Liberalization of trade creates changes in trade flows and specialization. Depending on the characteristics, the trade is classified as both inter-industry trade and intra-industry trade.

Inter-industry trade

Inter-industry trade can be understood as exchanging one type of good, produced in one industry for another type of good, produced in another industry, for example exchanging rice and cars. Evidently, some countries have better opportunities to produce rice while others have endowments suitable for the production of cars; this is essentially the base for the theory of comparative advantage.

The basic Ricardian model lies as ground for the more sophisticated Hecksher-Ohlin model. These theories focus on the supply side of the model and are based on theories of comparative advantage. Comparative advantages arise since countries have relatively different endowments of factors of production, for example capital and labours. According to Ricardian model, countries will specialize in production of the good that the lowest opportunity cost, caused by different production methods and different labour productivity.

The Hickscher-Ohlin model expands the theory and explains how trade emerges when factors productivity is equal across the world. The specialization of production will depend on a country's relative factor endowments and thereby relative price of factors of production. A labour rich country will produce the labour-intensive product and this specialization will continue until the incentive to trade is taken away, i.e. factor prices are equalized. Theories based on comparative advantage state that the greater the difference in factors endowments between two countries the greater the trade.

Intra- industry trade

The characterization of Intra- industry trade is simultaneous import and exports essentially the same kind of good. The most frequent intra – industry trade take places in the developed part of the world, between countries that have a similar economic and social structure. What lies behind the behaviour of importing and exporting the same kind of good are numerous things, but in the end it is the assumption of the consumer's love for variety that creates the demand for till another variety of the same kind of good. There are several gains from intra-industry trade. A price are pressed down by increased

competition in trade and as the market grows, there are expected gains from increasing returns to scale, which lowers the average production cost.

The supply of more varieties through imports satisfies the consumers that get a higher utility and to a lower price. Furthermore, according to theory, consumers that get a higher utility and to a lower price. Further, more, according to theory, intra-industry trade creates less distortion than inter-industry trade in an economy in the process of integration. The logic behind this is that one expects more flexibility within industries between industries, hence smaller adjustment costs are exhibited in industries with a large share of intra-industry trade.

The basic models of intra-industry trade refer to factors such as the existence of economies of scale and the production of differentiated goods. Assuming that the world consists of several smaller nations, producers can specialize in one variety each and because of economies of scale attain some monopoly power. The assumption of market structure of monopolistic competition makes producers of differentiated commodities perceive that they neither can affect the price level when they enter the market, nor the variety choice. Whereas the homogenous commodities are assumed to be produced in markets characterized by perfect competition. As consequences, the producers of differentiated commodities are assumed to produce in markets characterized by perfect competition. As consequences, the producers of differentiated commodities set their price to maximize profits and they all end up producing a different variety of the products. Since consumers have a love for varieties and all varieties will be consumed, intra-industry trade will take place when there are no trade restrictions.

Theory of intra-industry trade offers hypotheses on both country specific factors and industry specific factors. The empyreal assessment is undertaken to evaluate the relationship between the extent of intra-industry trade and industry specific factors as well as country specific factors. The hypotheses are presented below:

1. Intra-industry trade is expected to be higher in industries with higher degree of economies of scale and product differentiation. [Helpman, Elhanan and Krugman, Paul R. (1999) P. 168]. To meet consumer's demand for great variety, the producers take advantage of economies of scale in production and are able to specialize in production of a specific variety, which is then traded for other differentiated commodities. Hence, more differentiated products that are produced with economies of scale will increases the level of intra-industry Trade.

2. The degree of intra-industry trade is expected to be higher in trade between economies with high per capita income and between economies with greater similarities in per capita income. [Hine, Robert C. and Greenaway, David & Milner, Chris (1999). P. 83]. Differentiated commodities are assumed more capital intensive in production than homogenous commodities. An increase in income per capita and thus also in capital endowments yields an increase in the production of differentiated commodities and as a consequence also intra-industry trade. Further economies that are more similar are expected to have similar intra-industry specialization indices.
3. The degree of intra-industry trade is expected to be higher in trade between larger economies and the more similar the economies are in size. [Helpman, Elhanan and Krugman, Paul R. (1999) P. 2005]. Producers in large economies have a bigger market for products produced with increasing returns to scale. Thus, more differentiated products will be exported which will increase the extent of intra-industry trade. Furthermore, countries of similar size have the potential to export and import differentiated commodities produced with economies of scale. With different size of the economies, a larger economy can take advantage of economies of scale and export large amounts of a commodity and a smaller country would be forced to import differentiated commodities since they cannot benefit from economies of scale in their production.

4. Open economies are expected to have higher degree of intra-industry trade than closed economies. [Helpman, Elhanan and Krugman Paul R. (1999) P. 19]. This is especially important for smaller economies since larger economies may exhibit economies of scale even in autarky. However, if a small economy is closed, subsistence production accounts for a large share of total production and the development of the economy and higher share of production in capital-intensive commodities.

5. The intra-industry trade is expected to grow faster within the integration area than with world. [Langhammer, Rolf J. and Hiemenz, Ulrich (1998) P. 419]. Because of the abolishment of trade barriers creation will increase trade flows. Additionally, since producers are able to take advantage of economies of scale and produce more differentiated products within the integration area, the overall trade volume is

expected to increase more in the integration area than in trade with the world. Since intra-industry trade take places within these products, an increase in trade flows within the integration area will enhance even higher growth in intra-industry trade.

2.8: Inter-Industry Trade Specialisation Indices

The economic literature identifies about six techniques to measure the inter-industry specialisation.

Balassa index

Balassa (1965) explored the possibility of relying on various theoretical explanations of international trade to determine the patterns of comparative advantage. He stated that, "Comparative Advantages" appear to be the outcome of a number of factors, some measurable, other not, some easily pinned down, and other less so. One wonders, therefore, whether more could not be gained if, instead of enunciating general principles and trying to apply these to explain actual trade flows, one took the observed patterns of trade as a point of departure.... Blassa suggested to consider the comparative advantages as they "are revealed" by international trade because actual exchange "reflects relative cost as well as difference in non- price factors". He proposed a specialization indicator also known as the Balassa index

$$Byi = 100\left(\frac{x_{yi}}{\sum_{y=1}^{N} x_{yi}}\right) / \left(\frac{\sum_{t=1}^{M} x_{yi}}{\sum_{y=1}^{N}\sum_{i=1}^{M} x_{yi}}\right)$$

Where B_{yi} stands for country i's export of commodity y. The Balassa index has a lower bound of zero and no upper bound. A country, that is more specialized in some industry than the average of all countries taken together, presents an index value greater than 100 for this industry, whereas a value smaller than 100 reveals specialization compared to the average of all countries. In other terms value greater than 100 reveal the presence of comparative advantages. The standard deviation of this index across products can be used as measures of the comparative importance of inter – industry specialization and intra-industry trade. In fact, the greater the extent of inter-industry specialization, the greater is the value of standard deviation.

Many researchers have used the Balassa index to determine a country's weak and strong sectors. Michael Porter, for instance, adopted a Balassa index exceeding 1, in some cases strengthened to a Balasa index exceeding 2, to identify a country productive sector.

Normalised Balance and Neven index

The normalised balance is given by the ration between the value of trade and the value of total trade. This index, which takes into account both imports (m) and exports (x) is a good indicator for the economic performance of a country i. It is defined as

$$NB_{ji} = \left(\frac{x_{ji} - m_{ji}}{x_{ji} + m_{ji}} \right)$$

This ratio ranges between – 1 and +1. When the normalised balance is 1, a country or a region is completely specialized in the production of commodity j. When it is -1, there is despecialisation. When the index is zero, imports and exports are even. The normalized balance presents a limitation in that, since it focuses each time on a single commodity j, it does fulfill the contrasting dimension inherent in the principle of comparative advantages.

Neven (1995) provided an extended Normalized Balance formula to over come the aforementioned shortcoming

$$\mathrm{NEV}_{ji} = \left(x_{ji} / X_i - m_{ji} / M_i\right) / \left(x_{ji} / X_i + m_{ji} / M_i\right)$$

Where x and m are the total exports and imports of country i. The Neven index, however does not take into account world imports and exports.

Donges and Riedel index

The Donges and Riedel index (1977) circumrents the Neven index's limitations by including both country and world trade performance. Formally, it is expressed as

$$\text{D-R}_{ki} = \left[\left(\frac{(x_{ki} - m_{ki}) / (x_{ki} + m_{ki})}{(x_{kw} - m_{kw}) / (x_{kw} + m_{kw})} \right) - 1 \right] X \left[Sign(x_{ki} - m_{ki}) \right]$$

Where x_{ki} refers to the exports of commodity k in country i, m_{ki} to imports of commodity k in country i and x_{kw} and m_{kw} to the total world exports and imports of the commodity k.

Aquino index

Aquino (1999) suggests a new index given by

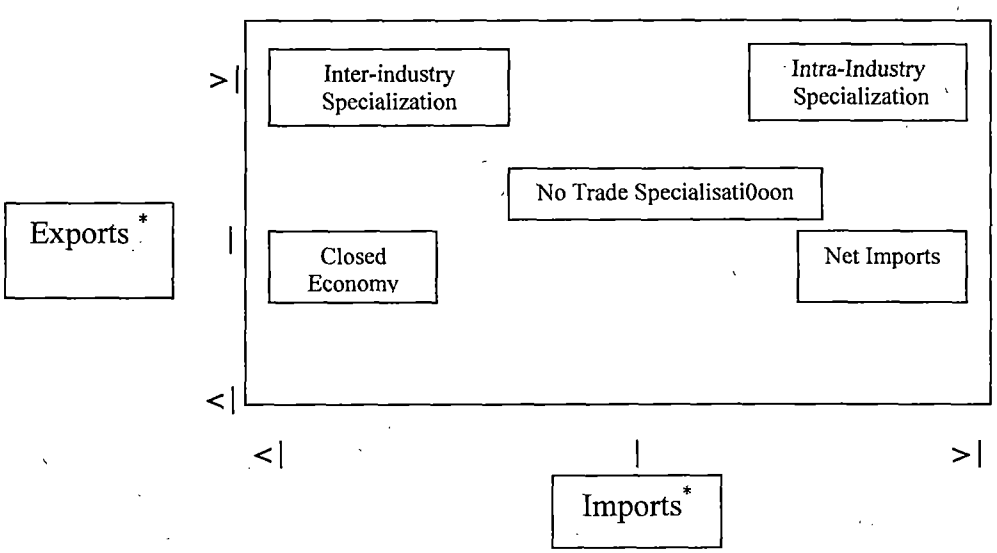
$$\mathrm{A}_{ki} = 100 * \left[\frac{x_{ki} / \sum_{K=1}^{M} x_{ki}}{\sum_{i=1}^{N} x_{ki} / \sum_{i=1}^{N} \sum_{k=1}^{M} x_{ki}} \right] / \left[\frac{m_{ki} / \sum_{K=1}^{M} m_{ki}}{\sum_{i=1}^{N} m_{ki} / \sum_{i=1}^{N} \sum_{k=1}^{M} m_{ki}} \right]$$

Where x_{ki} refers to the exports of commodity k of a country or region i and m_{ki} to the imports of commodity $_k$ of a country or region i. This index is the ratio between the Balassa index calculated for exports and the Balassa index for imports. The numerator represents the share of commodity k in the exports of region i relatively to the share of

commodity k in the exports of the country. The denominator represents the same relative share for imports. The Aquino index, therefore, gives a measure of specialization by sector and region for the country. By considering the normalized quotas of exports as well as imports, this indicator appears to be an unbiased measure of specialization and an unbiased predictor of the intensity of comparative advantage. In fact, the Aquino index overcomes the shortcoming of the Balassa index, in which only exports are considered. In order to get a measure of country trade specialization for all sectors rather than for each sector, we use the standard deviation of the Aquino index (Algieri et. al. 2001).

One limitation of the Aquino index is that it measures only the relative values of the Balassa index for imports and exports. For example, when $A_{ki} = 1$, the index does not distinguish whether this is due to either high relative exports and imports of commodity k (that is the Balassa index for imports and the Balassa index for exports of an industry are equal and both greater than one), or due to low relative exports and imports of commodity k (that is the Balassa index for imports and the Balassa index for exports are equal and both smaller than one), or whether the trade profile of commodity k does not differ from the one of the country (that is the Balassa index for imports and the Balassa index for exports are both equal to one). To gain more detailed information out of the index, one could look separately at the numerator and denominator of the Aquino index for each industry, that is the Balassa index for imports and the Balassa index for exports. It then becomes possible to determine not only the sectors of specialization but also to define the area of trade structure. Plotting the Balassa index for exports on the vertical axis against the Balassa index for imports on the horizontal axis, we get the following matrix

Figure 2.1: The Aquino Matrix-Regional Specialization Patterns Relative to the country-The Balassa index



The economic literature identifies other three techniques to measure the inter-industry specialization which do not make of import and export flows the Hine-Greenaway method, the Sapir method, and the Gini method.

Hine and Greenaway method

Hine (1990) and Greenaway and Hine (1991) use the Fingr -Kreinin statistics (F-K) applied to production and export data on 28 manufacturing industries in order to compute specialization in Europe over the period 1980-85. They prove that inter-industry specialization has been increasing in European Community and in the EC- EFTA areas. The first step in their analysis was to calculate for individual countries the share of each industry in total production. These shares were then compared between countries to obtain a measure of industrial similarity. The Finger statistics is defined as follows

$$(F\text{-}K)_{ij} = \sum_{m=1}^{N} Min(x_{mi}, x_{mj})$$

Where x_{mi} refers to the industry m's share in total production of country i and x_{mj} to the industry m's share in total production of country j. This index ranges between zero and one: it gives a unit value if countries have identical production patterns (intra-industry trade), and gives a zero value for disjoint ones (inter- industry trade). Finger – Kreinin is a relative index in that it compares the industrial share in total exports of one country with respect to another.

The drawback in this index is that the mean of the *F-K* index may not be a satisfactory summary measure of specialization, if the bilateral comparison of a country j with every other country in the sample moves in different directions. Large variation in production shares of small countries could easily drive the value of the index (Amiti, 1999). The index is, therefore, misleading because it does not take into account of the size and the different characteristics of the countries.

Sapir method

Sapir (1996) adopts the Herfindhal index to measure manufacturing specialization in Europe using data on 100 manufacturing industrial sectors. He finds the specialization remained constant in Italy, Germany and Great Britain between 1977 and 1992, and increased in France since 1986. The index is formalised in the following way

$$H_i = \sum_i (s_i)^2$$

Where, s_i is the share of sector i in the total exports of the country. A value of H close to unity implies that the little specialization in sector, while a value close to 100 implies complete specialization in one sector. The main implication is that the Herfindhal index is an absolute measure because it indicates the geometric distance between the distribution of production share and a uniform distribution (Amiti, 1999).

Gini index

Another method to measure the intensity of specialization is to calculate the Gini index. In order to do so, it is first necessary to construct a Lorenz curve by ranking the Balassa index in descending order and then by representing the cumulative value of the denominator on the horizontal axis and the cumulative value of the numerator on the vertical axis. There are differences between the 45° line and the Lorenz curve multiplied by two gives the Gini index. This index can take values between zero and 1, if the index is zero, there is no specialization; The higher the Gini index, the more specialized the country.

The Gini index is based on comparison between the geographic patterns of employment for one industry and in the aggregate. With the Gini index, inter-industry comparison appear to be very sensitive to industry characteristics and results are highly dependent on the concentration of the production with in the industry (Maurel and Sidillot, 1999). For this reason, it is a better measure of productive specialization rather than trade specialization. Moreover, the Gini index places implicit relative value on changes in the middle parts of the distribution. This implies that a transfer from a big industry to a small one has a much greater effect on the country if the two industries are near to the central part of the distribution rather than at either end (Aniti, 1999). For example, the horizontal axis indicate, region *j's* production of industry *i* as a proportion of total country production of industry *i*, While the vertical axis indicates region *j's* share of manufacturing in the total manufacturing of the country.

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