THE NATURE AND EXTENT OF

INTRA-INDUSTRY TRADE IN SOUTH AFRICA

by

RICHARD GEOFFREY PARR

submitted in fulfilment of the requirements
for the degree of

MASTER OF COMMERCE

in the subject

ECONOMICS

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: PROF C S W TORR

JUNE 1999

CONTENTS

LIST OF DIAGRAMS

LIST OF TABLES

DECLARATION

Student number: 479-831-7

I declare that *The nature and extent of intra-industry trade in South Africa* is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

SIGNATURE
MR R G PARR

14-6-1999
DATE

ACKNOWLEDGEMENT

The financial assistance of the Centre for Science Development (HSRC, South Africa) towards this research is gratefully acknowledged. Opinions expressed, and conclusions arrived at, are mine, and are not necessarily to be attributed to the Centre for Science Development.

ABSTRACT

Intra-industry trade occurs when goods from the same industry category are both exported and imported. Types of intra-industry trade are identified, and theoretical models of intra-industry trade under conditions of imperfect competition are examined. The results of thirty-seven empirical studies on the determinants of intra-industry trade are analysed. Methods of measuring intra-industry trade and marginal intra-industry trade are discussed, and various measurement problems are dealt with. The extent of intra-industry trade in South Africa in 1992 and 1997 is measured, using the Grubel-Lloyd and Michaely indices. The Brülhart indices are applied to measure marginal intra-industry trade. South Africa has a relatively low and stable level of intra-industry trade in manufactured goods: the Grubel-Lloyd index for 1997 is calculated to be 37 per cent.

Key terms:

Intra-industry trade, marginal intra-industry trade, South Africa, product differentiation, scale economies, Grubel-Lloyd index, Brülhart index, Heckscher-Ohlin theorem, imperfect competition, data aggregation.

INTRODUCTION

Intra-industry trade, also known as two-way trade, refers to the simultaneous export and import by a country of goods from the same industry (Grubel and Lloyd 1975: xiii). Inter-industry trade, or net trade, on the other hand, refers to the export and import by a country of goods from different industries. The total trade of a country (exports plus imports) can be obtained by adding inter-industry trade and intra-industry trade. The nature and importance of intra-industry trade in total trade will be examined in this dissertation.

Traditional trade theory concentrated on explaining trade in different goods, that is inter-industry trade. In fact, the possibility of intra-industry trade was not even considered by Smith, Ricardo or Heckscher and Ohlin. The theories of absolute advantage and comparative advantage are theories of why some countries are better at producing certain goods than other countries are. Consider a world with only two goods and two countries. If one country is found to have a comparative advantage in the production of one of the goods, then it should specialise in the production of that good, and export some of it in exchange for imports of the other good from the second country. Within the confines of traditional trade theory, it was nonsensical that both countries should both export and import one or both goods. And yet two-way trade in similar goods is exactly what has been observed in empirical studies of trade patterns since the 1960s.

Two-way trade, or intra-industry trade, is pervasive. There are numerous studies documenting the occurrence of intra-industry trade in the industrialised countries, the developing countries and the newly industrialised countries. Certainly, intra-industry trade is mostly a feature of trade in manufactured goods. Therefore, intra-industry trade is more prevalent in the total trade of industrialised countries, as trade in manufactured goods is very important in these countries.

It is necessary to explain the fact that intra-industry trade is such an important share of total trade in goods worldwide. Traditional trade theory does not consider intra-industry trade, or the conditions under which it might arise. There have been many attempts since the

1970s, however, to account for the prevalence of intra-industry trade.

One approach is to keep the explanation within the ambit of the Heckscher-Ohlin theory, in which comparative advantage is based on the resource endowments of countries. Selected assumptions of the Heckscher-Ohlin theory are relaxed, one at a time, in order to show that intra-industry trade is possible in a Heckscher-Ohlin setting. Hence, if the assumption that transport costs are zero is relaxed, a certain amount of border trade may occur. This is a type of intra-industry trade that arises because it is cheaper to import goods (particularly low value, high volume goods) from just over the border, than it is to haul them from a more remote domestic source, even if the home country is a net exporter of such goods. Another example of relaxing a non-crucial assumption of the Heckscher-Ohlin theory is to consider goods differentiated by time. A country may export certain types of vegetables in summer and yet import the same vegetables in winter, thereby giving rise to periodic intra-industry trade. There are several other types of intra-industry trade that can arise if one or more of the Heckscher-Ohlin assumptions are relaxed. Some of these, for example product cycle trade and technological gap trade, should be quite important.

One of the major causes of intra-industry trade is the interaction between economies of scale and product differentiation in manufactured goods. It is not really possible to allow for increasing returns to scale and product differentiation without relaxing the Heckscher-Ohlin assumption of perfect competition. This is a crucial assumption of the theory, so a second approach to the explanation of intra-industry trade has developed. Several theoretical models of intra-industry trade under conditions of imperfect competition have been devised, particularly since the 1980s. These models incorporate increasing returns and product differentiation on the supply side, coupled with the assumption of preference diversity on the demand side. Production of differentiated goods occurs in response to consumer demand for different varieties. Home varieties are exported and foreign varieties imported, and the consequent expansion of the market allows for unit costs to fall, as scale economies are present.

Two-way trade in different varieties of products, classified in the same industry categories, is prevalent in modern trading patterns, and the new trade theories have become more and more popular, at the expense of the factor proportions model of Heckscher and Ohlin.

There have been some convincing efforts, however, to restore the credibility of traditional trade theory and to explain the occurrence of intra-industry trade alongside trade in different goods (inter-industry trade). Trade in natural resource-intensive goods is still adequately explained by the factor proportions theory. For example, South African exports of gold, platinum and coal are due to resource endowments. World trade is however dominated by flows of manufactured goods between the industrialised countries, and much of this is intra-industry trade.

There are several different measures of the extent of intra-industry trade, and there are, of course, measurement problems. According to theory, an industry should produce a distinct product. In practice, it is difficult to define an industry widely enough to include all product varieties, and yet sufficiently narrowly to exclude altogether different products. This is a problem of data grouping and aggregation. There is also the question of whether or not to adjust measures of intra-industry trade for overall trade imbalance, which can markedly affect the results obtained. In addition, the measurement of changes in the level of intra-industry trade over time is not simply one of comparing the relevant measures between the two periods concerned. Measures of marginal intra-industry trade have been put forward recently.

The numerous empirical studies of intra-industry trade did not only measure the extent of the phenomenon in different countries and in particular industries. Many of these studies also investigated the statistical relationships between intra-industry trade and certain other factors. These explanatory variables include similarity of per capita income between pairs of countries, transport costs, tariff levels, foreign direct investment, scale economies and product differentiation. Unfortunately, the measurement problems associated with many of these determinants of intra-industry trade are fairly intractable. Some of the explanatory variables have to be replaced by proxy variables, and regressions using intra-industry trade as the dependent variable are often plagued by multicollinearity and heteroskedasticity. In general, the explanatory power of regressions relating intra-industry trade to its determinants is rather low.

In South Africa, an upper-middle income economy which is still quite heavily dependent upon natural resource-based industries, the level of intra-industry trade is expected to be relatively low, compared with the industrialised countries. The democratic elections in 1994 brought about many changes in South Africa's trade relations with the rest of the world - sanctions were lifted, investment flowed into the country and tariff barriers began to fall. The level of intra-industry trade in South Africa, and the extent to which adjustments to a more competitive international trading environment can be accomplished by intra-industry adjustments, are crucial to employment in South African manufacturing industries. Therefore it is important to measure and to interpret correctly the level of intra-industry trade in South Africa.

Traditional trade theories and their relevance to intra-industry trade are examined in chapter 1, where it is shown that traditional trade theory does not admit the possibility of intra-industry trade. Chapter 2 is concerned with the extent of intra-industry trade, as measured for different countries and industries. Clearly, intra-industry trade is prevalent across countries and cannot be ignored by economic theory.

Several types of intra-industry trade are derived by relaxing one or more assumptions of the Heckscher-Ohlin theory in chapter 3, but some of these types are not expected to be empirically important. In chapter 4, theoretical models of intra-industry trade in conditions of imperfect competition are discussed. These models include preference diversity, scale economies and product differentiation, and represent a departure from the Heckscher-Ohlin trade theory.

Chapter 5 discusses several measures of intra-industry trade and some of the problems associated with the measurement process. The determinants of intra-industry trade are discussed in chapter 6, and many empirical studies of the factors associated with intra-industry trade are reviewed. Finally, in chapter 7, intra-industry trade in South Africa is considered.

CHAPTER ONE

TRADITIONAL TRADE THEORY

This chapter will discuss how traditional economic theory has attempted to account for trade. It has had little to say on the matter of trade in similar goods. Traditional theories implicitly assume that all international trade involves the exchange of goods from different industries between countries. An overview of the theories of absolute and comparative advantage is presented. In particular, the views of Smith and Ricardo are examined. Thereafter, the factor proportions theory of Heckscher and Ohlin is discussed.

Intra-industry trade (hereafter IIT), also known as two-way trade, refers to the simultaneous export and import by a country of goods from the same industry (Grubel and Lloyd, 1975: xiii). Inter-industry trade, or net trade, on the other hand, refers to the export and import by a country of goods from different industries.

Traditional trade theory has for centuries sought to explain trade of the inter-industry variety, without even considering the possibility of IIT taking place. Goods from different industries are traded between countries according to the principles of absolute and comparative advantage, which are due to the differences in labour productivities or factor endowments that exist between the trading nations. There is no need for the international exchange of goods from the same industries, in other words similar goods. We will now briefly examine the reasons none of the theories of international trade advanced by Smith, Ricardo or Heckscher and Ohlin admit the possibility of IIT taking place.

1.1 ADAM SMITH AND THE THEORY OF ABSOLUTE ADVANTAGE

Smith's *Wealth of Nations* (1776 [1961]) was written in an age when it was customary to present in general terms an exposition of what we would nowadays call a model. Therefore we must infer for ourselves the assumptions of Smith's model from his analysis on pages 478 to 480. Chiefly, these are: two countries, each with two industries, each of which produces a homogeneous product; one factor (labour); different labour productivities between the countries; perfect competition on all markets; factor immobility internationally; constant returns to scale; a fixed demand for the two commodities; and the absence of impediments to trade such as transport costs and tariff barriers.

As labour is mobile domestically, wage rates are equalised between the two industries. Since labour is the only factor, relative commodity prices in both countries are determined solely by the labour requirements in the production of the two commodities relative to each other. Differences in labour requirements for each commodity between the two countries is consequently the basis for trade, and a country will specialise in producing that commodity which it can produce more efficiently than its trading partner can. This is the principle of absolute advantage.

In the case where one country has an absolute advantage in the production of both commodities, no trade is deemed viable. Furthermore, only inter-industry trade is considered by Smith, perhaps for the following reasons. The two commodities (usually wine and cloth) are homogeneous, that is, there is no differentiation according to quality or variety and therefore no call for two-way trade (IIT) in slightly different types of either commodity. There are neither economies of scale nor imperfectly competitive market structures, which factors could otherwise interact and facilitate the occurrence of IIT, as will be seen later in chapters 3 and 4. Nor are there transport costs or tariff barriers, which could also be associated with IIT under certain conditions.

In summary, Smith shows the benefits of inter-industry trade between two countries. While Smith's theory certainly explains a fair share of total trade, it should be emphasised that it explains only one part of inter-industry trade, and none of IIT. It was left to Ricardo and Torrens and Heckscher and Ohlin to explain the rest of inter-industry trade, while IIT has only recently been accounted for by modern trade theorists.

1.2 THE RICARDIAN THEORY OF COMPARATIVE ADVANTAGE

While Robert Torrens seems to have given the first formulation of the theory of comparative advantage, in a pamphlet published in 1815, *Essay on the External Corn Trade,* it was

David Ricardo who contributed the first rigorous theoretical exposition.

Building on Smith's analysis and using the same assumptions, Ricardo went on to examine whether trade was beneficial or not in the case where one country (Portugal) has an absolute advantage in both commodities (wine and cloth). In chapter 7 of *Principles of Political Economy and Taxation* (1817 [1963]), Ricardo developed his law of comparative advantage. Haberler (1936) has since re-stated the theory in terms of opportunity costs. The opportunity cost of one good (wine) is equal to the amount of the other good (cloth) that must be sacrificed in order to produce one more unit of wine. Rather than relying only on the labour cost (in hours) to explain whether or not trade is feasible, Ricardo (in terms of Haberler) refers to the internal opportunity costs of the two commodities faced by each of the two countries. If these opportunity costs are different between the countries, then comparative advantage exists and it is worthwhile for the countries to specialise and engage in trade. The terms of trade depend on the patterns of demand in the two countries, but must settle between the two autarky price ratios. It is possible for trade to be beneficial even if one country has the absolute advantage in both commodities. Indeed, the only instance in which trade is not beneficial is when the opportunity costs of the two commodities are identical in both countries.

Suppose Portugal has the absolute advantage in producing both goods and that the cost comparisons by which this is established are as follows:

Labour costs (in hours per unit)

	wine	cloth
England	30	36
Portugal	15	30

Portuguese labour takes less time to produce units of both wine and cloth than does English labour. To obtain opportunity costs, the labour hours expended per unit for each commodity are divided by the labour hours embodied in each unit of the other commodity forgone. The results are shown below.

Opportunity costs (in units of the other good)

	wine	cloth
England	30÷36 = 5/6	36÷30 = 1 1/5
Portugal	15÷30 = 1/2	30÷15 = 2

It is evident from the above that England has a lower opportunity cost for cloth than does Portugal (1 1/5 versus 2), whereas the reverse is true for wine (5/6 versus 1/2). In this case England has a comparative advantage in the production of cloth, and Portugal has a comparative advantage in the production of wine. The existence of comparative advantage is sufficient for trade to benefit both countries: rather than produce wine domestically, England would prefer to import Portuguese wine at an agreed price (terms of trade) of between 1/2 and 5/6 units of cloth. England would thus export cloth in exchange for wine from Portugal which, though more efficient in both lines, would sooner import cloth at terms of trade between 1 1/5 and 2 units of wine than produce cloth itself. Portugal would therefore export wine in exchange for English cloth.

Such trade would usually imply complete specialisation of production in both countries, or at least in the smaller of the two countries, because of constant opportunity costs. That both countries would benefit from trade under such circumstances is the remarkable result of the theory of comparative advantage, and one which is certainly not self-evident. While both countries will be better off after trade, Ricardo overlooked the fact that there is no guarantee that each individual will be better off than under autarky. This is because the distribution of income within the two countries will move in favour of those workers engaged in the exporting industries, and against workers in the importing industries.

The theory of comparative advantage was the basis for an explanation of all inter-industry specialisation and trade that might arise between two (or more) nations. But the Ricardian model is inadequate in that comparative advantage is ultimately presumed to originate in the differences between countries in labour productivity. Other factors of production ought really to be considered, in order to explain the nature of these productivity differences. Further, IIT is not recognised, for much the same reasons as apply to the theory of Adam Smith.

1.3 HECKSCHER-OHLIN AND THE FACTOR ENDOWMENT BASIS OF COMPARATIVE ADVANTAGE

Heckscher (1949) and Ohlin (1933) introduced factor endowments into the analysis of international trade. Their model holds that comparative advantage can be ascribed wholly to differences in countries' relative abundance of the factors of production. Therefore resource endowment differences are the only source of trade, which is why the Heckscher-Ohlin (H-O) theory is also referred to as the factor-proportions theory.

The model assumes two factors of production (for example labour and capital) and two production functions, one for each of the two commodities. The two production functions are identical for both countries but different for each commodity, such that one commodity is labour intensive and the other is capital intensive. Figure 1.1 (from Winters, 1991: 33) shows examples of isoquants (4C and 2F) for both goods (cloth and food) in the H-O model and an example of a budget line (AB) for the two factors of production, capital (K) and labour (L). Under conditions of perfect competition, if one unit of food costs the same to produce as two units of cloth, then two units of cloth will trade for one unit of food. The slope of the factor price ratio line AB in figure 1.1 is therefore also the budget line for the two goods. This illustrates the one-to-one relationship between factor prices and commodity prices in the H-O model (prices will equal costs).

Crucially, the direct relationship between factor prices and commodity prices applies regardless of changes in factor prices. Thus there is no possibility of factor intensity reversals. There are no impediments to trade but the two factors are immobile internationally. The difference between the two countries is in their endowments of the two resources. The H-O theory assumes constant returns to scale, but diminishing marginal returns for each factor of production, that is increasing costs. The assumption of increasing costs is necessary because specialisation in production would clearly raise costs, for there are two factors of production that are not equally adaptable to the two alternative uses. The consequence is that trade no longer depends purely on costs, but rather on the fact that, at a given level of cost (price), one country is able to produce relatively more of one good than the other country.

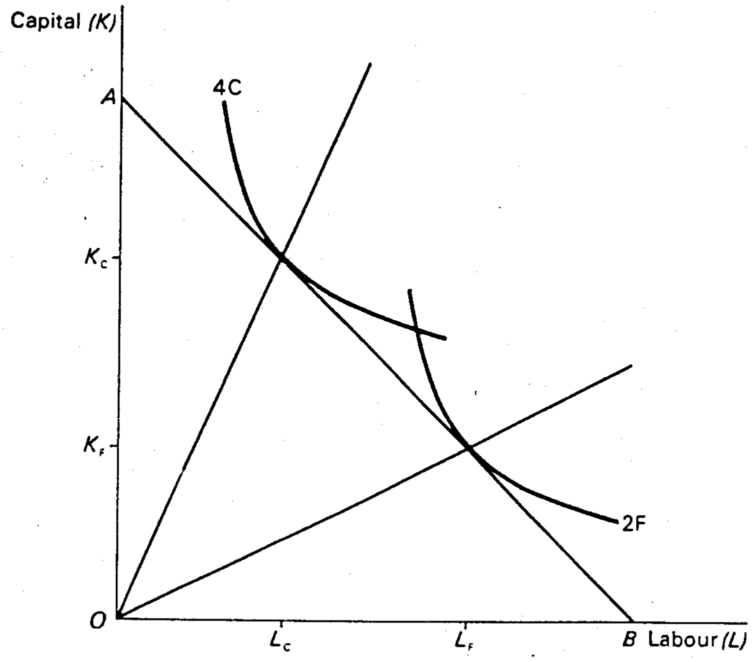

Figure 1.1 Production conditions for two goods (Source: Winters, 1991: 33)

The H-O theorem states that a country will export that good whose production uses its abundant factor intensively. This applies, however, only if factor abundance is defined in terms of factor prices. This is not a very strong statement though, as factor prices do not only reflect factor endowments (supply conditions) but demand factors too. If one defines factor abundance in physical terms instead, one can only say that a country has a bias in favour of exporting that good whose production uses its abundant factor intensively. That predisposition may be more than offset by widely differing demand conditions between the two countries. In such a case, the capital-rich country may export the labour-intensive commodity. Even so, the capital-rich country will still produce relatively more of the capital-intensive good than the labour-rich country. Therefore, regardless of how factor abundance is defined, the H-O theory still holds that the capital-abundant country has a comparative advantage in the production of the capital-intensive good.

The Heckscher-Ohlin theory therefore presents a more elaborate and realistic basis for comparative advantage than Ricardo's theory, and is described in terms of resource scarcity as well as production conditions. Nevertheless, the H-O theory is still aimed squarely at explaining inter-industry trade. No trade of the IIT variety is considered at all. However, as will be seen in chapter 4, there have been subsequent attempts to reconcile the H-O theory with the occurrence of IIT.

The implications of the H-O theory are important to the modern theory of international economics. The most important implication is the theorem of factor price equalisation (FPE), the first proof of which was published by Samuelson (1948, 1949). The assumption of incomplete specialisation is needed to prove FPE, and we have seen above that incomplete specialisation in both countries is likely anyway, due to the assumption of increasing costs. Once trade is opened up, a country will wish to specialise in the output (for export) of that good whose price is more attractive on the world market. This will be the good whose production uses the country's abundant factor intensively. The demand for that factor will then increase and its price will rise (in a situation of full employment). The price of the relatively scarce factor in the same country will fall, as the good which is produced using that factor more intensively is imported. Opposite trends in the respective factor prices will be observed in the second country, so that factor prices tend towards equality internationally. FPE is assured if there is incomplete specialisation (as is assumed), but not if one country specialises completely in production. In such a case, a country would be forced to adopt the factor proportions of its national endowment (Södersten, 1980). Factor prices would still tend towards equality, but if the price of the good produced by the country that has reached complete specialisation rises further, the relation between the marginal productivities of the two factors internationally will differ, and factor prices will not be completely equalised. This is illustrated by means of a box diagram in figure 1.2 below (adapted from Södersten, 1980: 52).

An increase in demand for good *A* will increase Country One's output along its contract curve *OO'* from a starting point of say *T*, to point *E*. At the same time, Country Two will increase its output of *A* from *T'* to *O"*. At these levels of production, FPE is still assured, as the factor intensity in both lines is the same between countries: good *A* is produced at the overall factor intensity of Country Two, both by Country One (line segment *OE*) and Country Two (*OO"*). Meanwhile, good *B* is produced by Country One only, at a factor intensity shown by line segment *O'E*. Any further increase in the demand for (and therefore the price of) good *A*, however, can only be met by increased output from Country One, as

Country Two is already completely specialised in good *A*. From this point on, factor intensities, and thus relative factor prices between the two countries, will diverge.

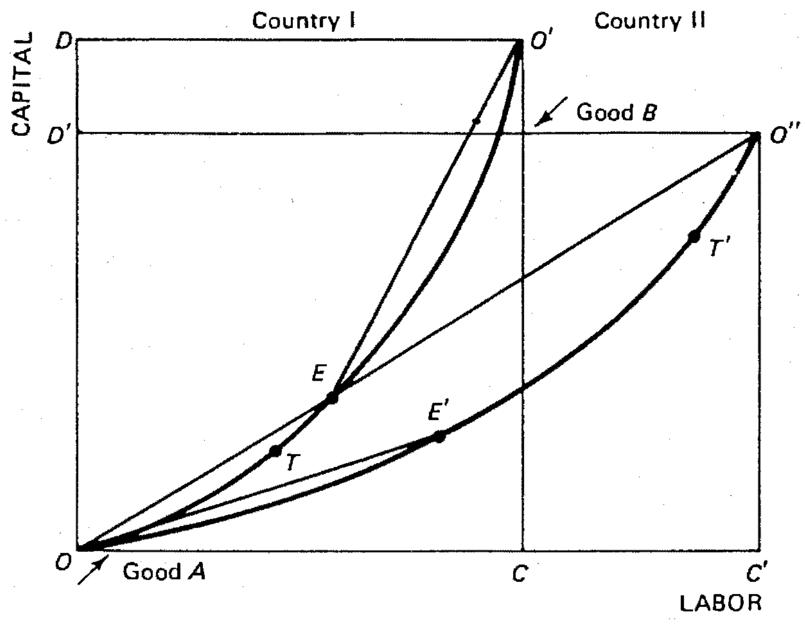

Figure 1.2 Complete specialisation (Source: Södersten, 1980: 52)

If we leave aside for the moment the requirement of incomplete specialisation for FPE to occur, what are the factors that would tend to lead to complete specialisation in trade? According to Södersten (1980: 53-54), complete specialisation is more likely the more different are the factor endowments between the two countries; complete specialisation is also more likely the closer are the factor intensities in the two lines of production.

The relevance of all this to IIT is as follows. The more different are the factor endowments of two trading partners, the more likely there is to be net (inter-industry) trade between them; and the more similar the factor intensities in the two lines of production, the more net trade too. But in the latter case, trade would seem suspiciously like IIT rather than inter-industry trade, since IIT is often defined as trade in goods with similar factor intensity.

FPE is a substitute for the international mobility of resources, which has been assumed away in the H-O model. FPE implies, in turn, that factor incomes will be upset by the introduction of free (inter-industry) trade, with the relatively abundant factor gaining at the expense of the scarce factor. The relevance of this to the subject of IIT is that the associated adjustment costs for an economy of opening up trade (or reducing protectionist measures) are large when such new trade is inter-industry trade. This is because the import-competing sector of the domestic economy is hard hit by falling factor incomes and such displaced factors cannot be absorbed into the totally different production conditions existing in the expanding export sector. By contrast, if new trade is IIT, then factors displaced from the import-competing sector are easily absorbed into the similar production environment of the expanding export sector.

The Stolper-Samuelson (1941) theorem rests upon much the same assumptions as does the H-O theory. The theorem states that a rise in the price of one good raises the return to the factor used intensively in its production and lowers the return to the other factor. A rise in the price of one good might be due to the imposition of a tariff on the importable good. Domestic producers will increase their output of the importable and decrease their output of the export good. If the importable good is capital-intensive, then production methods in both lines will become more labour-intensive, as the price of capital rises on the back of the increased production of the importable good. This is because producers of both goods try to economise on capital by substituting labour. The return to capital rises and that to labour falls. Thus major upheavals may be caused by the application (or removal) of protectionist commercial policy measures, but only when trade is of the inter-industry type.

The H-O theory offers a more realistic and comprehensive view of inter-industry trade than the Ricardian version, but it still ignores the possibility of IIT. At the same time, the H-O theory and its extensions shed some light on the problems of changes in inter-industry trade levels, in respect of income distribution effects and adjustment problems.

1.4 CONCLUSION

The present chapter has briefly reviewed the trade theories put forward by Smith, Ricardo and Heckscher and Ohlin, insofar as they have a bearing on the IIT issue. Each of these authors contributed greatly to the development of international trade theory. Smith (1776 [1961]) demonstrated that trade would be beneficial to both nations under conditions of absolute advantage. This debunked the mercantilist notion that trade benefits only the exporting nation. The theory of comparative advantage was developed by Ricardo (1817 [1963]). He showed that beneficial trade is possible between two countries, even when one country has an absolute advantage in the production of both commodities. The factor proportions theory introduced by Heckscher (1949) and Ohlin (1933) gave a factor endowments basis to the theory of comparative advantage. Their theory is a more realistic explanation of inter-industry trade than Ricardo's.

The H-O theory has become part of mainstream economics, and it gives a good account of the reasons for trade in different commodities. But, in common with the other traditional trade theories, the H-O theory does not consider the possibility of IIT. The inclusion of factors such as product differentiation and scale economies into the analysis of international trade has only taken place in the last few decades. Theoretical models of IIT will be discussed in chapter 4. In the next two chapters however, attention is first given to the prevalence of IIT and to the types of IIT.

CHAPTER TWO

THE EXTENT OF INTRA-INDUSTRY TRADE

While the H-O theory soon became the received view on trade, since the 1950s the theory has been criticised on the grounds that it no longer adequately explains the observed patterns of world trade. In particular, the H-O theory does not account for the occurrence of IIT. This chapter will review those studies that have investigated the extent of the occurrence of IIT in various countries, country groupings and industries. Since IIT is found to be prevalent, we must ask whether the H-O theory is still relevant.

2.1 EARLY INDICATIONS OF THE PHENOMENON

Leontief (1953) conducted an empirical test of the H-O theory using United States data on exports and imports, expecting to find that the exports of the capital-abundant USA were more capital-intensive than its imports. In fact he found the factor content of US imports to be more capital-intensive than that of its exports. This anomaly, since dubbed the 'Leontief paradox', called into question the credibility of the H-O theory, although several explanations were subsequently advanced to explain the paradox.

Furthermore, several studies of trade patterns were conducted in the 1960s, following the formation of the European Economic Community (EEC). The expectation was that inter-industry specialisation would follow trade liberalisation. In particular, specialisation in agricultural production was expected to occur in Italy and France, while the Federal Republic of Germany was expected to specialise in industrial activity (Greenaway and Milner, 1986: 2). The results of these studies showed, however, that such expectations were not realised and that it was intra-industry specialisation which had increased appreciably in the decade following the formation of the EEC.

These early studies, for example Verdoorn (1960), were followed by further reports, which documented the significant extent of IIT in other countries too.

2.2 THE CONTRIBUTION OF GRUBEL AND LLOYD

The study by Grubel and Lloyd (1975) provided evidence of IIT for all the major industrialised countries. Grubel and Lloyd measured IIT as a percentage or proportion of total trade, which is comprised of inter-industry and intra-industry trade. Although the measurement of IIT is discussed in more detail in chapter 5, it is necessary to explain here the basic measure of IIT before we can examine the evidence on the worldwide extent of IIT. In order to arrive at the standard Grubel-Lloyd (*GL*) index of IIT, we proceed as follows:

Inter-industry trade is the absolute value of the difference between exports (X_i) and imports (M_i) in an industry category *i*, or

$$\text{inter-industry trade} = |X_i - M_i|$$

A measure of intra-industry trade may now be derived as what remains after the deduction of inter-industry trade from total trade:

$$\text{IIT} = (X_i + M_i) - |X_i - M_i|$$

Taking IIT as a fraction of total trade in an industry *i*, we arrive at the Grubel-Lloyd (*GL*) index, using throughout the notation adopted by Kol (1988):

$$GL_i = \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)}$$

The GL_i measure of IIT ranges from 0 (complete inter-industry specialisation, where either *X* or *M* in that industry is zero) to 1 (all trade is of the IIT variety, as *X* is exactly matched by *M*). Rather than using a proportion from 0 to 1, some authors refer to the percentage (0 to 100) of trade that is IIT. This is a simple matter of multiplying the GL_i score by 100.

In order to obtain an aggregate measure of IIT across all *i* industries for the country concerned, Grubel and Lloyd weighted the individual GL_i measures by the respective industries' exports plus imports, as a share of the total exports plus imports for all industries in the relevant country. Kol (1988: 39) expresses the *GL* measure as follows:

$$GL \quad = \quad \Sigma GL_i \ . \ [\frac{(X_i + M_i)}{\Sigma (X_i + M_i)}]$$

Thus it can be seen that the IIT scores of individual industries are not weighted equally but rather according to their respective shares in total trade.

Grubel and Lloyd calculated IIT as a percentage of total trade, aggregated across industries using the weighting method as described above. Their study covered ten OECD countries. The unweighted mean share of IIT in total trade for these ten countries turned out to be exactly 50%. But weighting the countries' IIT by their individual shares in total OECD trade yielded a result of 63% IIT of total OECD trade in 1967. In that year those ten countries accounted for some 58% of total world exports. Thus the global importance of IIT had been demonstrated by Grubel and Lloyd. Clearly, at that stage IIT was a phenomenon in search of a theory, as the H-O theory had incorporated only inter-industry trade.

2.3 TOWARDS A FULLER AWARENESS OF THE OCCURRENCE AND EXTENT OF INTRA-INDUSTRY TRADE

Since the publication of Grubel and Lloyd (1975), there has been a plethora of studies on the extent of IIT in every country and group of countries imaginable, between various country groupings and within many diverse industries. Indeed, IIT rapidly became the most studied topic in the field of international economics.

It has become conventional in studies on the extent of IIT to focus on trade in manufactured goods - trade in raw materials and services is excluded from the analysis. It is normally conceded that trade in primary products is mainly inter-industry, or 'Heckscher-Ohlin' trade (primary products typically being exported by developing countries in exchange for manufactures from industrialised countries). As for services, there is not enough detail on different types of services from which to compile IIT statistics.

The focus of research has now shifted towards determining the importance of certain factors that go hand-in-hand with IIT, and this is the topic of chapter 6. Section 2.3 contains a broad review of the literature relating purely to the extent of IIT. Many of the articles also report IIT levels in different years for the countries surveyed, in order to establish a trend in IIT over time. The method normally employed is a simple comparison of Grubel-Lloyd indices for the years in question, but this has since been shown to be misleading (see chapter 5). These results on IIT trends will be briefly reported below but should be interpreted with circumspection.

2.3.1 INTRA-INDUSTRY TRADE IN THE INDUSTRIALISED COUNTRIES

In a comprehensive study of OECD trade with the rest of the world, Culem and Lundberg (1986) showed that the share of IIT in total OECD trade in manufactures varied from 29% to 80% in 1980 (see column 2, headed *world*, of table 2.1). In general, the IIT of the OECD countries was greatest with other developed countries and smallest with Latin America. A simple comparison of the *GL* indices of 1980 with those of 1970 showed that IIT had, in most cases, increased by several percentage points.

Culem and Lundberg also divided the total number of manufacturing industries into three groups, namely consumer goods (*C*), semi-fabricated products (*S*) and investment goods (*I*) (see table 2.2). The second column of the table (headed *All goods*) presents the same data as the column headed *world* in table 2.1. The next three columns of table 2.2 show IIT with all countries, but separated according to trade in consumer goods, semi-fabricated goods and investment goods respectively. IIT in most OECD countries was evenly spread between the three groups of products. For example, French IIT in consumer goods was 71%; in semi-fabricated goods 86% and in investment goods, 86%. Therefore, if we consider total French trade in consumer goods, for instance, IIT was 71% of such trade, and the rest (29%) was inter-industry trade.

	Trade with						
Country	world	South Europe	Asian NICs	Latin America	other LDCs	all LDCs	all DCs
Australia	35,8	16,3	26,9	19,4	22,9	29,2	22,7
Belgium	79,7	54,1	29,8	11,4	33,4	40,1	77,6
Canada	58,5	30,6	15,7	25,0	11,0	33,0	56,7
France	80,4	64,4	29,7	16,3	31,4	44,2	79,2
Germany	65,4	42,3	24,4	13,0	28,9	34,6	74,1
Italy	65,4	55,1	36,0	19,8	28,1	44,3	59,8
Japan	28,8	14,8	27,2	10,6	10,1	17,6	33,6
Netherlands	74,2	43,0	24,8	17,7	35,5	45,5	70,3
Sweden	66,5	29,2	15,1	7,6	8,8	17,4	72,5
UK	79,1	50,7	27,4	24,0	38,6	44,2	77,5
USA	60,7	33,8	26,5	29,6	25,8	35,0	66,7

Definitions: South Europe: Greece, Portugal, Spain, Cyprus, Gibraltar, Israel, Malta, Turkey, Yugoslavia. Asian NICs: Hong Kong, Macao, Singapore, Taiwan, South Korea.

Table 2.1 OECD IIT (*GL, %*) in total trade and in trade with certain groups of countries in 1980 (Source: Culem and Lundberg, 1986: 116)

The last two columns of table 2.2 indicate the group of products (*C, S* or *I*) for which IIT was highest in each OECD country's trade with the group of less-developed countries (LDCs), and with the group of developed countries (DCs). For example, Belgian IIT with all countries was highest in consumer goods (*C*), amounting to 85%. The second-last column of table 2.2 indicates that Belgian IIT with the LDCs only, however, was highest in semi-fabricated goods (*S*), while the final column shows that Belgian IIT with the developed countries only was highest in consumer goods (*C*). Table 2.2 suggests that IIT between developed and developing countries consists, in the main, of an exchange of similar semi-fabricated goods, whereas IIT among the developed countries is more evenly spread among the three classes of goods.

Country	All goods	Consumer goods	Semi-fabricated goods	Investment goods	LDCs	DCs
Australia	35,8	18,6	53,9	32,8	I	S
Belgium	79,7	84,5	76,4	77,0	S	C
Canada	58,5	72,3	43,9	59,0	S	C
France	80,4	70,9	86,2	85,8	S	S
Germany	65,4	62,0	71,4	60,3	S	S
Italy	65,4	51,7	75,5	70,2	S	I
Japan	28,8	18,4	38,0	31,5	S	I
Netherlands	74,2	69,0	74,7	85,8	S	I
Sweden	66,5	67,3	59,2	79,7	S	I
UK	79,1	78,6	78,8	80,0	I	I
USA	60,7	63,1	63,4	54,0	C	S
Number of products	81	36	28	17		

Table 2.2 IIT (*GL, %*) in consumer goods, semi-fabricated goods and investment goods in 1980 (Source: Culem and Lundberg, 1986: 118)

Niroomand (1988) calculated bilateral IIT of the USA with Europe and other countries for the years 1963, 1967, 1977 and 1980. He found that USA levels of IIT were highest with Europe, and rose from 50% in 1963 to 57% in 1980. The IIT of the USA rose with all other country groups too. With Canada and Japan, US IIT rose from 28% and 25% to 50% and 42% respectively. US IIT with the newly-industrialised countries (NICs) rose from 26% to 39%, while US IIT with developing countries was low but growing slowly from 20% to 31% over the period surveyed.

The research surveyed by Greenaway and Hine (1991) indicates that, at least in the EC countries, IIT started peaking in the late 1970s and 1980s.

Australia, an atypical member of the OECD because of the dominance of commodity exports in its trade, has relatively low levels of IIT (35% in manufactures in 1980: see table

2.2 above). But Menon (1994) reported that IIT (for all goods) has risen from 21% in 1981 to 33% in 1991.

It is clear from even a cursory glance at the evidence that observed levels of IIT are related to certain country attributes (such as levels of economic development). The nature and strength of these associations with IIT are discussed in chapter 6.

2.3.2 IIT IN THE DEVELOPING COUNTRIES AND EMERGING MARKET COUNTRIES

Of greater relevance to the present study on South Africa, much of the recent research into IIT has enquired as to whether the IIT phenomenon is pervasive in the case of the developing countries and in the case of emerging economies, for example South Africa, Mexico, certain newly-industrialised countries and the former Eastern Bloc countries. The general expectation is for rather lower levels of IIT in the total trade between developing countries and the industrialised countries. This is because the developing countries usually have factor endowments very different from the industrialised countries, so high levels of net (inter-industry) trade are likely, according to the H-O theory. While the industrialised countries are typically well-endowed with capital and human capital, the developing countries are often rich in unskilled labour and natural resources. Therefore there is good reason to believe that inter-industry trade (as predicted by traditional theories of comparative advantage) will dominate total trade between developed and developing nations.

For a sample of 44 developing countries, Havrylyshyn and Civan (1985) found an average IIT in manufactured goods of 23% for 1978 (see table 2.3 below). Average IIT for the 13 newly-industrialised countries (NICs) included in the study was 42%, but average IIT for the 31 other developing countries was only 15%. The thirteen NICs in the survey generally experienced an increase in IIT between 1968 and 1978, from 32% to 42% on average.

There is also the matter of how much IIT occurs among developing countries, which was also investigated by Havrylyshyn and Civan (1985). They found that for the 31 non-NICs, IIT with developing countries was slightly higher (26% on average) than IIT with the whole world. But the opposite was found for the 13 NICs, where IIT with developing countries was slightly lower at an average of 38%, and lower still at 30% for IIT with other NICs only. Some of the results of the study by Havrylyshyn and Civan are presented in table 2.3 below. As will be noted in chapter 6 on the factors associated with IIT, similarity of per capita incomes between countries appears to be positively related to IIT. Therefore IIT among developing countries is expected to be higher than IIT between developing and developed countries. Table 2.3 below shows that IIT is indeed important, even for the developing economies. It is evident that for many countries in the sample of Havrylyshyn and Civan (1985), inter-industry trade dominates total trade. But the existence of IIT in most developing countries is certainly not negligible. Manrique (1987) confirmed that USA bilateral IIT with a group of seven NICs was substantial and had grown significantly over the period 1967 to 1982.

Baumann (1992) showed for seven Latin American countries that IIT in 1988 was an important and growing feature of bilateral trade with other regions and within the region itself. It was noted that the apparent growth in IIT was occurring at a time when corresponding indicators for OECD countries were stable. A more recent study by Gonzalez and Velez (1995) analysed bilateral IIT of the USA with eight Latin American countries. It was found that IIT in manufactures between the USA and Mexico was quite high at 63%, but much lower with the other countries surveyed (from only 1% with Paraguay to 29% with Brazil).

Much of the most recent research into the extent of IIT has focused on the South-East Asian economies. Lee and Lee (1993) reported that (South) Korean IIT had risen from 35% in 1977 to 50% in 1985 - not much lower than levels experienced by developed countries. Korean IIT was greatest with neighbouring countries with a similar cultural background. Studies by Yavas and Vardiabasis (1994) and Chow, Kellman and Shachmurove (1994) both show significant and rising levels of IIT (on average 30% in 1990) for Hong Kong, Singapore, South Korea, Taiwan and Malaysia. Khalifah (1996) calculated IIT in manufactures in 1990 for the following ASEAN countries as: Singapore 72%; Malaysia 57%; Thailand 37% and Indonesia 13%. A more detailed study by Khalifah (1995) put total Malaysian IIT at 40% in 1991.

	Intra-industry trade index with		
	World	DCs	NICs
Algeria	1,47	1,49	-
Argentina	42,33	49,13	48,69
Brazil	37,84	43,6	-
Cameroon	6,14	8,79	-
Central African Republic	0,74	0,74	-
Chile	10,09	15,61	-
Colombia	20,01	27,90	-
Costa Rica	32,44	43,74	-
Dominican Republic	6,90	10,09	-
Egypt	6,82	7,65	-
El Salvador	33,03	42,80	-
Ghana	4,30	5,29	-
Greece	21,12	31,94	12,31
Guatemala	32,65	43,25	-
Guyana	19,57	34,99	-
Haiti	46,33	48,68	-
Hong Kong	40,82	33,62	34,66
India	37,41	22,75	15,12
Israel	61,85	38,30	18,27
Côte d'Ivoire	13,44	36,94	-
Jamaica	14,39	23,30	-
Jordan	14,92	18,39	-
Kenya	13,87	36,68	-
Korea	34,91	26,31	29,37
Malawi	6,58	9,14	-
Malaysia	32,41	50,01	-
Mexico	31,91	38,73	42,23
Morocco	10,85	8,73	-
Nigeria	0,19	0,30	-
Pakistan	14,78	28,16	-
Peru	10,31	13,62	-
Philippines	15,03	19,13	-
Portugal	32,78	42,52	28,01
Senegal	18,65	38,97	-
Singapore	66,90	74,94	47,13
Spain	52,13	35,12	24,64
Sri Lanka	4,80	4,02	-
Sudan	0,84	1,05	-
Taiwan	34,74	25,67	-
Thailand	17,34	35,32	28,02
Trinidad	14,33	22,37	-
Tunisia	17,26	12,32	-
Turkey	7,94	17,23	-
Yugoslavia	50,68	31,81	16,36
Unadjusted mean	22,58	26,38	30,50

Table 2.3 IIT indices (*GL, %*) for 44 developing countries, 1978 (Source: Havrylyshyn and Civan, 1985: 269)

Another area of recent interest to IIT researchers has been Eastern Europe and the former Soviet Union (FSU). Mardas (1992) calculated levels of IIT in seven former Eastern Bloc countries, for the years 1980, 1984, 1987, 1989 and 1990. Little growth in IIT was noted, but large variations between countries' IIT levels were observed. The IIT indices for 1990 were as follows: the Soviet Union 18%; East Germany 44%; Poland 36%; Czechoslovakia 42%; Hungary 46%; Romania 24% and Bulgaria 25%. But trade patterns have changed dramatically since the Council for Mutual Economic Assistance (CMEA) was dissolved in December 1990 (although data quality remains poor). The Central and Eastern European Countries (CEECs) comprise Bulgaria, the Czech Republic, Hungary, Poland, Romania and Slovakia. These countries have re-orientated much of their trade with the FSU (now the Commonwealth of Independent States - CIS) towards the European Union (EU) in particular, according to Andreosso-O'Callaghan and Noonan (1996). For example, the share of total Czechoslovakian exports going to the EU shot up from 9% in 1989 to 49% in 1992, and the share of imports from 10% to 42%. The authors provide lists of "potentially desirable developing industries" (Andreosso-O'Callaghan and Noonan, 1996:158) for which each of the CEECs have IIT levels higher than 50%.

Hoekman and Djankov (1996) calculated levels of IIT for the CEECs, the FSU and several comparator countries for the period 1989 to 1994. IIT has increased substantially for all CEECs, especially the Czech Republic at 47% in 1994, up from 24% in 1989. IIT for 1994 is also high in Slovenia at 41% and in Hungary at 39%. The extent of IIT in these countries is still below that of industrial countries in the region, for example 58% in 1993 for Austria and Switzerland, but greater than Portugal and Greece (34% and 18% respectively in 1993). IIT in 1994 was also given for Poland (28%), Bulgaria (24%) and the FSU (barely 10%).

Schuler (1995) calculated IIT in Spain at 66% in 1990, and 29% for Turkey. In India, a labour abundant, capital deficient country with most of its trading partners having the opposite characteristics, inter-industry trade would be expected to predominate. But Bhattacharyya (1994) reported India's IIT at a substantial 25% in 1987.

Havrylyshyn and Kunzel (1997) computed IIT of Arab countries. Israel as a comparator country has the highest IIT in the region (58% for 1992-94). The Arab region does not have a highly advanced industrial base, so levels of IIT are low, except for Oman, due to re-exports (domestic absorption of imports is only about 45%). Table 2.4 below (from

Havrylyshyn and Kunzel, 1997:9) reports IIT of the Arab countries, for the mid-80s and mid-90s. As far as OPEC member countries are concerned, low values of IIT are expected. Patterns of trade are biased towards natural resource-based inter-industry trade. Countries such as Kuwait, Saudi Arabia and the United Arab Emirates are major exporters of crude oil and can well afford to import manufactured goods. The increase in IIT over the last decade can possibly be attributed to rising levels of industrialisation in these countries, and the sustained real decline in crude oil prices during the period under consideration.

	1984-86	**1992-94**
Algeria	5,1	5,2
Bahrain	10,7	-
Djibouti	5,5	2,6
Egypt	10,2	17,2
Jordan	20,7	24,8
Kuwait	19,2	13,1
Morocco	15,8	20,4
Oman	16,4	41,4
Qatar	-	7,6
Saudi Arabia	4,7	9,6
Syrian Arab Republic	14,3	12,5
Tunisia	23,8	30,1
United Arab Emirates	7,4	8,1
Arab Countries *	15,9	25,0
Comparator Countries:		
Israel	46,9	58,4
Turkey	15,9	28,4
Regional Averages *		
Industrial Countries	87,6	87,8
EU	86,0	88,6
Andean Pact	23,7	29,0
APEC	87,4	90,3
Mercosur	42,8	51,9
NAFTA	68,7	77,3

* Weighted averages.

Table 2.4 IIT (*GL, %*) in manufactures in the Arab region (Source: Havrylyshyn and Kunzel: 1997)

As far as South Africa is concerned, Simson (1987) reported IIT levels of 35% in 1981 (for all goods); Parr (1994) found that IIT in 1992 was 32% for all goods, and 34% for manufactures. A detailed discussion of South African IIT is the subject of chapter 7.

2.3.3 INTRA-INDUSTRY TRADE IN PARTICULAR INDUSTRIES

Some of the research into the nature and extent of IIT has taken the form of sectoral studies, which usually go into more detail than merely calculating the GL_i index for a particular industry or cluster of closely-related industries.

Cooper, Greenaway and Rayner (1993), in a study on the tractor industry, found high levels of IIT for countries involved in tractor exports, such as the USA (IIT in 1989 = 84%), Austria (90%) and Belgium/Luxembourg (92%).

Jordan (1993) used questionnaire data to calculate IIT for liquid pumps in Sweden, finding prevalent IIT (50-60%) only in respect of pumps for the pulp and paper industry. Prevalent IIT was recorded for several other types of centrifugal pumps, but only if re-exports were included in the calculations.

French IIT in the automobile industry was investigated by Becuwe and Mathieu (1992). They found that IIT had increased greatly between 1974 and 1986, from 46% to 86%. Much of the IIT comprised intra-firm trade.

Bilateral IIT in the European computer industry for 1989 was found by Somma (1994) to vary widely between 13% (UK - Denmark) and 98% (Germany - Netherlands).

Tharakan and Kerstens (1995) studied North-South IIT in the toy industry (excluding video games). They found that total IIT between their group of eight European countries and the group of southern countries was very low in eight out of 14 products examined. But bilateral IIT (between one country from the north and another from the south) was far higher.

IIT in the EC meat market was measured for beef and pork and for three processing stages by Christodoulou (1992). In most cases, the highest levels of IIT were observed for countries which are dominant exporters, for example Germany (83% for all meat) and Italy (78%).

The extent of bilateral IIT in wheat between the USA and Canada was studied by Uri and Beach (1996). Wheat is normally thought of as a homogeneous commodity, which is either exported or imported, but not both - that is, IIT is not expected to be pervasive. But the authors explain that wheat is actually differentiated according to protein content and the percentage of heat-damaged kernels, thereby leading to IIT in varieties of wheat.

Karrenbrock (1990) calculated IIT in the beer brewing industry for 23 countries in 1975 and 1987. The majority of countries (70%) had IIT levels of less than 50% for beer, although IIT had become more prevalent than it was in 1975.

2.4 CONCLUSION

The prevalence of IIT, for most countries and for many industries, has been demonstrated by the studies reviewed in this chapter. In general, levels of IIT are higher in the industrialised countries and in the manufacturing industries. But several studies have shown that IIT is also prevalent in the less-developed countries and in some non-manufacturing industries, for example beef and wheat. In summary, the present chapter has shown that for the industrialised countries, and for the manufacturing industries, IIT makes a bigger contribution to total trade than inter-industry trade. On the other hand, even in many less-developed countries and in many non-manufacturing industries, IIT is not swamped by the occurrence of inter-industry trade.

The fact that IIT is a prominent part of total world trade requires some explanation. This is the aim of the following two chapters. In chapter 3, several types of IIT will be discussed and explained in terms of the reasons for their existence. More complex theoretical models of IIT under conditions of imperfect competition will be covered in chapter 4, and the status of the H-O model will be re-examined in light of some recent H-O models of IIT.

CHAPTER THREE

TYPES OF INTRA-INDUSTRY TRADE

There are many circumstances which might lead to the occurrence of IIT. This section will identify and describe the types of IIT that arise when one or more underlying assumptions of the H-O model are relaxed. Note that the assumption of perfect competition is maintained for the time being, but that it will be relaxed in chapter 4.

Certain analysts (for example Finger, 1975) have denied the very existence of IIT, calling it 'Heckscher-Ohlin trade in disguise'. This is due to problems of statistical aggregation of the trade data and the difficulty of precisely defining an industry such that the goods within it are produced with similar factor intensity (see chapter 5 for a more detailed discussion). The consensus view, however, is that IIT remains intact even at very fine levels of disaggregation of the data.

Several explanations of IIT were advanced by Grubel and Lloyd (1975) by relaxing selected assumptions of the H-O model. Their discussion of types of IIT was fairly vague in places and so it was left to authors such as Kol (1988:13-23) to classify the types of IIT in a more organised way. The approach adopted here (in section 3.1) is similar to that of Kol, but with some differences of interpretation of Grubel and Lloyd's work where noted.

3.1 GRUBEL AND LLOYD'S TYPOLOGY OF INTRA-INDUSTRY TRADE

Grubel and Lloyd (1975:69-118) considered the following underlying assumptions of the H-O model for relaxation. Note that although the assumption of perfect competition was not considered to be dispensable, several theoretical models of IIT do consider other market structures (see chapter 4).

1 Commodities produced and traded are homogeneous with respect to location, time of use and packaging.
2 Commodities are homogeneous with respect to end use, that is there are no joint products in consumption.
3 Inputs of capital and labour are homogeneous both within and between countries.
4 Commodities produced and traded are homogeneous with respect to all functional characteristics.
5 The production functions for all commodities are linearly homogeneous.
6 Production functions are identical in all countries.

3.1.1 INTRA-INDUSTRY TRADE IN COMMODITIES DIFFERENTIATED WITH RESPECT TO LOCATION, TIME OF USE OR PACKAGING

Assumption (1) above is relaxed, which allows us to consider circumstances in which commodities are not homogeneous with regard to location, time or packaging. In many cases, this amounts to assuming that costs of transport, storage, selling or information are positive.

Border trade

Certain goods may be differentiated according to location. Commodities such as sand and bricks are expensive to transport relative to their value, so production tends to be located close to raw material sources, and sales tend to occur in the same vicinity. Perishable goods such as milk and fresh vegetables are ideally produced on land closest to consumer markets. In both cases, if the nearest supplier of such goods happens to be over the border, then imports may be observed, although the importing country might itself produce (and export) the same goods in a more remote location. Such two-way trade of heavy or perishable goods has been called border trade.

The following additional factors will affect the extent of IIT of the border trade variety:

- the geographic distribution of consumers
- natural barriers (eg mountains, lakes) between consumers and domestic producers, as compared with natural barriers between consumers and foreign producers of the relevant goods
- the size of the country and of its neighbouring countries (the average distance to the border is less in a smaller country)
- transaction costs imposed by national borders: tariffs, and the cost and time involved in filling in customs forms and exchanging currencies.

Because border trade is limited to heavy and perishable goods, it is not expected to be an important share of total IIT.

Periodic trade

Differentiation by time affects seasonal agricultural products and electricity. It is the timing of production or consumption that differentiates these goods: a country may export certain fruit, vegetables or cut flowers in summer and yet import them in winter, thereby giving rise to periodic IIT in otherwise functionally homogeneous goods. Here, a steady consumption pattern is observed (within each country and internationally), which is met by alternating sources of supply, both local and international.

The consumption of electricity, however, varies daily between nations as peak demand rolls from one time zone to the next. Thus, if a country's generating capacity is between off-peak and peak demand, it has an opportunity to export electricity at off-peak hours and to import it at peak hours. This is another case of periodic IIT, although the period is only a day as opposed to agricultural products, where the period may stretch to six months. A fluctuating pattern of electricity consumption within each country (but a fairly steady demand across nations) is observed, and this is met by steady sources of supply from both or all countries involved.

Both types of periodic IIT mentioned above are expected to be smaller for geographically large and climatically varied countries, such as the USA and Australia. Such countries will have summer and winter crops of many seasonal agricultural goods, from different regions within the borders. National power grids will be able to even out peak domestic demands in widely spaced zones. But smaller countries, such as those in Europe, will have relatively more IIT in these products. The level of disposable income per capita will also influence whether trade in for example cut flowers will be net trade or IIT. One would expect the Netherlands, for example, to import cut flowers from Kenya during the off-season, and to export flowers when they are in season, thereby causing IIT. But one would hardly expect a low-income country like Kenya to have a domestic demand sufficient to warrant imports of horticultural produce in the off-season.

In terms of overall empirical significance, periodic IIT is not expected to be large.

Cycle trade

A further category of goods differentiated by time is known as cycle trade. In contrast to periodic trade, here the pattern of trade is random or cyclical. The two examples cited are the lumpiness of some investments and the inequality of phase and amplitude of the business cycle between countries.

Should two trading partners' economies be out of step with respect to the business cycle, then they could swop roles as importer and exporter for certain goods produced by both. For example if factories in both countries produce polyethylene at minimum average cost levels of output, they would trade according to the vagaries of demand patterns. As cycle IIT would only arise in response to differences in the stage or intensity of the business cycle between two countries, its empirical relevance is slight.

The empirical relevance of lumpy investment projects is also questionable. Examples are the enormous polyethylene, fertiliser and gas liquefaction plants, as well as alumina and copper mines and smelters. Once such a project comes on stream, it can turn a country from importer to exporter of the output overnight. This two-way trade would be a one-off, however, and only show up if the switch happened during an accounting period.

Entrepôt/re-export trade

The import and export of goods after storage and wholesaling is called entrepôt trade, whereas re-export trade refers to goods having been subjected to blending, packaging, bottling, cleaning, sorting, husking, shelling and so on, which leaves them essentially unaltered. Entrepôt and re-export trade are clearly IIT and are typical of countries on major sea-routes, with natural harbour facilities and abundant labour, such as Hong Kong, Singapore and Oman, as noted in the study of Havrylyshyn and Kunzel (1997) in section 2.3.2 above. For these countries, entrepôt/re-export trade is an extremely significant part of total IIT.

Kol (1988:21) includes packaging differentiated trade as a further category of IIT in addition to entrepôt/re-export trade, but it seems that this is a misinterpretation of Grubel and Lloyd, as they surely intended it to fall under re-exports.

Services trade

Positive information costs are associated with financial, insurance, shipping and brokerage services purchased by exporters and importers. Information about the creditworthiness of borrowers and the reliability of transactors is costly initially, but low at the margin and depreciates quickly. Local firms in all countries have accumulated a stock of the relevant information and can provide it at very low marginal cost. This gives rise to IIT in these functionally homogeneous services.

The empirical component of the present study will not treat such services trade, as the data are insufficiently detailed, but it is easy to imagine IIT in services other than those mentioned by Grubel and Lloyd. For example, entertainment, hotel accommodation, transport and medical services, where the products may or may not be deemed functionally homogeneous, but the supply thereof is location-bound.

Services trade is not included in Kol's classification of IIT types.

Bilateral agreements trade

Government actions and regulations may give rise to IIT that Kol (1988:23) has dubbed bilateral agreements trade. For example South Africa may enter into a trade agreement with European Union countries to import products for which domestic demand is inadequate, or for which re-export is viable or politically expedient in terms of another trade agreement. Policies leading unintentionally to IIT (due to imperfect information) would no doubt be changed once their outcomes are realised. This type of IIT is therefore unlikely to be of much significance.

3.1.2 INTRA-INDUSTRY TRADE IN COMMODITIES DIFFERENTIATED WITH RESPECT TO END USE

The assumption that goods are homogeneous with respect to time, location and packaging, so that costs of transport, storage and information are zero, is restored. Instead, assumption (2) is relaxed and goods are now assumed to be differentiated with respect to end use.

Joint-product trade

Certain production processes yield distinct, joint products in fixed proportions, depending on the nature of the inputs or on the technical characteristics of the capital equipment used. Examples are the petroleum derivatives tar, gasoline (petrol) and oils of different weights. The production process in this case can initially be tailored to suit a country's demand for the different outputs, but once in existence the cracking and polymerisation plants cannot readily be adjusted to vary the mix of outputs. Therefore joint product IIT might be observed between petroleum producing countries, seeking to balance their excess demands and supplies of the various derivatives.

Other examples of joint products are beef and hides, and of more relevance to South Africa, mining products. For instance, the platinum group metals (PGMs) are all mined together, resulting in a mix of platinum, palladium, rhodium and others. Little IIT would be expected in this case though, as SA exports the bulk of its PGMs. Joint product IIT is readily explained by the H-O model, and empirically it is not expected to be important.

3.1.3 INTRA-INDUSTRY TRADE IN COMMODITIES DIFFERENTIATED WITH RESPECT TO INPUTS

We now relax assumption (3) that inputs of capital and labour are homogeneous both within and between countries. Differentiation may relate to production or consumption, for while the focus here will be on differentiated inputs, goods may also be differentiated according to outputs (see section 3.1.4 below). Indeed, the data are classified in aggregates of products that comprise close substitutes in production, consumption or both.

Input-differentiated trade

Some products are functionally homogeneous but are produced from entirely different materials, for example furniture of wood or steel and yarn of nylon or wool. Grubel and Lloyd (1975:87) contend that input-differentiated trade is

> "Analytically ... the least interesting of the three groups";
> "simply the result of statistical aggregation"; and
> "Quantitatively ... reasonably important."

The first contention is due to the fact that IIT observed in these products is not necessarily inconsistent with the principle of comparative advantage, as inputs are so different that the H-O theory could readily explain such trade. The second quotation is true only insofar as there are no other reasons for observed IIT in products of this nature, for example horizontal or vertical differentiation of steel furniture (see 3.1.4 below).

3.1.4 INTRA-INDUSTRY TRADE IN FUNCTIONALLY DIFFERENTIATED COMMODITIES

Horizontally differentiated trade and vertically differentiated trade

If we relax assumption (4), that commodities are homogeneous with respect to all functional characteristics, we allow for the occurrence of IIT in differentiated products, by far the most prevalent type of IIT. As discussed below, it may also be necessary to allow for scale economies by relaxing assumption (5), that production functions are linearly homogeneous.

Functional differentiation with respect to style and quality are also referred to in the literature as horizontal and vertical differentiation, respectively. Certainly, this is the convention adopted by most authors, as noted by Greenaway and Milner (1986), and it will be used in the present study.

Horizontal differentiation arises when different varieties (styles) of a product are of similar quality.

Vertical differentiation occurs when different varieties are of differing quality.

Some analysts, notably Grubel and Lloyd (1975) and Kol (1988) reserve the term 'vertical differentiation' to indicate products at different stages of the production process (eg intermediate versus final goods). Therefore they use the term 'quality differentiation' to denote varieties of differing quality. These authors also drop the term 'horizontal differentiation' in favour of the term 'style differentiation'. Gray (1988) stresses that goods are in fact differentiated 'gradiently', by a combination of vertical and horizontal differentiation.

There are numerous industries, representing the bulk of trade in the developed countries, which produce many varieties of substitute products, using inputs and production processes that are very similar. Examples of such products are processed foods, beverages, textiles, clothing, shoes, cars, furniture, cigarettes, computers and appliances, and producer goods such as presses, lathes, drills, communication equipment and mainframe computers. In order to make sense of the very substantial IIT that occurs in these products, it is usually deemed necessary to rely on the interaction between economies of scale and horizontal and/or vertical product differentiation. That is, in addition to relaxing H-O assumption 4 (functional homogeneity), assumption 5 (linearly homogeneous production functions) must also be relaxed. Note that for the moment, assumption 6 is maintained (production functions are identical across countries).

Goods with identical production functions between developed countries with similar factor endowments, are likely to be quoted at similar relative prices, and are highly substitutable in consumption. Little two-way trade would be expected in such goods, but by far the bulk of IIT is observed in these products.

The explanation of this phenomenon by Grubel and Lloyd (1975:89-95) relies on internal economies of scale. Rather than assuming that these increasing returns are a function of plant size and that products are produced in different plants, all varieties are produced in the same plant and all plants are of the same size. Therefore the economies of scale are a function of the length of the production run, and are due to cost savings associated with relatively reduced downtime of machines, greater specialisation of machines and labour, and relatively smaller stocks of raw materials, components and products. Production of more than one variety of a given product in a plant requires minor adjustments to the production process, but involves costly machine downtime, and the shorter runs per variety necessitate relatively larger inventories and selling costs.

In autarky, countries are assumed to produce several varieties of each product in an oligopolistic market equilibrium. Upon integration, all producers' markets are enlarged and potential average costs fall due to the prospect of increased production runs. But some varieties from each country turn out to be extremely close substitutes for each other. Whichever firms had the longest runs and/or lowest costs in autarky will further increase their sales as trade opens up and enjoy even greater cost savings as production runs have increased. The competing models would experience reduced sales and therefore increased costs, forcing their producers to concentrate on another variety of the same product. After trade, each firm in both or all countries produces longer runs (at lower average cost) of fewer varieties than before trade. Consumers lose some domestic varieties, but gain some imported varieties, and because of lower unit costs throughout are probably left with a wider, lower-priced choice of varieties of each product than before.

For example, Japanese cameras might sell in Western Europe while European cameras still sell in Japan. Similarly, the US iron and steel market has been penetrated by foreign producers while US exports to the same countries continue.

Having dealt with economies of scale on the supply side, we now continue to examine the demand side of the nature of horizontal and vertical differentiation. Grubel and Lloyd

(1975:95) state "quality differentiation is based on measurable performance characteristics of products while style differentiation is based on product appearance and marginal performance characteristics, often exaggerated by advertising".

With respect to horizontal (style) differentiation, a country will tend to specialise in those styles popular in the home market and export them, while importing other styles. The logic is that when trade is opened up, a country will have longer runs and lower average costs in the styles most popular domestically, and therefore will be most competitive in those particular styles. An example is furniture: small, light Scandinavian style and the large, colonial-style furniture made in the US. Smaller countries without a large enough group of buyers with homogeneous national tastes to justify production of any style in particular, may produce and export styles free of national influences and import other styles. The example related by Grubel and Lloyd is from Dreze (in Grubel and Lloyd, 1975:97): Belgium produces plain white china, which can readily be used in restaurants worldwide.

As for vertical (quality) differentiation, a country will tend to specialise in and export varieties of a quality in accordance with the level of income in that country, in other words the most popular style before trade opens up will be one of a quality commensurate with income levels. This reasoning is attributable to Linder (1961). Several analysts (eg Falvey, 1981) have subsequently pointed out that higher-quality varieties are produced under more capital-intensive methods than are their lower-quality counterparts. Therefore they contend that because the factor intensities of vertically-differentiated varieties are not similar, trade in such products is not IIT at all, but rather 'Heckscher-Ohlin trade in disguise'.

3.1.5 INTRA-INDUSTRY TRADE IN COMMODITIES DIFFERENTIATED WITH RESPECT TO THEIR PRODUCTION FUNCTIONS

Here we relax assumption (6) from the list at the beginning of the chapter, which states that production functions are identical in all countries. Differentiated production functions may give rise to technological gap trade. We will also consider product cycle trade, where production functions differ across countries in terms of the performance of the product. Finally, we consider commodities differentiated according to stages of processing.

Technological gap trade

If production functions are not identical across countries, a technological gap may open up in the production processes of identical goods between countries. Note that the other assumptions in the list are reinstated so that the only possible cause of IIT is differentiation in production processes.

Posner (1961) put forward the idea that the generation of innovations is often concentrated in one industry or in a group of industries and will lead to a temporary comparative advantage in the relevant product or group of related products. Such a cluster of innovations might be due to "a technical connexion between one innovation and its successor. A break-through on one front will bring, quite rapidly, associated successes" (Posner, 1961:329). This generation of know-how can be specific to a firm and provide it with a temporary comparative advantage over its foreign competitors. The period of time it takes the foreign competitor to catch up (the gestation period or imitation gap) allows the innovating firm a period of increased sales, exports and profits. If there is a continuing technical correlation between the innovations and if follow-up research is conducted and further investment made, then the original innovator may open up successive technological gaps just as the foreign competitor catches up. Thus the leader in process technology might export one variety of a product, while its competitor exports another, functionally homogeneous variety, produced with one-generation-old technology.

Empirically, technology gap IIT is expected to be fairly prevalent, and can be observed, for example, in microchips and automobiles.

Product cycle trade

The product cycle hypothesis is due to Vernon (1966, 1979). A new product is introduced in a developed country and produced in larger quantities and in due course it is exported as it gains wider consumer acceptance. In the mature product stage of development, the product is replicated by foreign competitors in other developed countries and so the exports of the innovator and the imports of the other developed countries start to fall. Once the product is universally known and will sell on the basis of price, it has reached the standardised product stage and is produced mainly in less-developed countries, where labour is cheaper and marketing costs are no longer significant (as the product has become standardised). Meanwhile, the innovator has long since introduced a new variety of the product which it will export, giving rise to IIT.

Although similar to the case of a technology gap trade in that there exists an imitation gap, product cycle trade is related to product innovation rather than to process innovation. The product involved thereby acquires a performance advantage over its foreign competitor; this might simply be due to perfection of the good in its operation, or growing consumer acceptance of the variety following an advertising campaign. One can easily imagine, however, product innovation flowing from improved design characteristics, such as better ergonomics or new features on offer. In relation to the H-O model, assumption 4 regarding functionally homogeneous products is the only assumption that need be relaxed (although, for the purpose of his focus on stages of the cycle, Vernon (1966:203) introduced economies of scale, which violates assumption 5 about linearly homogeneous production functions). Note that product innovation involves new product attributes, whereas horizontal and vertical differentiation involve varieties of products with different mixes of existing attributes.

Empirically, product cycle IIT is expected to be pervasive, although Vernon (1979:263) conceded that the rise of multinational corporations (MNCs), with global networks of subsidiaries, has foreshortened the phase and lessened the explanatory power of the product cycle hypothesis in recent decades. Examples of products subject to the product cycle are consumer electronic products, such as personal computers, cameras and hi-fi equipment.

Foreign processing

The rising importance of MNCs has played a part in the increasing tendency observed for firms to leave the production of components (or intermediate goods) to other, often less-developed countries. Japanese firms, for example, may export parts to subsidiary firms in Korea, where they are assembled and exported back to Japan and other markets. Foreign processing IIT arises when the components and final goods are classified in the same statistical category. According to the theoretical framework, such goods are differentiated with respect to stage of processing (H-O assumption 6 is relaxed). Foreign processing is consistent with the factor endowment basis of trade, as the assembly or finishing processes are often more labour intensive than the component production processes.

Empirically, foreign processing is expected to be widespread. Examples cited by Helleiner (1973) are clothing sewn together in Mexico and south-east Asia from components imported from the US and Japan, and German cameras assembled in Singapore from German parts. A further example is of firearms manufactured in Belgium and assembled in Portugal.

3.2 CONCLUSION

It is evident that there are many possible reasons for the occurrence of IIT. The circumstances in which IIT may arise can be stated as deviations from the assumptions of the H-O theory, and this was the approach adopted in the present chapter. Relaxing one or more of the H-O assumptions creates conditions conducive to the occurrence of IIT. Consequently, many types of IIT are consistent with most H-O assumptions. But these types of IIT are not expected to be empirically important, with the exception of foreign processing, which itself is arguably H-O trade in disguise. Furthermore, the analysis so far has stopped short of relaxing the crucial H-O assumption of perfect competition. Explanations of IIT which do not uphold the assumption of perfect competition are not regarded as being consistent with the H-O theory. In the next chapter, non-Heckscher-Ohlin theoretical models of IIT under conditions of imperfect competition will be discussed.

CHAPTER FOUR

THEORETICAL MODELS OF INTRA-INDUSTRY TRADE

It is possible to identify various circumstances in which IIT might arise by relaxing particular assumptions of the traditional H-O theory. This was investigated in chapter 3. However, the assumption of perfect competition is crucial to the H-O theory. Strictly speaking, any explanation of IIT that does not assume perfect competition cannot be considered an H-O account of trade. The analysis of IIT under conditions of imperfect competition is complex and requires modelling of preferences and scale economies. Accordingly this chapter will review these more sophisticated models of IIT.

Sections 4.1 to 4.3 describe models based on the market structures of imperfect competition and conjectural variation. Many models of IIT based on alternative market structures and types of competition have been devised since the work of Grubel and Lloyd (1975). Several of these models have been inspired by the advances made by Dixit and Stiglitz (1977) and Lancaster (1979) in modelling preference diversity and scale economies in a general equilibrium framework.

The numerous models which have been developed in the last twenty years or so will be divided into 'large numbers cases' (section 4.1) and 'small numbers cases' (section 4.2), following Greenaway and Milner (1987) and within those two categories the structure will be as suggested by Greenaway and Milner (1986). In section 4.3, the analysis will be extended to cover multi-product and multi-national firms.

Some authors believe, however, that models of IIT do not require the relaxation of H-O assumptions and consequently have developed H-O models to explain IIT. These will be discussed in section 4.4.

4.1 'LARGE NUMBERS' MODELS OF INTRA-INDUSTRY TRADE

These models are set in imperfectly competitive markets and assume a large number of producers, freedom of entry, and features of imperfect competition, namely economies of scale and/or diverse consumer preferences. Consumers demand a single, horizontally differentiated variety, or a single, vertically differentiated variety, or all available varieties. These are general equilibrium models which allow for factor endowments to vary and for the existence of inter and intra-industry trade. The results are that the direction of trade is determinate in these models and that the split between inter- and intra-industry trade depends on initial factor endowments.

4.1.1 NEO-HECKSCHER-OHLIN INTRA-INDUSTRY TRADE

There have been several efforts to reconcile IIT and H-O theory. These attempts have been called neo-H-O models, in contrast to the H-O and H-O-R (R for Ricardo) models, which adhere more strictly to the H-O assumptions in explaining IIT (see section 4.4 below).

Falvey (1981) and Falvey and Kierzkowski (1987) developed models where differences in factor endowments determine the direction of IIT flows. Similarities to the H-O model are that there are two countries, two factors (capital and labour), and factor endowments are different between the two countries. Falvey's (1981) model differs from the H-O model in two respects:

- Capital is industry-specific and immobile between sectors, and
- At least one sector produces a vertically (quality) differentiated product.

In addition, a product's quality is a positive function of its capital intensity. The demand side, which was made explicit in Falvey and Kierzkowski (1987), assumes that consumers prefer higher quality products, but that they are constrained by relative prices and income. Where the home country has a higher initial quality-specific capital-to-labour ratio, it will have a comparative advantage in high-quality varieties of vertically differentiated products, while the foreign country has a comparative advantage in low-quality varieties. Thus if there is a demand for a range of qualities then IIT will occur, in a manner consistent with the predictions of the H-O theorem. Each country exports qualities of products which use their abundant factor intensively.

Many quality-differentiated products might be expected to be subject to this so-called 'Falvey trade', but the question is whether it is properly construed as IIT or not. Gray (1988:220) contends that "the exchange of Fiats or Yugos for Rolls Royces or Mercedes is not intra-industry trade". Concentrating on reliability as a manifestation of quality, Gray argues that because improvements in reliability may be considered more capital intensive, it is necessary to define an industry in quite narrow reliability ranges. However, the consensus of most analysts would be to classify Volkswagens in the same category as BMWs. Furthermore, Greenaway and Milner (1986:10-11) state "one can just as easily think of examples where higher product quality does not follow from higher physical capital-intensity, hand-made clothing or footwear, or custom-built motor cars, are obvious examples".

4.1.2 NEO-CHAMBERLINIAN MODELS OF MONOPOLISTIC COMPETITION

Many models of IIT have extended the analysis of Chamberlinian monopolistic competition to an open economy. Products are differentiated and their production is subject to increasing returns; each firm has a measure of market power, but free entry drives profits to zero.

Krugman (1979, 1980, 1981, 1982) has devised several influential neo-Chamberlinian models of IIT. The main features of these models will be represented using Krugman (1980). There are economies of scale in production and firms can costlessly differentiate their products. Diversity of consumer preferences follows the 'love of variety' approach developed by Dixit and Stiglitz (1977). There are certain products that consumers like to consume in many varieties, so that variety is valued *per se*. For example, one might wish to drink white wine with certain meals, and red wine with other meals; one might usually wish to drink South African wine, but occasionally from a different estate or from another country such as France or Australia. One's welfare would be reduced if one were restricted to consume one varietal of wine, from one country, all of the time.

The Dixit-Stiglitz (1977) specification is that the number of potentially available (horizontally differentiated) varieties is infinite; but an element of fixed cost in production and the scarcity of resources limit the number of varieties supplied in a closed economy equilibrium. All varieties enter symmetrically into demand, so consumers will want to purchase as large a number of varieties as possible, as long as they do not differ too much in price. Admittedly, this means that each consumer buys minuscule amounts of each variety, but if all consumers are alike, then aggregation ensures a healthy demand for all varieties.

Krugman (1980) assumes one factor of production, labour, and that all goods are produced according to the same cost function, which is comprised of a fixed cost component and a constant marginal cost component. Therefore economies of scale are such that average cost will decline at all levels of output, but at a diminishing rate. Each good is produced by only one firm, because differentiation is costless and all goods enter into demand symmetrically. Prices of all goods are the same, and economic profits are eliminated by entry of new firms. Finally, the number of goods produced depends on the size of the fully-employed labour force (the resource constraint).

Trade is examined between two identical economies with zero transport costs, and it is assumed that labour is the only factor of production. Since the economies are identical, there can be no differences in factor endowments between the countries. Each good will be produced in only one country, for the same reasons that each good was produced by only one firm in autarky. Therefore twice as many goods (varieties) are available to consumers as before trade, at the same prices as before. Note that twice as many goods could have been had by consumers in autarky, but at higher prices. If consumers had chosen twice as many goods in autarky, they would have been able to afford less units of each, which means that the fixed cost per unit (and therefore the price charged) for all goods would have been higher. Welfare will increase even though the real wage is unchanged, because utility rises in proportion to the number of varieties consumed. All trade is IIT, which arises due to the interaction of economies of scale and preference diversity. Krugman (1980:956-958) goes on to show that, if consumers in the two countries in the model have sufficiently different tastes, each will specialise in goods for which it has the larger home market. This is confirmation of the Linder hypothesis (Linder, 1961).

The volume of trade in Krugman's model is determinate, but not the direction of trade (ie which country produces which goods). But, according to Krugman (1980:952) "nothing important hinges on who produces what within a group of differentiated products". Note that the gains from trade are due solely to increased product diversity, and that trade has not affected the scale of production in either country. An increase in scale as well as diversity is probably the normal case, according to Krugman, and can be achieved by assuming that elasticity of demand rises as the number of firms rises, once trade opens up. This would be plausible, as finer-differentiated products will likely be better substitutes for one another. The simpler assumption of constant elasticity, though, is far more tractable.

Venables (1984) examined models of the sort developed by Krugman, and found that small changes in the parameter values might lead to radical changes in the equilibrium of the model and the existence of multiple equilibria. Further criticism of Krugman's models came from Gray (1988:216-217), who described them as oversimplified. Krugman's specification of economies of scale as merely a fixed cost component means that, for established firms, economies of scale at the margin will be small once trade opens up. Furthermore, Gray takes Krugman to task with the assumption of constant marginal costs, whereas differentiated products require a marketing and distribution network, which could have increasing marginal costs, particularly on entering a foreign market. Gray is also critical of the absence of 'gradient' differentiation from Krugman's models, that is a mixture of horizontal (style) and vertical (quality) differentiation. Gray concludes that the models of Krugman and Lancaster (see below) "cannot pretend to the degree of precision that might be used for a more uniform body of goods. The large number of factors which can generate IIT argues for a paradigm rather than for a precise formal model" (Gray, 1988:227).

Many authors have used Krugman's basic models as a starting point for their analyses of particular determinants of IIT or to generate empirical hypotheses. Amiti (1998) uses Krugman's (1980) model and assumes that there are two countries which differ only in size, and that there are two imperfectly competitive industries which can differ in factor intensity, transport costs and demand elasticities. Capital is perfectly mobile between countries, not so labour, which is only mobile within countries. According to the 'new economic geography' theories of where firms will locate internationally (eg Krugman, 1991), the market access effect attracts firms to the larger country (to save on transport costs), while the production cost effect attracts firms to the smaller country due to its lower wages. The model predicts that inter-industry trade arises when the two countries are of differing size, although they may be similar in factor endowments, technologies and tastes. Even though the countries start off with equal capital-labour ratios, capital moves to the larger country and that country then exports the more capital intensive good. Then the pattern of trade is consistent with the H-O theorem, but in Amiti, comparative advantage arises endogenously.

The interesting aspect of Amiti's model is that while it purports to explain inter-industry trade (using Krugman's 1980 model of IIT!), one could nonetheless quite easily construe the two goods as vertically differentiated, Falvey goods, the exchange of which would amount to IIT (see the neo-H-O argument above). The large country would export the high quality, thus capital intensive variety, while the small country would export the low quality, labour intensive variety.

4.1.3 NEO-HOTELLING MODELS OF MONOPOLISTIC COMPETITION

The neo-Hotelling approach differs crucially from the neo-Chamberlinian approach in that horizontally differentiated product varieties enter into demand asymmetrically rather than symmetrically. That is to say, each consumer has an ideal or favourite variety, as articulated in Lancaster's (1980) model of IIT, rather than the Dixit-Stiglitz 'love of variety'. For example, an individual may be particular about only wanting to drink dry red wine. Nevertheless, in a population composed of individuals with different preferences for their favourite variety, there will be an evenly spread taste for a variety of wines in the population as a whole. Therefore, upon aggregation of consumers, there is a taste for variety, effectively similar to that in the 'love of variety' approach.

Goods in the Lancastrian approach are combinations of continuously variable characteristics, or attributes. In Lancaster's characteristics approach (Lancaster, 1979:17),

> [i]ndividuals are interested in goods not for their own sake but because of the characteristics they possess ... Differences in individual reactions to the same good are seen as expressing different preferences with respect to the collection of characteristics possessed by that good and not different perceptions as to properties of the good.

The usual assumption that preferences are stable is taken by Lancaster to mean that preferences over characteristics are stable. But preferences over goods may change if their combinations of characteristics change. Since goods are purchased for their characteristics, Lancaster views goods as a transfer mechanism: characteristics are bundled up into packages (goods) in the manufacturing process, pass through distribution and marketing, and are then "so to speak, opened up to yield their characteristics again at the point of consumption" (Lancaster, 1979:21). Consumer welfare is therefore determined by the characteristics available for consumption, and how efficiently these are embodied in goods, for transfer to consumers. Thus the efficiency of the production process depends on the design of goods as well as the resources required to produce them.

In order for goods to be fully separable into groups, Lancaster (1979:25) specified that:

1. all goods in the subset possess certain characteristics in common,
2. none of these group characteristics is found in any goods outside the group (so-called outside goods), and
3. consumers' utility functions have the structure $U(v_g, v_{ng})$, that is, they are separable between subutilities derived from group characteristics (v_g) and nongroup characteristics (v_{ng}).

Full separability would be impossible to achieve without having inordinately widely defined groups, to ensure that group characteristics are not shared to some extent by outside goods. Lancaster (1979:25) maintains that it is sufficient for most purposes to have approximate full separability, in which the proportion of nongroup characteristics found in group goods, and the proportion of group characteristics found in nongroup goods, are both so small that they do not affect decision making. For the purposes of the present study, the product group corresponds to the concept of an industry. The correct definition of an industry is crucial to the empirical analysis of IIT (see chapter 5, section 5.2). In practice, it is extremely difficult to decide to what extent the overlapping of characteristics is to be allowed between goods in different groups, as defined.

Within product groups, the variation of characteristics gives rise to product differentiation in Lancaster's approach. Product differentiates correspond to different models of goods in the same group. Each differentiate is identified within its group by its specification, which depends on the mix of characteristics per unit quantity. Not all characteristics of a good need to be listed in its specification, as some characteristics are implied by membership in a group as defined. For example, all cars have four round wheels. Therefore it is possible to restrict the specification of a differentiate to a subset of characteristics which vary within a group.

Lancaster therefore defines product differentiation as a process of varying the specification of goods within a group. His analysis is concerned with horizontal product differentiation, whereby varieties or differentiates are merely changed relative to one another, not improved or deteriorated.

Consumers will consume varieties that embody their preferred mix of characteristics, or those varieties that come closest. The further away is an available variety from the ideal mix of characteristics, the less willing is a consumer to pay, according to a function assumed to be:

> the same for all consumers so that two consumers with quite different most preferred goods will have identical views with respect to two available goods which are at the same spectral distances from their respective most preferred goods. (Lancaster, 1980:154).

It is this aspect of distances from ideal blends of product attributes which has led to such models being dubbed 'neo-Hotelling', as there are similarities to location theory. Another property of the Lancastrian utility function is that of non-combinability: if variety 2 is most preferred, but only varieties 1 and 3 are available in the product spectrum, the consumer cannot purchase both in order to obtain the ideal mix of attributes, although this might be feasible for certain goods in reality.

Production in Lancaster's model is subject to initial decreasing costs (a U-shaped average cost curve), so the number of varieties will be limited and some consumers will have to settle for the closest variety to their most preferred. Each producer makes only one variety, distinct from all other varieties, in order to maximise profit. Free entry and an equal density of consumer preferences mean that varieties produced will be equally spaced along the product spectrum; each variety will have carved out an equal market niche, and each will fetch the same price. There is also a sector producing outside goods, which in this model are homogeneous agricultural goods produced under constant returns, and which are sidelined for most of the analysis. The equilibrium, with differentiated products, scale economies over the relevant range of output, and zero profits due to free entry, conforms to Chamberlin's version of monopolistic competition. Lancaster (1980:157) maintains however that

> [t]he market structure derived here can be called perfect monopolistic competition since it represents the Nash equilibrium of perfectly informed firms facing perfectly informed consumers under conditions of perfect flexibility in choice of specification, absence of collusion, and free and willing entry.

A doubling of the population in autarky increases the demand for all varieties; therefore producers expand their output and earn economic profit as average cost falls. Attracted by the profits to be made, new producers enter the market and each introduces a new variety, which reduces the output of existing producers and eliminates excess profits as costs rise once more. Consumers are better off as they have a greater variety of products, at much the same prices as before. Trade is now considered as between two identical economies, and conditions are analogous to a doubling of the population. Each variety is produced by one firm in only one country and half of each firm's production is consumed domestically, the other half being exported. IIT takes place as foreign varieties are imported and domestic varieties are exported. Consumers have more varieties to choose from and therefore more consumers will be able to find their ideal variety.

As in Krugman's (1980) model, it is preference diversity that causes IIT, and the volume of trade is determinate, but not the direction (ie which country produces which varieties). Lancaster (1980:167-68) proceeds to consider differences in country size. In autarky, the large country will produce more varieties at a lower unit cost than the smaller country, but this is a 'false comparative advantage', as it is shown that with trade, each good is produced at the same average resource cost. The small country will import more than half the varieties and gains more from IIT than the large country. The H-O case of different factor endowments is also examined (Lancaster, 1980:171-72). The capital-rich country produces a higher ratio of manufactured to agricultural goods than the labour-abundant country, and is therefore a net exporter of manufactures and a net importer of agricultural goods. This conforms to the H-O prediction, but there is also IIT in manufactures, as each variety is produced in only one country. The more similar are the countries' factor endowments, the less net trade will take place and the more IIT. This has also been confirmed in Helpman's (1981) model of IIT.

4.2 'SMALL NUMBERS' MODELS OF INTRA-INDUSTRY TRADE

Oligopolistic markets have a few interdependent producers who influence and react upon each other's behaviour, of which they are uncertain. The way in which oligopolists' behaviour might vary is referred to as conjectural variation. Three different types of conjectural variation are considered here: the Cournot assumption of zero conjectural variation in a single-stage game, the Bertrand assumption in a three-stage process, and a modified Bertrand assumption which generates consistent conjectures in a two-stage process.

4.2.1 COURNOT BEHAVIOUR AND TRADE IN IDENTICAL GOODS

The Cournot assumption is that each of two duopolists takes the other's output as given and then decides on its own output. Each duopolist's conjecture is to ignore the other's response to its own decision. That is why the Cournot assumption is known as zero conjectural variation. Once equilibrium is attained, each firm charges the same price and each supplies one-third of what a competitive industry would have supplied (two-thirds in total). The Cournot model is unrealistic and ignores the oligopoly problem, but it does have a determinate solution and has been used in a number of models of IIT, for example Brander (1981) and Brander and Krugman (1983).

Brander and Krugman (1983) assumed two identical countries with one producer of an identical commodity in each country. If we assume zero transport costs and constant marginal costs, each producer supplies half the market in each country, which amounts to IIT ('cross-hauling' is Brander's term). Incorporating 'iceberg' transport costs into the analysis renders marginal costs of exports higher than output for domestic consumption. Iceberg costs are so named because it is assumed that freight charges form a part of the export that 'melts' en route. The result is that the domestic firm keeps a larger share of the market for itself, in proportion to the level of transport costs. The need to sell in both markets at the same price means that ex-factory prices for export are lower than those for domestic sale, as producers must absorb transport costs. Immediately it is evident that price discrimination exists, so the IIT in these models has been labelled reciprocal dumping by Brander and Krugman (1983). Note that although such trade involves unnecessary transport costs, increased competition will improve welfare - after all, each producer is a monopolist in autarky.

Hwang (1984) extended the analysis to include more conjectural variations, from perfect competition, through zero conjectural variation, to collusive oligopoly. The outcome is that the amount of IIT varies, from zero in pure competition (the local firm doesn't face transport costs) to larger amounts as competition decreases. Free trade was found to hurt consumers if firms colluded.

Donnenfeld (1986) devised a model of IIT in identical commodities which depends on imperfect information about product quality. Consumers have imperfect information about product quality of imports once trade opens up, leading to two-way trade in identical goods. As consumers learn from experience, this will be a short-run phenomenon for each product.

4.2.2 NATURAL OLIGOPOLY AND TRADE IN VERTICALLY DIFFERENTIATED GOODS

Where products are differentiated according to quality and it is assumed that substantial investment in research and development is required to improve product quality, there are barriers to entry and thus it is likely that a natural oligopoly will emerge. Models such as that of Shaked and Sutton (1984) describe a three-stage (Bertrand) decision process: whether to enter a market; what quality to produce; and at what price. Trade is examined as between two identical countries with two firms each, producing two qualities of a differentiated good. Consumers all have identical tastes and will rank varieties according to quality. Consumers are uniformly distributed on a continuum of income from low to high, which affects their ability to pay for quality. In autarky, each market supports two firms.

Because the number of qualities is independent of the size of a country, the short-run impact of opening up trade is that two firms are forced out by competition and two remain to supply the expanded market. Trade is IIT, as each country exports one variety and imports the other. After trade, the two varieties will be priced lower. With more firms per country and different income distributions in each, trade will reduce the number of firms, but not to the extent of cutting the number in half. In the long run, trade improves welfare due to lower prices and quality improvement throughout the range of varieties.

With identical countries, the direction of trade is indeterminate, but if income distribution is different between countries then the higher-income country will specialise in high-quality varieties, with the lower-income country specialising in lower-quality varieties. This result conforms to the Linder (1961) hypothesis, and is in agreement with the Falvey (1981) result if it turns out that the higher-income country is relatively capital abundant. The results of Shaked and Sutton (1984) are dependent on the assumption that quality improvements are due primarily to heavy research and development outlays, whereas average variable costs are assumed constant; otherwise the result is a large-numbers solution. Examples of industries best served by these sophisticated 'natural oligopoly' models are cars and consumer electronic goods.

4.2.3 OLIGOPOLY AND TRADE IN HORIZONTALLY DIFFERENTIATED GOODS

The model of Eaton and Kierzkowski (1984) considers trade in horizontally differentiated goods, in a structure where decisions concerning entry, product specification, and price and output are taken sequentially, rather than simultaneously. The demand side of the model is Lancastrian, while the cost function for any firm is

$$C(Q) = K + c\,Q$$

where K is fixed cost, incurred before any decision as to output level; and where c is marginal cost. An even distribution of consumer preferences would lead to a large-numbers (monopolistic competition) solution, were it not for the following restrictions imposed by Eaton and Kierzkowski.

- Only one type of consumer, demanding one ideal variety, or
- Only two types of consumer, with different ideal varieties.

No justification is given for this restriction , but Greenaway and Milner (1986:38) state "one could view it as representing a situation where tastes are 'clustered' around a particular specification(s) as a result, for instance, of bandwagon effects".

If there are two varieties, designated *V1* and *V2,* and the corresponding numbers of consumers interested in these two ideal varieties are *n1* and *n2,* then the number of producers in the market is determined by *K, c, n1, n2, p1, p2,* and the distance between *V1* and *V2* on the product spectrum. If *K* and *c* are large, and *n1, n2, p1* and *p2* small, then entry is not even feasible for one producer. But if *K* and *c* are smaller and *n1, n2, p1* and *p2* are large enough to encourage entry, then the market will be served by one or at most two producers.

The case of two types of consumer and two most preferred varieties is relevant to IIT. Consider a Lancastrian product spectrum, as represented in figure 4.1 (a) below. Points along the spectrum reflect different combinations of two product attributes, which comprise the specifications of different product varieties. As one moves to the right along the product spectrum, so the varieties incorporate more of one attribute, but less of the other. If there are only two ideal varieties, these may be indicated as *V1* and *V2* on the product spectrum in figure 4.1 (a). The sequence of events in the model is as follows. First, if it is feasible, one firm enters the market and produces a variety. Other firms take this variety as given, in deciding whether or not to enter. If the first firm chooses to offer one variety, it will try to deter other firms from entering by locating its variety on the product spectrum at *V3,* between the two ideal types *V1* and *V2*. This is viable if *V1* and *V2* are close enough in the specification of their attributes to one another (see fig 4.1 (a)). But it may be impossible to prevent another firm entering the market if the two ideal varieties are further apart, as in figure 4.1 (b). In this case, the first firm produces one variety and subsequently a second firm will enter the market and produce the other variety.

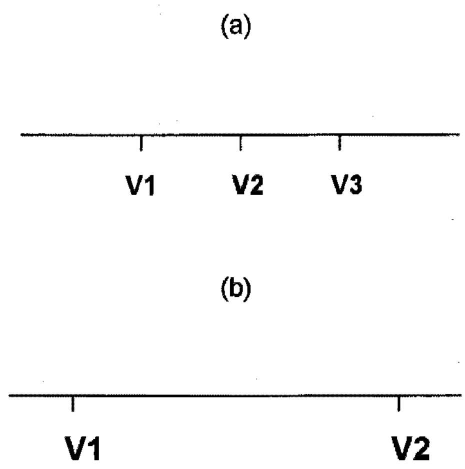

Figure 4.1 The location of differentiates on the product spectrum (Source: Greenaway and Milner, 1986:39)

The interesting part of Eaton and Kierzkowski's (1984) model is how further profitable entry is deterred. If a third firm were to enter the market between *V1* and *V2,* the demand for its variety would be negligible, given the concentration of tastes at the existing varieties *V1* and *V2.* On the other hand, should the new entrant take on either of the incumbent firms by producing *V1* or *V2,* a Bertrand price competition would take place, driving price down to marginal cost and forcing the exit of one firm. Where two firms occupy the market as duopolists, Eaton and Kierzkowski specify asymmetrical expectations with regard to price cuts and price rises. When considering a price reduction, each firm makes the Bertrand assumption that the other's price will not change. Nevertheless, the initial price was chosen to ensure that profit cannot increase by selling to both consumers at a lower price, as long as the other firm's price is constant. On considering a price rise, each firm assumes that the other will cut its price, in an attempt to supply both consumer types. Therefore, once established, equilibrium is stable as neither firm has an incentive to change its product price.

Once trade is considered between two countries identical in every respect as described above, equilibrium will be established with a single producer for each variety, sold at lower prices than before. Should one producer be located in each country, then IIT in style-differentiated goods takes place. This is not a necessary outcome however, for the model has a homogeneous goods sector too, so one country may specialise in and export both varieties of the differentiated product, and import the homogeneous good. The extent of IIT will rise though, the more similar are taste patterns in the two countries, the more equal they are in size, and the more alike are their ideal varieties.

4.3 MULTI-PRODUCT FIRMS, MULTI-NATIONAL FIRMS AND INTRA-INDUSTRY TRADE

So far we have implicitly assumed that each firm produces only one product and operates in only one country. Now we relax that assumption and examine the impact of multi-product and multi-national firms on IIT.

4.3.1 MULTI-PRODUCT FIRMS AND INTRA-INDUSTRY TRADE

Although reference is made to multi-product firms, we take this to mean that a firm considers producing more than one variety, differentiated horizontally or vertically. Greenaway (1982) makes use of Lancaster's (1980) model of IIT in horizontally-differentiated products (see section 4.1.3 above) to compare the benefits and costs, to new firms and incumbent firms, of introducing a new variety to the market.

Two existing varieties are initially produced, each by one firm only. Denoted as *V1* and *V2,* these varieties are represented on the product spectrum *xy* in figure 4.2 (*x* and *y* are product attributes appearing in different proportions along the continuum). The graphs of producer surplus for *V1* and *V2* are *abc* and *cde* respectively, whereas consumer surplus for *V1* and *V2* is shown added vertically to producer surplus as *afcb* and *cged* respectively. Assume a third variety, *V3,* is to be introduced, between *V1* and *V2:* the associated consumer and producer surpluses are shown in figure 4.2 as *V1hV2n* and *V1nV2* respectively. The producer of *V3* will capture *jV3* of the market from the producer of *V1,* and *V3k* from the producer of *V2,* thereby acquiring producer surplus of *jmnrk.* A new firm will enter the market and produce *V3* as long as *jmnrk* is greater than the fixed costs involved. The incentive for an incumbent firm to introduce *V3* is smaller than for a new firm, since part of the producer surplus gained is merely an internal transfer from *V1* or *V2*. For example, if the producer of *V1* were to start producing *V3,* then *jmc* would be the amount of producer surplus transferred from *V1* to *V3.* The net gain in producer surplus is *mnrkc,* which is less than *jmnrk*. If we assume that the fixed cost of introducing *V3* is the same for new and existing producers, there are greater incentives for new firms to produce *V3* than for incumbent firms.

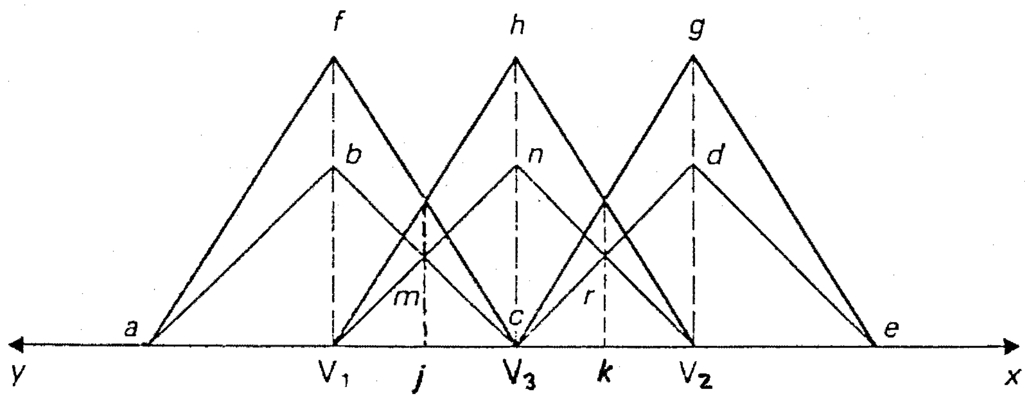

Figure 4.2 Consumer surplus and producer surplus, represented on the product spectrum (Source: Greenaway and Milner, 1986:45)

Greenaway (1982) cites several reasons why incumbent firms might nevertheless produce new varieties. Where fixed costs of product development are sunk costs (ie non-recoverable), incumbent firms may wish to pack the product spectrum with varieties in order to discourage entry and so avoid the costs of altering product specification. The more varieties offered by an incumbent, the lower are the potential gains in producer surplus to new entrants. Greenaway and Milner (1986) also mention that multi-product economies of scale and economies of scope may give a decisive advantage to incumbent firms over new entrants. The former refers to the ability to spread overhead costs across more than one variety, while the latter is due to the flexibility of modern capital equipment: for example, the use of robotics in car production lines can enable one production line to produce several varieties with minimal adjustments and downtime.

IIT can arise between countries with multi-product firms for the same reasons as discussed in section 4.1.3 above: taste overlap, the distribution of preferences over the product spectrum in each country, and the economies of scale brought about by trade. Similarly, economies of scope can stimulate IIT so that firms in different countries may specialise in ranges of product varieties. If firms can produce more than one variety of a product, however, there is the possibility that they will do so in order to deter entry of foreign firms too, thereby preventing or diminishing IIT.

4.3.2 MULTI-NATIONAL FIRMS AND INTRA-INDUSTRY TRADE

Norman and Dunning (1984) have applied Dunning's OLI paradigm of the motives behind foreign direct investment (FDI) to the analysis of IIT. The OLI paradigm (for ownership, location and internal) identifies three types of reasons why firms might undertake FDI. First, a firm should own (hence *O*) patent rights, technological know-how, or brand image on its product(s). Secondly, the foreign location (*L*) should offer access to raw materials, cheap labour, immunity to tariffs and quotas, and responsiveness to market trends such as changes in tastes. Thirdly, firms wish to control the production and distribution of their products internally (*I*), rather than relying on arms-length agreements such as foreign licensing.

Further development of these ideas is reported in Greenaway and Milner (1986:51-53). The decision of whether to invest in production facilities abroad or to export instead depends on several factors, including:

- relative unit production costs at home and abroad;
- additional 'costs of control' for foreign investments;
- export marketing costs versus domestic marketing costs; and
- the value of patents, brand image and know-how.

With horizontally-differentiated products, the choice of location is unlikely to depend on differences in factor prices, as Kol (1988:30) has pointed out. IIT is expected to arise as varieties move from their production locations to their markets. With vertically differentiated products, firms may decide to locate their production of low quality varieties where labour is cheap, if quality is a function of capital-intensity (see neo-H-O models, above). Motta's

(1994) model of IIT incorporated FDI and predicted that IIT would only take place between a large (capital-rich) country and a small country if the quality gap were not too great. A large quality gap (out of proportion to price differences) would make it difficult for the small country to sell its low-quality variety to its own consumers, let alone export the product. FDI would put domestic producers out of business in the small country in this situation and inter-industry trade would occur.

Overall, it is not certain whether FDI encourages or inhibits IIT (Norman and Dunning, 1984). Sometimes FDI is a substitute for IIT, and sometimes the two go hand-in-hand. A large part of IIT associated with multi-national firms is in fact intra-firm trade. In turn, a large share of intra-firm IIT is foreign processing (or sourcing), that is to say, the exchange of intermediates for final products.

4.4 HECKSCHER-OHLIN AND HECKSCHER-OHLIN-RICARDO MODELS OF INTRA-INDUSTRY TRADE

Several authors maintain that despite the findings of Leontief (1953), H-O or H-O-R models can successfully explain modern patterns of global trade. Several different approaches have been taken in order to reconcile traditional H-O theory with the occurrence of IIT. These will be discussed in section 4.4.1. The introduction of Ricardian technical factors into an H-O model of IIT by Davis (1995) is unique in the literature and will be discussed in section 4.4.2.

4.4.1 HECKSCHER-OHLIN MODELS OF INTRA-INDUSTRY TRADE

There have been several ingenious attempts to explain away the Leontief paradox and to reconcile the H-O theory with the prevalence of IIT. Wood (1994) contends that most empirical tests of the H-O theory (eg Leontief, 1953) have mis-specified capital by treating it as similar to land, whereas capital is internationally mobile and does not greatly influence the pattern of trade. The definition of factors of production should accordingly be restricted to inputs that are internationally immobile - skilled and unskilled labour, land, and infrastructure. Wood found that even a 'skilled-and-unskilled-labour-only' H-O model provided an accurate explanation of North-South trade in manufactures (inter-industry trade and IIT). The link between the skill intensity embodied in goods traded and the relative skill endowments of the two regions was established. Wood acknowledged that North-North trade is likely to be dominated by IIT, due to economies of scale, variation in tastes and imperfect competition. His argument is that H-O theory is complementary to the new trade theories in that it explains North-South trade in manufactures and is also likely to give a good account of trade in primary products.

A different tack was taken by Ethier (1982), who developed an H-O model that explains IIT without recourse to economies of scale or product differentiation in final goods. Ethier's is a factor-endowments model with two countries, two primary factors and two final goods, wheat and manufactures. Wheat is land intensive and manufactures are capital intensive. The model incorporates product differentiation and economies of scale in the intermediate stages of production only, such that the assumption of perfect competition is not violated. The trick is that the two final goods are not themselves differentiated, but manufactures are presumed to be assembled costlessly from differentiated manufactured components. Most other models of IIT treat consumer goods as differentiated (rather than components, or producer goods), but Ethier (1982:391) is quick to point out that producer goods are more widely traded than consumer goods.

The number of components embodied in the production of manufactures rises as the size of the market for manufactured goods increases (with trade, for example). A larger number of components embodied in manufactures reflects a greater division of labour, which Ethier (1982:392) calls 'international' returns to scale, as they are due to an expansion of the market for manufactured goods. These economies are external to the individual firm, so that firms will not tend to expand and eliminate their competitors. In turn, each component itself is produced subject to economies of scale in the traditional sense, or what Ethier calls 'national' returns, involving considerations of minimum plant size (the existence of fixed costs) and requiring total production to be geographically concentrated. These economies are assumed to be internalised and exhausted by firms. Components are assembled into finished manufactures by competitive firms, each of which operates according to constant returns to scale, as the number of components in the production process is taken as a parameter.

Ethier's use of international returns to scale implies a theory of IIT in intermediate goods (components). In free trade equilibrium, each component is produced in only one country, so that the two countries produce distinct collections of differentiated components. These components are then traded (IIT) and subsequently assembled costlessly into finished manufactures where consumed. Ethier's results are best illustrated with extreme cases. If factor endowments are sufficiently different so that one country specialises in wheat, there is no IIT. But if the two countries are equally endowed with capital and labour, each country will be self-sufficient in wheat, and IIT will be at a maximum as the countries produce (and trade) distinct collections of an equal number of components. Therefore IIT, as well as net trade, is sensitive to factor endowments, whereas the H-O theory was originally put forward to account for only the occurrence of net trade.

Whereas Ethier (1982) showed how IIT depends upon factor endowments, the model developed by Rodgers (1988) demonstrates that IIT increases as the production functions of goods grouped into the same industry become more similar. Her analysis concentrates on models containing many goods and many factors. In models of two countries, it is possible for there to be IIT within industries using similar capital-labour ratios. In the two-factor/three-good case, one country may export the most capital intensive and the most labour intensive goods and import the good of intermediate factor intensity. If the three goods are grouped into two industries according to similarity of capital-labour ratios, then there will be IIT in the industry composed of two goods.

With more than two factors of production, production functions can no longer be compared by simple factor ratios. Instead, the Euclidian distance between the elasticities *(ß)* in the Cobb-Douglas production functions are used to measure the similarity between two production functions, *m* and *n* (Rodgers, 1988:9):

$$d_{mn} = \sqrt{\sum_{i=1}^{3} (\beta_{im} - \beta_{in})^2}$$

Rodgers (1988) creates a two-country, four-good, four-factor H-O model, with two industries, each of two goods. She uses this model to investigate the relationship between IIT and the similarity of production functions of goods grouped into the same industry.

Country One is relatively well endowed with factor 1 and Country Two is relatively well endowed with factor 3, whereas both countries have equal endowments of factors 2 and 4. It is assumed that the goods in one industry have more similar production functions than those in the other industry (as measured by Euclidean distances). Therefore goods 1 and 2 form industry A, and industry B comprises goods 3 and 4. In addition, the production functions of goods 1 and 2 are less similar than those of goods 3 and 4.

The results of the model are as follows. In industry A, Country One exports good 1 and imports good 2, and exports of good 1 exceed imports of good 2 (the matched trade is IIT). In industry B, Country One imports good 3 and exports good 4; imports of good 3 exceed exports of good 4 (again, the matched amounts are IIT). Thus Country One is a net exporter of the services of factor 1, with which it is relatively well endowed, and a net importer of the services of factor 3, with which it is relatively poorly endowed.

Rodgers (1988:14-16) proves that the industry containing the two goods with the more similar production functions (industry B: goods 3 and 4) has more IIT as a proportion of total industry trade. She goes on to prove that IIT, as a share of total trade in the economy, rises as production functions of goods in the same industry become more similar. These conclusions were reached without introducing economies of scale or monopolistic competition into the analysis. In this sense, Rodgers' model conforms more closely to the assumptions of the H-O theory than does Ethier's model, in which scale economies and product differentiation are merely pushed out of view rather than excluded altogether.

4.4.2 A HECKSCHER-OHLIN-RICARDO MODEL OF INTRA-INDUSTRY TRADE

Davis (1995) devised a model of IIT which does not rely on economies of scale or monopolistic competition. His reason for excluding economies of scale was the following (Davis, 1995:202):

> Theory suggests that some degree of economies of scale is necessary to induce specialisation and trade: beyond this there should be a range in which scale economies are unrelated to the volume of intra-industry trade; and only when the scale economies force great concentration of production should it start to reduce this trade.

Davis considers that the intermediate range is relevant, so he excludes economies of scale from his model. Instead, he introduces Ricardian determinants of trade into an H-O model, in order to explain the occurrence of IIT. His model may thus be described as Heckscher-Ohlin-Ricardo (H-O-R). The definition of IIT, as trade in goods of similar factor intensity, indicates the possibility of substitution across such goods in production. The large number of goods relative to factors indicates that some sectors may be expanded and others contracted without rising opportunity costs in the expanding sectors. These two features of IIT suggested to Davis the relevance of Ricardian determinants of trade.

Davis calls goods which have identical factor intensity at any common factor prices 'perfectly intra-industry' goods. These goods are identical in consumption (eg, identical televisions), rather than being differentiated on the demand side (which would necessitate the introduction of monopolistic competition). They are, however, assumed to differ on the production side by *Hicks-neutral shifts.* These are cross-country, technical (Ricardian) differences in productivity in the perfectly intra-industry goods. With N goods and M factors, a country's matrix of optimal technical coefficients (Davis, 1995:207) might be:

$$A(\Omega) = [A_1\, A_2 \ldots A_N] = \begin{bmatrix} a_{11}\; a_{12} \ldots a_{1N} \\ a_{21}\; a_{22} \ldots a_{2N} \\ \cdot \quad \cdot \quad \cdot \quad \cdot \\ a_{M1}\; a_{M2} \ldots a_{MN} \end{bmatrix}$$

Each column of $A(\Omega)$ is the optimal factor coefficient for a single good. If the columns of $A(\Omega)$ are linearly independent, then it is not possible to express one column as a linear combination of other columns. Therefore it is impossible for other sectors to release factors in the necessary proportion for use in an expanding sector. Expansion of the production of a good requires that some factor prices be bid up (changing the optimal coefficients), which yields increasing costs of the good in terms of the other goods. This gives the bowed-out appearance of the production possibilities frontier (PPF).

But this is not so if goods 1 and 2 are perfectly intra-industry goods: $A_1 = \alpha A_2$ (a Hicks-neutral shift). If there are cross-country technical differences (themselves Hicks-neutral) which motivate the expansion of one of these sectors, then the other can release factors in exactly the proportion used in the expanding sector, without increasing opportunity costs. Therefore technical differences alone, however small, can induce specialisation and trade.

Davis' model incorporates three goods: two of them (X_1 and X_2) are perfectly intra-industry goods as described above, and the third good (Y) represents the other industry. There are two factors (capital and labour) and X_1 and X_2 are capital-intensive relative to Y. A small cross-country technological difference in X_1 is reflected in the production functions:

Country One: $X_1 = AF(K_{X1}, L_{X1})\ ;\ A > 1$

Country Two: $X_1 = F(K_{X1}, L_{X1})$.

The full-employment integrated equilibrium derived by Davis (1995:209) is the resource allocation that would occur if both goods and factors were perfectly mobile (ie if the two countries were one). Within the integrated equilibrium, a set of partitions of world factor endowments may be derived in which the countries attain all the benefits of the fully integrated world by trade in goods alone, and in which factor prices are equalised. According to this Factor Price Equalisation set (FPE), production of the goods in which technologies are identical (X_2 and Y) is apportioned between the countries, whereas only Country One produces X_1, in which it has a technical advantage.

The production of goods X_1, X_2 and Y by the two countries can be represented graphically, as in figure 4.3. World factor endowments are represented by O_1K and O_1L or, equivalently, O_2K and O_2L. The division of world factor endowments between the two countries may be indicated by any point within the box diagram. The diagonal O_1O_2 is the locus of points according to which both countries have identical factor endowment ratios. Points closer to O_1 than to O_2 (whether on the diagonal or not) indicate that Country One has a larger share of total resources than Country Two, and vice versa for points closer to O_1 than to O_2. Endowment points above the diagonal indicate that Country One is capital-abundant relative to Country Two, whereas for points below the diagonal, Country One is labour-abundant relative to Country Two. Finally, factor usage in the production of the three goods is at fixed factor intensities, which are also the same between the two countries.

The quantities produced of the three goods are indicated by the vectors that extend from the two origins, O_1 and O_2. Since capital (K) is indicated on the y-axis and labour (L) on the x-axis in figure 4.3, the slopes k of the vectors reflect factor intensities, such that increases in k correspond to increases in capital intensity of production methods.

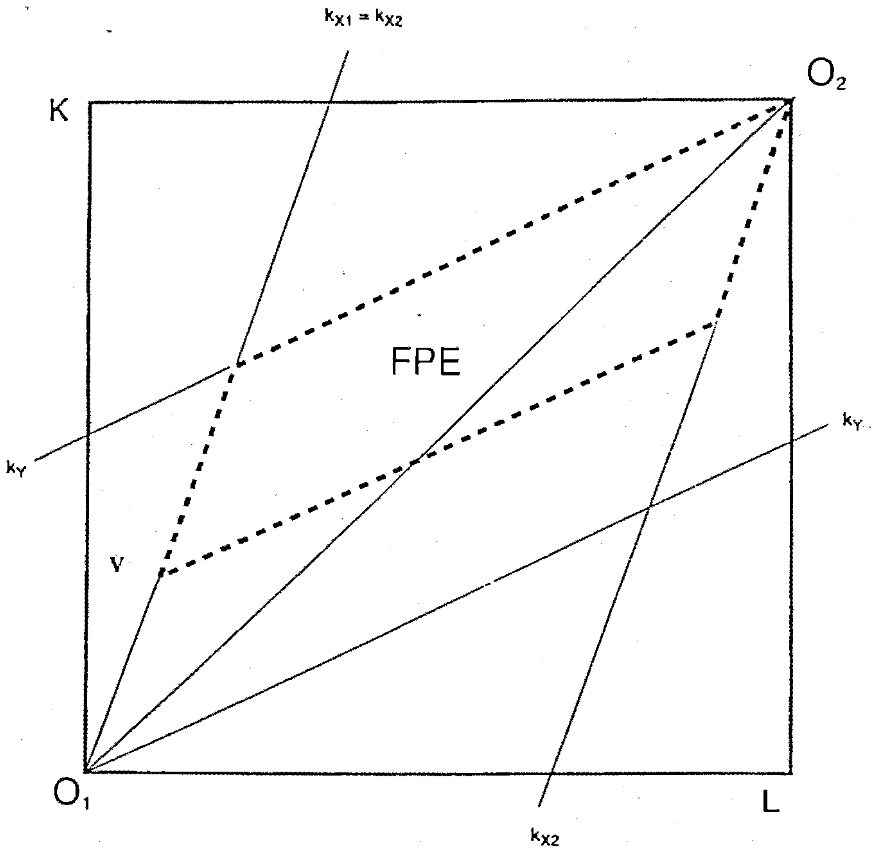

Figure 4.3 The Factor Price Equalisation set (Source: Davis, 1995:210)

The factor intensity of good X_1 is equal to that of good X_2, and both are more capital intensive than good Y. Therefore the slopes of the vectors representing the three goods are related as follows:

$$k_{X1} = k_{X2} > k_Y$$

Country One produces the world supply of X_1, as it has a technical advantage in producing that good. Hence point V is taken as a new vertex (or origin) for Country One. The vectors extending from the vertex V and the origin O_2 define cones for the two countries in factor space, within which the distribution of the production of goods X_2 and Y may be determined. The area of intersection of the two cones is the parallelogram defined by the broken lines, and labelled FPE in figure 4.3. Any world factor endowment that falls within this area allows for the replication of the integrated equilibrium. Therefore the factor price equalisation set is represented geometrically in figure 4.3 as the parallelogram enclosed by broken lines.

The figure also allows a simple analysis of trade patterns, once an isoincome line has been drawn (see fig 4.4, which contains a part of fig 4.3). An isoincome line divides world income between the two countries such that factor incomes are the same at any combination of endowment ratios traced out by that line. In figure 4.4, the isoincome line *ABCD* indicates the division of income between the two countries, in terms of its factor content. If we assume identical and homothetic tastes, the factor content of consumption anywhere along isoincome line *ABCD* is the intersection of the diagonal (O_1O_2 in fig 4.3) and the isoincome line. Along the isoincome line, the consumption vector is fixed, Country One produces the world supply of X_1, and there is reallocation of production of goods X_2 and Y. Recall that along the isoincome line *ABCD* and above or to the left of the diagonal, Country One is capital-abundant relative to Country Two, whereas below the diagonal, Country Two is relatively capital-abundant.

We can now examine the patterns of trade for different endowment ratios within the FPE set. For this purpose we refer to figure 4.4.

At point *A*, on the vector with slope k_Y, Country Two produces only good Y, which it exports for goods X_1 and X_2. This case is dubbed pure inter-industry trade by Davis (1995:211).

Moving towards *B*, Country Two starts producing X_2, but not enough for its own consumption, so it still imports X_1 and X_2 in exchange for its exports of Y. At point *B*, Country Two reaches self-sufficiency in X_2, so it no longer needs to import that good.

Note that in figure 4.4, the ray labelled $X_{2\text{-}SS}$ joins all endowment points at which Country

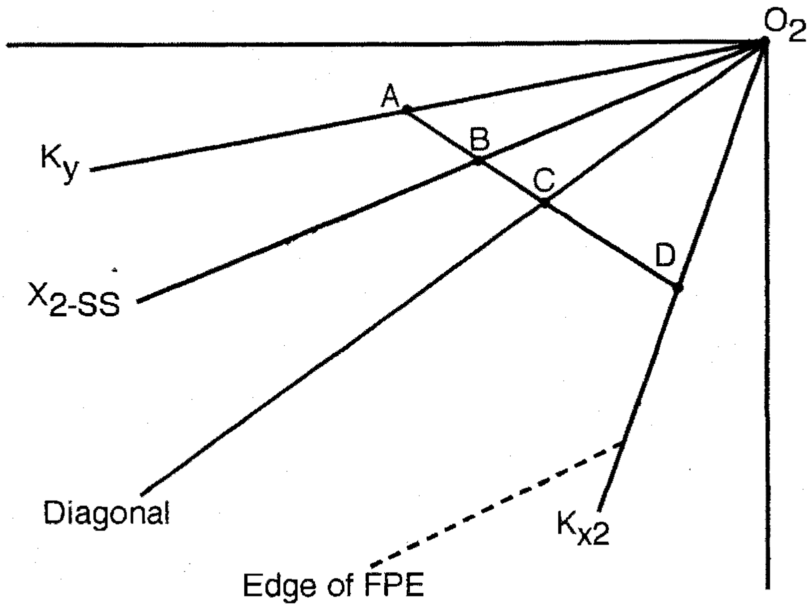

Figure 4.4 The pattern of trade (Source: Davis, 1995:212)

Two is just self-sufficient in the production of good X_2. Country Two exports *Y* in exchange for X_1, and this is what Davis calls partial inter-industry trade (as yet there is no IIT).

Proceeding away from point *B* towards point *C*, Country Two begins exporting X_2. That is, the labour-abundant country exports one of the capital-intensive goods; since it still imports the other capital-intensive good, there is now the emergence of IIT. At point *C* (on the diagonal), each country is self-sufficient in *Y*. Country Two imports X_1 in exchange for exports of X_2: this is called the case of pure IIT.

Going from *C* to *D*, Country Two is now relatively capital-abundant and begins importing *Y* as well as X_1, but continues to export X_2 . Country One is now labour-abundant and exports the labour-intensive good (*Y*) and one capital-intensive good (X_1), but is a net importer of the intra-industry goods. At point *D*, Country Two produces and exports only X_2, in exchange for imports of X_1 and *Y*. As there is substantial inter-industry trade and IIT at this point, Davis calls it the case of heterogeneous trade.

The important aspect of Davis' model is that IIT arises within a traditional H-O-R framework, where IIT is in identical goods of identical factor intensity - unlike Falvey trade, where Rolls-Royces are lumped together with lower-quality Fiats. The main result of the model is that all trade is IIT when the countries have identical factor endowment ratios. Ricardian technical differences, as well as variations in the factor intensity ratios of the countries, are the determinants of trade patterns. No reliance is placed upon scale economies or imperfect competition.

4.5 CONCLUSION

In chapter 3, several types of IIT were identified as being the result of relaxing one or more of the H-O assumptions. But the assumption of perfect competition was not considered for relaxation, as this was thought to be a crucial assumption of the H-O theory. Nevertheless, it was acknowledged that two features of imperfect competition, namely economies of scale and product differentiation, are major causes of IIT. The present chapter has therefore examined modern theoretical models of IIT in which the assumption of perfect competition is relaxed. Instead, different types of imperfectly competitive market structures are assumed. This analysis was extended to cover the cases of multi-product and multi-national firms.

In section 4.4, several models of IIT were examined in which the assumption of perfect competition is maintained. These models are an attempt to defend the H-O theory against the challenge by Leontief (1953).

Bensel and Elmslie (1992) evaluate whether theorists are justified in clinging to the H-O theorem, in the face of the Leontief paradox and other empirical evidence at variance with the H-O predictions. Adopting the terminology of Lakatos (1970), the authors treat the H-O model as a scientific research programme (SRP), which can adjust to the presence of anomalies by means of either progressive or degenerating problem shifts. An SRP is progressive if it is able to meet successive problems and predict "some novel, hitherto unexpected fact" (Lakatos, 1970:118).

Bensel and Elmslie (1992:257) consider that Helpman's (1981) C-H-O model is successful in combining scale economies, monopolistic competition and IIT into an H-O general equilibrium model, in which IIT is given an endowment basis. Helpman's model predicted the novel fact that IIT is inversely related to differences in factor endowments. Being partly based on Helpman's model, the work of Davis (1995) would also be regarded by Bensel and Elmslie as a progressive problem shift, since further insights as to trade patterns emerge, and without the need to adopt the framework of imperfect competition and scale economies. Certainly, the contributions of Helpman (1981), Ethier (1982), Rodgers (1988) and Davis (1995) have successfully extended and generalised the H-O model so that it need not be entirely replaced by the new trade theories. These models maintained the H-O assumption of perfect competition. Indeed, one might well regard the H-O scientific research programme as being progressive, as it has successfully dealt with the problems it has encountered.

CHAPTER FIVE

METHODS OF MEASURING INTRA-INDUSTRY TRADE

The measurement of IIT is fraught with problems such as which index to use, whether or not to adjust for overall trade imbalance, what level of data aggregation to use, and how to measure changes in IIT over time. Section 5.1 presents the most widely used indices of IIT and intra-industry specialisation. Two measurement problems associated with IIT are discussed in sections 5.2 and 5.3. The measurement of IIT in intermediate goods is considered in section 5.4, and recently-developed methods of measuring changes in IIT are discussed in section 5.5.

5.1 MEASURES OF INTRA-INDUSTRY TRADE

Several measures have been devised to measure the static extent of IIT, based on the export and import data for a particular year. Two early measures were those of Verdoorn (1960) and Balassa (1966), which will be described in section 5.1.1. The standard measure of IIT is the Grubel-Lloyd (1975) index, which is discussed in section 5.1.2. An alternative measure, examined in section 5.1.3, is the Michaely (1962) index, which measures intra-industry specialisation rather than IIT.

5.1.1 EARLY MEASURES OF INTRA-INDUSTRY TRADE

In his article on the intra-bloc trade of the Benelux countries, Verdoorn (1960) computed inter and intra-industry specialisation, for each industry, as the ratio

$$U_i = X_i / M_i$$

Exports from the Netherlands to Belgium and Luxembourg, of products in the *i*th industry, were represented by X_i, while M_i denoted Dutch imports of *i*th industry products from Belgium and Luxembourg. The ratio U_i varies from zero to infinity, whereas a value of 1 indicates complete intra-industry specialisation for that industry. There were two disadvantages of Verdoorn's ratio. First, any value of U_i, say $1/m$, indicates the same level of intra-industry specialisation as m itself. This happens if the values for X_i and M_i are switched. It is a problem because there is no unique value of the U_i index to represent different cases in which intra-industry specialisation is the same. Secondly, as a ratio, U_i does not indicate the proportion of total trade that is IIT.

A later measure developed by Balassa (1966) overcame these problems. $B1_i$ measures the proportion of total trade for industry i that is inter-industry, that is the proportion of trade that is not IIT:

$$B1_i = \frac{|X_i - M_i|}{(X_i + M_i)}$$

The value of $B1_i$ varies between 0 and 1 where 0 indicates complete IIT and 1 indicates no IIT (complete inter-industry trade). Aggregation across all i industries yields an unweighted average measure of IIT:

$$B1 = [1/n] . \Sigma \frac{|X_i - M_i|}{(X_i + M_i)}$$

5.1.2 THE GRUBEL-LLOYD INDEX

Grubel and Lloyd's (1975) index (*GL*) has already been introduced in section 2.2. It is re-introduced here so that different versions of the index may be explained. Like the Balassa index *B1, GL* takes on values between 0 and 1, except that a value of 0 indicates no IIT, whereas $GL = 1$ indicates that all trade is IIT.

IIT is what remains after deduction of inter-industry trade from total trade as follows:

$$IIT = (X_i + M_i) - |X_i - M_i|$$

Taking IIT as a fraction of total trade in industry *i*, we have:

$$GL_i = \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \qquad [5.1]$$

GL_i is a weighted index in that IIT in each industry (the numerator) is expressed as a share of total trade in that industry (the denominator).

Milner (1988) cautions that it is not always appropriate in empirical studies to make use of such IIT shares. They are certainly useful where one wishes to compare inter-industry differences in the share of IIT in each industry's trade. But the GL_i index is unable to indicate absolute amounts of IIT, or to compare these on an inter-industry basis, unless the amounts of total trade in each industry are equal. To illustrate, assume that the values of exports and imports in industry 1 are 50 and 25 respectively, and that the corresponding figures for industry 2 are 300 and 150. The GL_i scores are as follows:

$$GL_1 = [(50 + 25) - |50 - 25|] / (50 + 25) = 0,67$$

75 - 25 =/ 75

$$GL_2 = [(300 + 150) - |300 - 150|] / (300 + 150) = 0,67.$$

450 - 150 =/ 450

Also Consider pg 87 for Y/Y analysis

Industries 1 and 2 have the same ratio of IIT to total trade, but the absolute amount of IIT is greater in industry 2 (300 versus 50). Milner (1988:297) suggests that where the purpose is to compare absolute amounts of IIT between industries, the denominator should be the total amount of trade across that set of *n* industries:

$$GL'_i = \frac{(X_i + M_i) - |X_i - M_i|}{\Sigma (X_i + M_i)}$$

7

In the numerical example, the indices would be calculated as follows:

$$GL'_1 = [(50 + 25) - |50 - 25|] / (75 + 450) = 0{,}095$$

$$GL'_2 = [(300 + 150) - |300 - 150|] / (75 + 450) = 0{,}571.$$

Milner's index reflects the fact that the absolute amount of IIT in industry 2 is six times greater than IIT in industry 1. The GL'_i measure is therefore useful in studies which require the dependent variable to give some indication of the absolute amount of IIT. Note that Milner's index is usually preferable to an unweighted measure of the absolute amount of IIT, as it is possible to compare GL'_i scores directly with those for different time periods or different countries. Note also that GL'_i is always less than GL_i , unless there is but one industry under consideration.

The standard GL_i index is however far more widely used in empirical studies. In order to show the relation of the Grubel-Lloyd index to Balassa's index, equation [5.1] above may also be written as:

$$GL_i = \frac{(X_i + M_i)}{(X_i + M_i)} - \frac{|X_i - M_i|}{(X_i + M_i)}$$

Therefore

$$GL_i = 1 - B1_i$$

As mentioned in section 2.2, the GL_i index is sometimes referred to as a percentage (0 to 100) of trade that is IIT. This is achieved by multiplying the GL_i score by 100.

Grubel and Lloyd (1975) criticised Balassa's (1966) procedure of computing an aggregate measure of IIT across all *i* industries, which gives equal weight to the IIT score of each industry. Grubel and Lloyd weighted each GL_i measure by that industry's exports plus imports, as a share of the total exports plus imports of all the industries in the analysis.

Therefore each IIT score is weighted according to each respective industry's share of total trade:

$$GL = \Sigma \left[GL_i \cdot \frac{(X_i + M_i)}{\Sigma (X_i + M_i)} \right]$$

$$= \Sigma \left[\frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \cdot \frac{(X_i + M_i)}{\Sigma (X_i + M_i)} \right]$$

$$GL = \frac{\Sigma (X_i + M_i) - \Sigma |X_i - M_i|}{\Sigma (X_i + M_i)} \qquad [5.2]$$

The Grubel-Lloyd index, GL_i, has become the standard measure in studies of the level of IIT for particular industries, and their method of weighting has also been accepted where *GL* is used as an aggregate measure of a country's IIT.

5.1.3 THE MICHAELY INDEX

Whereas the Balassa and Grubel-Lloyd indices measure the overlap of export and import flows, the index devised by Michaely (1962) uses trade shares to measure the extent of intra-industry specialisation. The Michaely index takes exports at the industry level *i* as a fraction of total exports, compared with the same fraction for imports. Aggregation across industries yields:

$$E = \Sigma \left| \frac{X_i}{\Sigma X_i} - \frac{M_i}{\Sigma M_i} \right|$$

The value of *E* ranges from 0 (complete similarity of import and export shares in a country) to 2 (complete dissimilarity). To illustrate the relationship between IIT and intra-industry specialisation, as measured by the *GL* and *E* indices respectively, assume that:

$X_1 = 75$; $X_2 = 25$; $\Sigma X_i = 100$;

$M_1 = 25$; $M_2 = 75$; $\Sigma M_i = 100$.

IIT in industry 1 is 50, which is half of total trade in industry 1; thus GL_1 = 0,5. Similarly, GL_2 = 0,5, and aggregation across both industries gives GL = 0,5.

The Michaely index for this example is calculated as follows:

$$E = \left| \frac{X_1}{\Sigma X_i} - \frac{M_1}{\Sigma M_i} \right| + \left| \frac{X_2}{\Sigma X_i} - \frac{M_2}{\Sigma M_i} \right|$$

$$= |75/100 - 25/100| + |25/100 - 75/100|$$

$$= ½ + ½$$

$$= 1$$

The value of 1 is halfway in the possible range of E from 0 to 2, just as 0,5 is halfway in the possible range of GL from 0 to 1. It is possible to see the correspondence between the concepts IIT and intra-industry specialisation. Grubel and Lloyd (1975:27) proposed an alternative form of the Michaely index, F, which recognises the relationship between the two measures:

$$F = 1 - ½ \Sigma \left| \frac{X_i}{\Sigma X_i} - \frac{M_i}{\Sigma M_i} \right| \qquad [5.3]$$

Like GL, the value of F ranges from 0 to 1, so that 0 represents complete dissimilarity of trade shares and 1 reflects complete similarity.

The Michaely index is versatile: in addition to measuring the similarity of patterns of one country's exports and imports, it can be applied to measure:

- the similarity of export patterns between two countries/groups of countries, or
- the similarity of import patterns between two countries or groups of countries

The Michaely index suffers from the same drawback as the GL index in that it is based on ratios; therefore it gives no indication of the absolute amounts of trade flows involved.

5.2 THE DEFINITION OF AN INDUSTRY

IIT is defined as two-way trade in goods produced with the same factor intensities and with similar uses. The measures of IIT described in section 5.1 above must be applied to the available international trade data. Ideally, the data on exports and imports should be classified into industries containing "a group of production units producing, with the same factor proportions, goods which are similar in end-use thus satisfying similar consumers' needs (demands)" (Vona, 1990:385). In terms of product homogeneity, Vona attaches importance to both the factor inputs and the end uses of goods. Finger (1975) focuses on similarity of factor intensity only, whereas Falvey (1981) looks more at the specificity of factors, defining an industry by the range of products that a certain type of capital equipment can produce. In contrast, Lancaster's (1980:153) definition of an industry stresses consumption:

> all products, actual and potential, possess the same characteristics, different products within the group being defined as products having these characteristics in different proportions.

The definition of an industry with regard to product homogeneity is the subject of much debate. There are two related aspects to consider: first, the classification of products within industries, and secondly, the level of disaggregation of the data to be used.

Some authors, notably Finger (1975), emphasise the product classification aspect, arguing that the trade data are classified into heterogeneous categories. If the product categories are heterogeneous with respect to factor input mixes, then any IIT measured with such data is spurious, as one would expect two-way trade in goods with different factor contents to take place. Finger (1975) investigated the variation of input requirements, both within and between 3-digit groups of the SITC (Standard International Trade Classification) data. He found (p 586) that

> the proportion of variation in the US production characteristics which is within SITC groups is at least as large as the proportion of US trade which is between these

groups. Thus it is difficult to agree with Grubel and Lloyd's and Gray's presumption that the observation of exports and imports in the same category is reason to reject the factor proportions approach to trade theory.

Finger introduced the term trade overlap to describe the spurious IIT within SITC groups, and denied the existence of IIT, labelling it a statistical artefact. He argued that for US 3-digit trade data, there was more variation in factor intensities within groups than between groups. Pomfret (1979) studied Israeli trade data down to the 7-digit level of the ISIC (Industrial Standard International Classification) data and still found some degree of heterogeneity within the industry classes. Pomfret saw this as an indication of the need for even finer disaggregation of the data. Vona (1990) turns Pomfret's argument on its head by stating that together with 'some' heterogeneity of inputs within 7-digit categories, there is also 'a lot' of homogeneity. In a study of Swedish liquid pump trade, Jordan (1993) found that product heterogeneity existed even at the finest level of disaggregation of the HS (Harmonised System) data. But disaggregation did not reveal varying factor intensity in these products, and Jordan concluded that substantial volumes of true IIT exist.

Vona (1990) maintains that it is practically impossible to define an industry according to the H-O model, because trade statistics are not compiled according to H-O criteria, but also because each firm produces bundles of differentiated goods rather than one homogeneous good. Therefore one should concentrate on choosing the most appropriate disaggregation of the trade data rather than search for the 'homogeneous product industry' of the ethereal H-O world.

This brings us to the second aspect of the definition of an industry. If we assume that products are not misclassified, then what is the most appropriate level of disaggregation of the data to be used for IIT calculations? The correct level of disaggregation is one that allows the maximum homogeneity of products within an industry, without splitting up industries. Therefore industrial categories should be neither too wide (so as to avoid product heterogeneity within categories) nor too narrow (so as to avoid product homogeneity between categories).

Grubel and Lloyd (1975) examined the effect of disaggregation on the measured bilateral

IIT of Australia with several countries, including South Africa (see table 5.1). IIT decreased with disaggregation of the data as expected, but some IIT remained even at the finest level of disaggregation, the 7-digit SITC sections. In addition, differences in IIT among industries were insensitive to the level of aggregation chosen. A careful study of the SITC classification convinced the authors that the 3-digit classification placed goods into groups corresponding closest to the idea of 'industries'. One exception was the steel industry, for which the 2-digit level appeared more appropriate.

	Digit level of aggregation				
Country	**7**	**5**	**3**	**2**	**1**
USA	2,3	7,0	10,3	17,5	27,8
UK	1,0	3,1	5,7	9,3	23,5
Japan	0,2	1,5	3,3	7,2	12,2
New Zealand	2,8	12,3	19,3	30,1	50,5
South Africa	0,4	4,5	10,0	18,7	40,3
All countries	6,1	14,6	19,7	25,3	42,0

Table 5.1 Australian IIT (*GL, %*) with selected partners, 1968/69
(Source: Grubel and Lloyd, 1975:50)

Most studies of IIT have used the 3-digit SITC trade data. In the present study, the Harmonised System (HS) data will be used, disaggregated to the 4-digit level, which corresponds closest to the 3-digit SITC classification.

The level of aggregation of the trade data should be chosen so as to minimise aggregation bias. This occurs if sub-group trade imbalances have opposite signs. Within an industry i as indicated by a 3-digit category, there are several products and product groups *j* at a more disaggregated level, say the 4-digit level. The trade imbalance at the industry level $|X_i - M_i|$ may conceal opposite-signed imbalances at the product level $|X_{ij} - M_{ij}|$. This has the effect of increasing the numerator in the GL_i index ([5.1] above), which results in a higher measure of IIT than if trade imbalances at the product level had been of the same sign. Rewriting [5.1] to incorporate the product-level imbalances, we have

$$GL_i^D = \frac{\Sigma_j (X_{ij} + M_{ij}) - |\ \Sigma_j X_{ij} - \Sigma_j M_{ij}\ |}{\Sigma_j (X_{ij} + M_{ij})} \qquad [5.4]$$

It is clear that in the second term of the numerator in [5.4], the product exports and imports are first lumped together before their difference is taken, thus concealing any opposite-signed trade imbalances at the product level. An alternative approach is to calculate the product-level trade imbalances before the absolute value of their sum is computed. Therefore we can rewrite [5.4] as

$$GL_i^A = \frac{\Sigma_j (X_{ij} + M_{ij}) - \Sigma_j |X_{ij} - M_{ij}|}{\Sigma_j (X_{ij} + M_{ij})} \qquad [5.5]$$

Kol (1988:41) refers to the index in [5.5] as the aggregate measure, since the differences between exports and imports in the numerator are taken separately at the product level and subsequently aggregated. He renames the original GL_i measure in [5.1] the direct measure of IIT (hence GL_i^D in [5.4]), because the difference between industry exports and imports in the numerator is taken directly, after summing the product-level exports and imports. Kol (p 41) notes that because the imbalances between exports and imports at the product level are preserved in GL_i^A, whereas they are lumped together in GL_i^D, the following relation holds:

$$|\Sigma_j X_{ij} - \Sigma_j M_{ij}| \leq \Sigma_j |X_{ij} - M_{ij}|$$

and therefore

$$GL_i^D \geq GL_i^A$$

To illustrate, consider two cases (see table 5.2). In case 1, all trade imbalances at the product level j of industry i are of equal sign, whereas in case 2, exports and imports of product 1 have been interchanged relative to case 1. For each product, GL_{ij} represents two-way trade, and the IIT measures GL_i^D and GL_i^A have been calculated for both cases. Note that the GL_{ij} scores are the same between cases for all three products.

	Case 1			Case 2		
Product	X_{ij}	M_{ij}	GL_{ij}	X_{ij}	M_{ij}	GL_{ij}
$j =$ 1	50	10	0,33	10	50	0,33
2	50	25	0,67	50	25	0,67
3	50	50	1,00	50	50	1,00
Industry i	150	85		110	125	
	$GL_i^D = 0{,}72$			$GL_i^D = 0{,}94$		
	$GL_i^A = 0{,}72$			$GL_i^A = 0{,}72$		

Table 5.2 An example of aggregation bias (Source: adapted from Kol, 1988: 42)

In case 1, $GL_i^D = GL_i^A = 0{,}72$ as trade imbalances at the product level do not cancel and hence there is no aggregation bias. But in case 2, $GL_i^D = 0{,}94$ is higher than in case 1 (0,72). The value of GL_i^A however (0,72), is the same as in case 1, as this measure adjusts for aggregation bias.

The measure GL_i^A described above is one method recommended by Greenaway and Milner (1983) of detecting the presence of aggregation bias. But this is not to say that the index GL_i^A should be used in place of GL_i^D as a measure of IIT for industry i. Greenaway and Milner (p 905) advise that GL_i^A should only be used "for those activities where categorical aggregation is known to be a problem". But this is circular reasoning when the index has already been employed to test for the presence of aggregation bias. If opposite-signed imbalances at the product level are due to different factor input requirements between these products, it begs the question of whether a more disaggregated level of data shouldn't be used, in order to prevent industries being classified as products. A more time-consuming and subjective approach would be to re-group the data. Where the opposite-signed imbalances at the product level are not ostensibly due to different factor proportions, then the GL_i^D index should be used. In this case, product-level trade imbalances will be allowed to cancel each other out, as such trade flows will be considered homogeneous in terms of IIT. For example, if a country specialises in and exports product $j = 1$ within industry i and imports product $j = 2$, this might be 'true' IIT if $j = 1$ and $j = 2$ are differentiated varieties of the same product.

Occasionally, the data classifications are revised in a way that recognises increasing product diversity and specialisation of production processes. Therefore one would expect product categories to be more homogeneous just after a revision of the classification, and to become gradually less so until the next revision. The implication is that measured levels of IIT will decrease sharply after each revision of the underlying data classification, and increase gradually between revisions.

5.3 ADJUSTMENT FOR TRADE IMBALANCE

The second major problem associated with the measurement of IIT is the influence of a trade imbalance at the aggregate level (a trade surplus or deficit). The (unadjusted) *GL* index cannot reach its maximum value of 1 (or 100 per cent), because imports cannot match exports in every industry, regardless of the pattern of trade.

To avoid this property of the index, Grubel and Lloyd (1975) proposed an 'adjusted' index, *C,* in which the trade imbalance is subtracted from total trade in the denominator of the original, unadjusted index:

$$C = \frac{\Sigma (X_i + M_i) - \Sigma |X_i - M_i|}{\Sigma (X_i + M_i) - |\Sigma X_i - \Sigma M_i|} \qquad [5.6]$$

The adjusted index *C* measures IIT with respect to total balanced trade and can attain its maximum value of 1, even when it is based on data indicating an overall trade imbalance. *C* is related to the unadjusted *GL* index as follows:

$$C = GL \, . \, \frac{1}{1 - k}$$

$$\text{where } k = |\Sigma X_i - \Sigma M_i| \, / \, \Sigma (X_i + M_i)$$

There is disagreement on whether or not adjustment for trade imbalance is necessary. The fact that the unadjusted *GL* index is unable to reach a value of 1 in the presence of overall trade imbalance is noted as an undesirable feature of the index, and considered a downward bias by some authors, for example Grubel and Lloyd (1975) and Aquino (1978).

But others (eg Greenaway and Milner, 1981; Vona, 1991) feel that there is little justification for adjustment and that the Grubel-Lloyd method of adjustment is *ad hoc,* as it is equally distributed over all industries. The presumption of the *GL* adjustment is that a trade imbalance is a deviation from equilibrium: the adjustment therefore simulates the measuring of IIT in a condition of balanced trade. Even if one accepts the presumption that a country's trade balance will tend to zero in the medium to long term however, in particular countries there are many industries which will always be net exporters or net importers. To extract a proportionate chunk of net trade from each industry, regardless of the differences between industries, is arbitrary. Greenaway and Milner (1981:761) suggest that

> the judicial selection of years so as to avoid periods of obvious, overall disequilibrium may be an appropriate means of excluding transitory influences of significant payments adjustment forces.

Kol (1988:62-63) lists several negative aspects of the *GL* adjustment procedure. For example, he notes that if the adjustment were applied at the industry level, the resulting measure C_i would always be equal to 1. In addition, if all trade imbalances are same-signed (all $X_i \geq M_i$ or all $X_i \leq M_i$), then

$$\Sigma |X_i - M_i| \quad = \quad |\Sigma X_i - \Sigma M_i|$$

and therefore $C = 1$, regardless of the size of the trade imbalances.

Aquino (1978) agreed with Grubel and Lloyd that some correction for trade imbalance is needed, and introduced a measure that is not susceptible to the two problems cited from Kol (above). Aquino's correction for trade imbalance adjusts the values of each industry's exports and imports "to what they would have been if total exports had been equal to total imports" (p 280). These expected or theoretical values of industry exports and imports are derived as follows.

$$X_i^e = X_i \cdot \frac{\Sigma(X_i + M_i)}{2\Sigma X_i}$$

$$M_i^e = M_i \cdot \frac{\Sigma(X_i + M_i)}{2\Sigma M_i}$$

Therefore exports are increased by a fixed proportion in the case of an overall trade deficit, and decreased by a fixed proportion in the event of a trade surplus. In turn, imports are increased (decreased) equiproportionally if there is a trade surplus (deficit). The values of X_i^e and M_i^e are then used in the GL_i and GL indices to arrive at Aquino's adjusted indices, Q_i and Q:

$$Q_i = \frac{(X_i^e + M_i^e) - |X_i^e - M_i^e|}{(X_i^e + M_i^e)}$$

$$Q = \frac{\Sigma\,(X_i^e + M_i^e) - \Sigma\,|X_i^e - M_i^e|}{\Sigma\,(X_i^e + M_i^e)}$$

Aquino's technique adjusts all exports by the same proportion and all imports by the same proportion. Furthermore, unlike the Grubel and Lloyd adjustment, the total amount of trade is not adjusted by Aquino's correction:

$$\Sigma\,(X_i^e + M_i^e) = \Sigma\,(X_i + M_i)$$

Instead, exports and imports are adjusted at the commodity level.

Kol (1988:68) shows that Aquino's corrected measure of IIT, Q, is in fact equivalent to the Michaely index, F (equation [5.3]), and as such it indicates the similarity of trade shares rather than the overlap of trade flows.

Aquino (1981) contended that the need for adjustment is not simply to correct for transitory imbalances in overall trade (as Greenaway and Milner, 1981, suggest), but rather to compensate for structural differences between countries. He cites (p 764) the example of Japan and the United Kingdom:

> [W]hile the UK is almost self sufficient for raw materials and has a structural surplus for services, Japan presents a strong structural deficit both for raw materials and for services which can only be compensated by a strong structural surplus for manufactures ... [A]ny unadjusted measure of IIT in manufactures would give a much lower value for Japan than for the UK ... Are perhaps G-M suggesting that before we make a meaningful comparison ... we wait until nuclear power will replace entirely crude oil so that Japan will have a more balanced trade in manufactures?

Certainly, Aquino's provocative point is relevant to the case of South African IIT. Structurally, South Africa has a services deficit associated with foreign debt service payments, and a corresponding merchandise trade surplus. In turn, this conceals a structural deficit in manufactures, compensated for by a strong structural surplus in traditional exports such as gold, platinum, coal and agricultural products.

Vona (1991) concedes that the Aquino correction does solve the problem of the *GL* adjustment (that it only applies to the aggregate measure, *GL*, and not to GL_i). However, he points out that the Aquino adjustment has the same conceptual problem as the Michaely index: they measure intra-industry specialisation rather than IIT. Vona recommends the use of the unadjusted GL_i and *GL* indices in preference to all adjusted indices.

5.4 MEASURING INTRA-INDUSTRY TRADE IN INTERMEDIATES

Most attention has focused on the theoretical explanation and empirical significance of IIT in final consumer goods, whereas very few authors have taken any notice of IIT in intermediate goods. There are a few exceptions: for example, in a study of 11 industrial countries, Culem and Lundberg (1986) found that IIT was higher for intermediates than for final goods. Schuler (1995) noted that most IIT of Spain and Turkey was in intermediates. Ethier (1982) developed a model of IIT in intermediate components of manufactures (see section 4.4.1), while Helpman and Krugman (1985) analysed the differentiation of intermediate goods.

The importance of intermediate goods in trade and in IIT indicates that due consideration should be given to special aspects of the measurement of IIT in intermediates. The extent of IIT is measured at a degree of disaggregation that allows for the identification of industries (see section 5.2 above), for example the 3-digit SITC data. At a more finely disaggregated level, however, there are several types of products which are traded. The 4-digit categories of the SITC may include capital, intermediate and consumer goods. Therefore IIT at the 3-digit level may involve similar capital, intermediate and consumer goods. But IIT also involves the export and import of intermediate goods at different stages of the production process, as well as the exchange of final goods for intermediates. As mentioned in section 3.1.4, some authors call this vertical IIT, but in this section the term 'foreign processing' will be used (see chapter 3, section 3.1.5). Note that such trade is only recorded as foreign processing IIT if the goods involved are classified in the same category.

Schuler (1995) employed the following scheme for decomposing IIT into its constituent parts:

Final products traded for final products (*FF*)
Final products traded for intermediates (*FI*)
Intermediates traded for intermediates (*II*)

Note that Schuler has lumped together consumption goods and capital goods as final goods. According to the analysis in chapters 3 and 4, the *FF* type of IIT is due to various factors, for example horizontal (style) and vertical (quality) differentiation. *FI* is the case of foreign assembly, where intermediates are imported, assembled and exported as final goods. *II* is more complex. In production processes of three or more internationally separated stages, foreign processing occurs where for instance intermediates of the first stage are exported and intermediates of the second stage are imported. Mixed up with this type of trade however, are exports and imports of differentiated intermediates.

Measuring the three types of IIT (*FF, FI,* and *II*) is usually done in case studies, as it is possible to obtain specific information about the technical relationships between exports and imports in a particular industry. At the aggregate level, however, it is necessary to use the United Nations' Classification of Broad Economic Categories (BEC) data set, which allocates most 5-digit items of the SITC to the categories of capital goods, intermediate goods and consumption goods. Treating all capital and consumption goods as final goods, Schuler (1995:71) measures IIT in industry *i* as

$$GL_i = 2 * min(X_i, M_i)$$

Now, imagine the following values for exports and imports:

SITC category	Exports	Imports	BE-Category
i.j	$X_j = 20$	$M_j = 25$	
i.ja	$X_{ja} = 10$	$M_{ja} = 5$	Final goods
i.jb	$X_{jb} = 10$	$M_{jb} = 20$	Intermediate goods

GL_i is now split up into:

$$FF_j = 2 * min(X_{ja}, M_{ja}) = 10$$

$$II_j = 2 * min(X_{jb}, M_{jb}) = 20$$

$$FI_j = \begin{cases} 2 * min(|X_{ja} - M_{ja}|, |X_{jb} - M_{jb}|), \\ \text{if sign } (X_{ja} - M_{ja}) \text{ not equal to sign } (X_{jb} - M_{jb}) \\ \quad = \mathbf{10} \text{ or,} \\ \text{if sign } (X_{ja} - M_{ja}) \text{ equal to sign } (X_{jb} - M_{jb}) \\ \quad = \mathbf{0} \end{cases}$$

Therefore IIT of the *FI* type exists if there are opposite-signed trade imbalances at the product level (ie there is categorical aggregation as discussed in section 5.2 above). Thus IIT per industry is as follows:

$$GL_i = FF_j + II_j + FI_j$$

and aggregate IIT is:

$$\Sigma GL_i = \Sigma FF_j + \Sigma II_j + \Sigma FI_j$$

The value of these measures of IIT is that they allow one to calculate the importance of IIT in intermediates, relative to total IIT.

There are several possible explanations for IIT involving intermediates. First, intermediate goods may be differentiated with respect to style or quality, just as consumer goods are. IIT in different varieties of intermediates may be regarded as 'true' IIT. Secondly, foreign processing IIT (including foreign assembly IIT) is often based on comparative cost differences between trading partners. Foreign processing IIT can therefore be explained by the factor proportions theory (see chapter 3, section 3.1.5). As IIT involving intermediates is a significant part of total IIT, it is important to know how much IIT in intermediates is accounted for by foreign processing IIT (*FI*-type IIT plus that part of *II*-type IIT that is not due to differentiation). The answer will help establish the importance of the H-O basis of IIT (although foreign processing IIT is not regarded as 'true' IIT but rather as trade overlap or 'H-O trade in disguise'). Schuler (1995) used differences in unit values of exports and imports to disentangle horizontal *II*-type IIT from foreign processing *II*-type IIT. The premise is that if unit values of exports and imports are different, then value has been added, which in turn is a sign of some foreign (or local) processing having taken place. Having determined such foreign processing *II*-type IIT, he added this to *FI*-type IIT (which is all foreign processing IIT). He found, however, that foreign processing IIT was a minor part of total IIT for Spain and Turkey, whereas most IIT was of the *II* type (IIT in differentiated intermediates, *à la* Ethier, 1982).

Because IIT in intermediates is extremely prevalent, it is necessary to be able to measure it correctly, and this section has reviewed a means of doing just that. From the limited evidence available however, it seems that most IIT in intermediates may be horizontal IIT, or due to the problem of categorical aggregation.

5.5 MEASURING MARGINAL INTRA-INDUSTRY TRADE

A recent development in the measurement of IIT is a new method of calculating the change in IIT over time. Previously, GL_i and GL indices were computed for particular years and then compared, but these comparative-static methods have since been shown to be unreliable and occasionally misleading indicators of dynamic shifts in IIT.

example, GL_i indices in two years are compared as follows:

1990:	$X_i = 100$	$M_i = 150$		1995:	$X_i = 500$	$M_i = 800$
	$GL_i = 0,80$				$GL_i = 0,77$	

is case, the extent of IIT as measured by the GL_i index has fallen from 0,80 to 0,77 /een the two years analysed. The increase in total trade between the two years is + 800) - (100 + 150) = 1050. Total IIT has risen from 200 in 1990 to 1000 in 1995 (a ıge of 800), whereas total inter-industry trade has risen from 50 in 1990 to 300 in 1995 (a change of only 250). Therefore between 1990 and 1995, trade growth has predominantly been IIT, whereas the GL_i index has declined. The reason for the decline in the index, of course, is that net trade has increased six-fold, whereas IIT has increased only five-fold. Thus the change in the GL_i index has correctly depicted the changes in the relative composition of total trade, between net trade and IIT, but it has concealed the fact that the increase in trade flows was primarily accounted for by IIT. Therefore, a decrease (increase) in the GL or GL_i indices over time is quite compatible with an increase (decrease) in IIT.

A further problem with the GL_i index in one-country studies is that a rise in the GL_i index may indicate either the erosion of a net export position or the balancing of a deficit in a particular industry (or for some cluster of industries, or for the whole economy). Clearly these two possibilities may have opposite implications for the evaluation of policy objectives.

The measurement of the absolute change in trade flows and the division of that into changes in IIT and inter-industry trade is nevertheless an unsatisfactory alternative to comparing GL or GL_i indices over time. Absolute values of trade are not scaled and cannot be compared with those derived for other industries or countries (unlike the GL and GL_i indices). Hence the usefulness of absolute value measures of changes in trade flows depends on their being scaled relative to other relevant variables, such as gross trade levels or output levels.

X 100 M 150

150 + 100 − 50 / 150 + 100

250 − 50 / 250 = 0,80

1300 − 250

5.5.1 BRÜLHART'S INDICES OF MARGINAL INTRA-INDUSTRY TRADE

Brülhart (1994) introduced a 'Grubel-Lloyd style' measure of marginal IIT (hereafter MIIT). While it is based on changes in trade flows, it is scaled relative to the total change in trade, such that the value of the index (which we shall call A_i) varies between 0 and 1 (like the GL and GL_i indices). A value of 0 indicates that marginal trade in that industry is all inter-industry, whereas a value of 1 indicates that marginal trade is all IIT.

$$MIIT = A_i = 1 - \frac{|(X_{i(t)} - X_{i(t-n)}) - (M_{i(t)} - M_{i(t-n)})|}{|X_{i(t)} - X_{i(t-n)}| + |M_{i(t)} - M_{i(t-n)}|}$$

The subscript t (where $t = 1 \ldots n$) indicates the two years under analysis, t and $t - n$. A_i can also be written as:

$$A = 1 - \frac{|\Delta X_i - \Delta M_i|}{|\Delta X_i| + |\Delta M_i|} \qquad [5.7]$$

Like the GL_i index, the A_i index can be weighted and summed across industries as follows:

$$A = \Sigma w_i . A_i \qquad [5.8]$$

$$\text{where} \quad w_i = \frac{|\Delta X_i| + |\Delta M_i|}{\Sigma(|\Delta X_i| + |\Delta M_i|)}$$

Therefore A is the weighted average of MIIT across all industries.

Brülhart (1994) devised a second index which is useful for determining whether a country is specialising into or out of a particular industry. The index, which we shall call $A2_i$, can only be used for industry-by-industry assessment of MIIT, as it is not possible to aggregate scores across industries.

$$A2_i = \frac{\Delta X_i - \Delta M_i}{|\Delta X_i| + |\Delta M_i|} \qquad [5.9]$$

where $|A2_i| = 1 - A_i$

Values of $A2_i$ range from -1 to 1, which is why it is not meaningful to aggregate scores across industries. When $A2_i$ is zero, all new trade is MIIT. Between values of 0 and -1, the index shows that new trade is increasingly inter-industry and that the country has specialised out of that industry ($\Delta X_i < \Delta M_i$). For values of 0 to 1, the index $A2_i$ also shows that new trade is increasingly inter-industry, but in this case the country has specialised into that industry ($\Delta X_i > \Delta M_i$).

5.5.2 THE 'CONTRIBUTIONS' MEASURES OF MENON AND DIXON

Another approach to the measurement of MIIT has been developed by Menon and Dixon (1996a). They measure the contributions of growth in net trade (NT) and IIT to the growth in total trade (TT). They also derive the contributions of imports and exports to the growth in TT, NT and IIT.

Where lower-case abbreviations signify percentage growth rates between the two years surveyed, the growth in TT is derived as:

$$tt_i = Cnt_i + Ciit_i$$

where C refers to the contributions made by nt_i and iit_i to tt_i;

$$Cnt_i = (1 - GL_i)\, nt_i$$

$$Ciit_i = GL_i \,.\, iit_i$$

and $GL_i = IIT_i / TT_i$ (measured in the first year).

Now, tt_i, nt_i and iit_i are decomposed into the contributions of imports and exports:

$$tt_i = Cmtt_i + Cxtt_i$$

where
$$Cmtt_i = (M_i / TT_i)\, m_i$$
$$Cxtt_i = (X_i / TT_i)\, x_i$$

$Cmtt_i$ and $Cxtt_i$ are the contributions of import and export growth to total trade in industry *i*. Decomposing nt_i and iit_i is more complex as it must first be determined whether a 'status switch' has occurred between the two years. A status switch takes place if a good changes from being a net export ($X_i > M_i$) to being a net import ($M_i > X_i$), or vice versa, during the period. First, if there has been no status switch in industry *i:*

$$nt_i = Cmnt_i + Cxnt_i$$
$$iit_i = Cmiit_i + Cxiit_i$$

where the contributions (*C*) of import (*m*) and export (*x*) growth to nt_i and iit_i are derived as:

$$(nt_i)\text{: } Cmnt_i = (M_i / (M_i - X_i))\, m_i$$
$$Cxnt_i = (X_i / (X_i - M_i))\, x_i$$

$$(iit_i)\text{: } Cmiit_i = \delta_i m_i$$
$$Cxiit_i = (1 - \delta_i)\, x_i$$

δ_i is 1 if $X_i > M_i$ and zero if $X_i < M_i$.

Secondly, for no-switch industries: growth in imports and reductions in exports cause nt_i to rise for net import industries; whereas reductions in imports and growth in exports cause nt_i to fall in net import industries. For net export industries, growth in imports and reductions in exports cause nt_i to fall; whereas reductions in imports and growth in exports cause nt_i to rise; growth in imports causes iit_i to rise in net export industries; whereas growth in exports causes iit_i to rise in net import industries.

Next, status-switch industries are considered. For a net import industry, a status switch happens if:

$$m_i \quad < \quad ((X_i / M_i) - 1) + (X_i / M_i)\, x_i$$

while for a net export industry, a status switch happens if:

$$x_i \quad < \quad ((M_i / X_i) - 1) + (M_i / X_i)\, m_i$$

For status-switch industries:

$$nt_i \quad = \quad -2 + (M_i / (X_i - M_i))\, m_i + (X_i / (M_i - X_i))\, x_i$$

and $iit_i \quad = \quad ((M_i / X_i) - 1) + (M_i / X_i)\, m_i$ for $M_i > X_i$ initially;

or $iit_i \quad = \quad ((X_i / M_i) - 1) + (X_i / M_i)\, x_i$ for $X_i > M_i$ initially.

A problem with this approach is that it is impossible to compute import and export contributions to nt_i and iit_i. The authors avoided the problem in their study for Australia by disaggregating one step further for those industries which experienced status switches. This procedure eliminated the status switches from those industries and also removed the opposite-sign effect, which had occurred only in those industries which experienced a status switch. Thus it appears that occurrences of status switch are rare, and most of those will be due to categorical aggregation.

Menon (1996) and Menon and Dixon (1996b) have extended the analysis above to the case of intra and extra-regional trade agreement trade.

A drawback of measures of MIIT is that they may be biased upwards if nominal trade data are used in their calculation (assuming that positive price inflation occurs between the two years chosen). Therefore trade data for the two periods under analysis should be expressed at constant prices.

5.6 CONCLUSION

Measures of IIT, intra-industry specialisation and MIIT were described in this chapter. In addition, several measurement problems were discussed. In general, the GL_i^D index is used to measure IIT, but the choice of index, the level of data aggregation and whether or not to adjust for overall trade imbalance, are all important considerations.

In chapter 7, South African IIT is measured. A consideration of the measures of IIT and the problems of measurement was therefore essential. The measure chosen for the present study is the unadjusted GL_i^D index, as it facilitates comparison with the vast majority of similar studies, as reviewed in chapter 3. It has also been used as the dependent variable in many studies of the determinants of IIT, as will be seen in the next chapter. The 4-digit HS level of data aggregation is preferred, as its categories correspond closely to the concept of an industry. In order to measure marginal IIT, Brülhart's (1994) measures will be used, as they are simple to apply and give consistent results. Unlike the measures proposed by Menon and Dixon (1996a and 1996b), they are not influenced by the existence of status switches in certain industries.

CHAPTER SIX

EMPIRICAL STUDIES OF FACTORS ASSOCIATED WITH INTRA-INDUSTRY TRADE

Numerous empirical tests of the factors related to IIT have been conducted. Many of these tests have sought to explain the observed level of IIT (the dependent variable, or DV) by means of cross-sectional or time-series (longitudinal) regression analysis, using one or more independent variables (IVs) as suggested by theory. As an empirical test of the determinants of IIT in South Africa is beyond the scope of this study, this chapter will merely review some of the methods used, problems encountered and results obtained in previous studies.

6.1 THE DEPENDENT VARIABLE

Overwhelmingly, the standard Grubel-Lloyd index of IIT (GL_i for each industry, or GL across all industries) is used as the DV in regression analyses. Chapter 5 has already detailed the problems of measuring IIT. But apart from the problems of categorical aggregation and an overall trade imbalance, there is the problem of the possible values of GL_i and GL. A bounded range of values from 0 to 1 (or 0 to 100) may be considered inappropriate if forecasting rather than hypothesis testing is the objective. Forecasting values of IIT using ordinary least squares (OLS) regression methods may generate values outside the interval (0, 1) or (0, 100). Here, a logit transformation of IIT may be used:

$$ln\ (IIT_i / 1 - IIT_i)$$

The above transformation may lead to heteroskedasticity however, which must then be remedied by weighting the data, a difficult procedure (see Greenaway and Milner, 1986:131). If there is expected to be a non-linear relationship between an IV (eg scale economies) and the DV (IIT), then IIT may be transformed into logarithm values, as part of a double-log-linear functional form.

6.2 INDEPENDENT VARIABLES

There are several explanatory variables that have been used in empirical studies of the determinants of IIT. Three groupings of variables have been suggested. Pryor (1992) classified IVs as follows:

- Demand-side factors (eg income, preference diversity)
- Supply-side factors (eg scale economies, technological differentiation)
- Institutional factors (eg trade barriers, market structure).

Clark (1993) stressed the importance of protectionist forces on trade and divided the determinants of IIT into those due to commercial policy and 'others'. A more common practice though (and one which will be adopted here) is to split the determinants of IIT into the following two categories, as per Loertscher and Wolter (1980):

- Country-specific factors (eg income, preference diversity, trade barriers, country size, MNCs, FDI)
- Industry-specific factors (eg scale economies, product differentiation, technological differentiation)

Most studies attempt to assess the strength and direction of the relationships between several possible determinants and the chosen measure of IIT. Differences of opinion do exist as to the expected signs of the coefficients of certain IVs, for example trade barriers, transport costs, FDI and economies of scale. Direct measurement of some of the key determinants of IIT is difficult. Various proxies have therefore been used to mimic the effect of the 'true' IVs. Commonly investigated IVs in empirical studies are discussed below.

6.2.1 COUNTRY-SPECIFIC FACTORS

Country-specific factors are expected to influence the overall level of IIT, as measured by the *GL* index. Some of these explanatory variables can only be used in bilateral studies of IIT, as their values differ according to trade partners. For example, transport costs are clearly lower from South Africa to Zimbabwe than they are to Hong Kong. Taste overlap and tariff barriers are also specific to pairs of countries.

Country size

If it is accepted that IIT predominantly involves differentiated goods subject to scale economies in production, then the size of the domestic market determines whether or not the development of industries with a minimum efficient scale takes place. In a large country therefore, a higher level of IIT can be expected than in a small country. Size is represented by GDP for each country studied. IIT indices may be calculated for all group countries, and the two variables, IIT and GDP, are then ranked for all countries. The rank correlation coefficient between these two rankings will indicate the relationship between country size and IIT.

Per capita income and taste overlap

It is hypothesised that the demand for differentiated goods is positively related to per capita income (the 'variety' thesis of Barker, 1977). In turn, product differentiation is related to IIT. Thus, rising per capita incomes are expected to be linked to increasing levels of IIT. Time-series studies have related per capita income to IIT, but most were conducted before the new methods of measuring marginal IIT as the DV were developed. Alternatively, cross-section analyses may be performed, relating per capita income levels of various countries to levels of IIT in a particular year.

Taste overlap is proxied by calculating the difference between per capita income levels in bilateral studies of IIT, or by taking an average per capita income for each pair of countries. The Linder hypothesis (1961) is that countries with similar per capita incomes will have similar taste patterns and higher levels of IIT.

Foreign direct investment

As discussed in chapter 4 (section 4.3.2), it is unclear whether FDI and IIT are substitutes for each other or whether they go hand-in-hand. In the absence of strongly motivated priors therefore, there should be no expected sign for the coefficient of the variable FDI. This restricts one to the use of a two-tail hypothesis test for significance of the IV. The FDI variable has been operationalised by Caves (1981) in two forms: the value of FDI, and the value of intra-firm trade by US MNCs.

Transport costs

If transport costs are high, then IIT is expected to be low, because a home variety would be cheaper than an almost identical imported variety. Since we assume that the elasticity of substitution is higher for products within an industry than it is for products between industries, IIT is expected to be more sensitive to transport costs than is inter-industry trade. Transport costs may be proxied by the distance between two trading partners. A negative relationship is expected between the distance variable and IIT. For example, low values of IIT might be anticipated for far-flung countries such as Australia, New Zealand and South Africa. An alternative is to use a dummy variable for the existence of a common border between trading partners. A positive relationship between the dummy and IIT is expected, as a common border indicates proximity and therefore lower transport costs, as well as the possibility of border IIT. An alternative to geographical distance as a proxy for transport costs was used by Lee and Lee (1993). They used surface postal rates from Korea to various trading partners, as they thought it would give a better idea of 'economic distance'.

Tharakan (1984) holds a dissenting view that high transport costs (and high tariff barriers, which have the same effect) allow for the protection of developing industries. When trade is opened up, IIT can occur, as the relevant industries are in place, having been fostered by natural or artificial barriers. Therefore Tharakan (1984) postulates an indirect relationship between transport costs and IIT.

Trade barriers

As represented by average nominal tariff levels per industry, trade barriers are expected to be negatively related to IIT, although there is the contrary view of Tharakan (1984) mentioned above. For studies of individual industries, a measure of effective protection might be better, if the data is available. Some studies use a measure of tariff dispersion within industries in order to proxy a high level of tariff protection, in which case the dispersion variable is expected to be negatively related to IIT. The argument is stated by Gunasekera (1989:87) as follows:

> The relatively high level of protection for some products within an industry reduces the exports as well as the imports of these highly protected products, since they compete directly with unprotected or lightly protected products within the same industry for scarce resources. Consequently, a reduction in the relatively high level of variation in protection within such industries will facilitate intra-industry adjustments and reduce the number of products in each industry. This will encourage the production and export of a small range of productions, but the production of each on a larger scale ...

The increasing importance of non-tariff barriers (NTBs) as protectionist measures has led to the development of proxy IVs to represent them. For example, Clark (1993) uses a dummy variable which takes a value of 1 if any of 15 major types of quantitative restrictions were present, and 0 if not. Note that the classification of trade barriers as a country factor rather than an industry factor may sometimes be inappropriate.

Economic integration and trade openness

Related to the trade barriers and distance variables, economic integration may be represented as a dummy variable which is activated if the country is a member of a free trade area, a customs union or another form of economic integration. Alternatively, within-region IIT may be compared with IIT for those countries with the rest of the world. Drabek and Greenaway (1984) argue that economic integration will cause more IIT than inter-industry trade if member countries' manufacturing industries are competitive with, rather than complementary to each other.

As regards trade orientation, several authors have devised measures of a country's openness to free trade. For example, Balassa (1986b and 1986c) used deviations of actual from hypothetical values of per capita exports as an indicator of trade orientation. In turn, the hypothetical export values were derived from a regression which included the explanatory variables per capita income, population, the availability of mineral resources, and distance from foreign markets. The reasoning was that if expected per capita exports exceeded their actual values, this would indicate an open trade orientation, which was expected to correlate positively with IIT.

6.2.2 INDUSTRY-SPECIFIC FACTORS

Product differentiation

If IIT is concentrated in industries producing differentiated goods, then the extent of product differentiation in a particular industry is likely to be positively related to IIT. There are several ways of proxying product differentiation (see Greenaway and Milner, 1986).

The Hufbauer index (which we shall call *HB*) proxies the *dispersion of export prices* in bilateral trade in industry *i:*

$$HB = \sigma_i / \mu_i$$

where σ_i is the standard deviation of export values of goods in industry *i* and μ_i is the mean of the unit values of those exports. The *HB* index tests for *vertical* product differentiation, which is detected when varieties have different values, possibly indicative of quality differences. But the index is not a reliable proxy of export price dispersion, as it is very sensitive to changes in the mix of shipments to various destinations. Even if *HB* were a perfect proxy for export price dispersion, that variable itself might not have much to do with product differentiation.

Advertising intensity measures are reasonable direct proxies for *horizontal* product differentiation, as the amount of persuasive and informative advertising expenditure might be directly related to the number of varieties that need to be told apart for the consumer. The proxied IV would be calculated as adspend, deflated by industry output or net sales.

Census classification proxies of product differentiation make use of two different levels of aggregation of the trade data. The assumption is that the aggregated series represents industries, while the more disaggregated data set represents products within those industries, which are counted up to arrive at a value for the proxy of product differentiation. The technique, while simple and quick to perform, is crude, and will simply indicate undesirable categorical aggregation where it exists. For example, if a category of the disaggregated data set contains products which are heterogeneous in terms of factor content, then that category will contain more products than it should. The census classification proxy will indicate a level of product differentiation that is too high, within that industry as defined. If the data were correctly classified, however, the industry in question might be split into two, each with perhaps half the number of products at the more disaggregated level, therefore indicating less product differentiation.

Hansson (1991) has introduced a new measure of product differentiation. He estimated the *elasticities of substitution* (ϵ_i) in demand between products in industry *i* and used them as a proxy for product differentiation.

$$\epsilon_i = \frac{\delta (ln\ q_i)}{\delta (ln\ p_i)}$$

where q_i and p_i are the quantities and prices of consumed products in industry *i*. These Hansson measured as the import quantity and the unit import value in trade with the country concerned. If we assume that elasticities of substitution are constant, ϵ_i is obtained as $-\beta_{1i}$ in the following equation:

$$ln\ \mathbf{q}_i = \beta_{0i} + \beta_{1i}\ ln\ \mathbf{p}_i$$

where $\mathbf{q}_i$ is the vector of import quantities of all products in industry *i* and $\mathbf{p}_i$ the vector of their values. Hansson (1991) used ϵ_i as a measure of product differentiation in industry *i*. The smaller the value of ϵ_i, the more substitutable (and differentiated) the products in that industry were assumed to be.

Technological differentiation

It is expected that IIT will be greater in industries characterised by technological differentiation, giving rise to product cycle trade and technological gap trade. These industries are generally expected to be research intensive and highly competitive internationally. Proxies for a technological factor IV include research and development expenditure, and the share of technical personnel in the labour force.

<u>Economies of scale</u>

In general, IIT is assumed to be positively related to the scope for economies of scale in an industry. Trade provides increased production runs for firms, which causes unit costs to fall and the number of varieties offered to rise. But if the minimum efficient scale is large relative to the size of the market, this may lead to a few large firms dominating the industry and deterring the entry of new firms and varieties. The outcome would be standardisation rather than differentiation, which would impact negatively on IIT. Thus it is unlikely that scale economies and IIT are continuously related.

Proxies for economies of scale have included length of production runs, relative value added and the share of the labour force employed in large factories. Bergstrand (1983) noted that the potential for scale economies is positively related to the potential for product differentiation and that therefore only one of these two IVs should be included in a regression, in order to avoid multicollinearity.

<u>Market structure</u>

Market structure embraces a range of aspects, such as market size, the number and behaviour of firms, entry conditions and minimum efficient scale. Nevertheless, it is generally anticipated (eg by Lancaster, 1980) that 'large numbers' market structures will be more conducive to IIT than markets dominated by a few firms. The specification of proxies for market structure presents problems because as a variable it has many dimensions. When specifying monopolistic competition, for example, one must include a large number of firms with very limited market power, freedom of entry, and product differentiation.

A commonly used proxy for concentration and thus monopoly power is the *concentration ratio,* which indicates the market share of the *m* largest firms out of *n* firms in the industry. For example, the five-firm concentration ratio ($m = 5$) is the market share of the five largest firms in that industry. Values of the concentration ratio vary from 0 to 1. The Herfindahl index is a more subtle measure of concentration, in that it is the sum of the squared market shares of the firms:

$$HD = \Sigma S_n^2$$

where S_n is the share of the *n*th firm. Values of *HD* also range from 0 to 1. There are no critical values for concentration ratios, however, and inter-industry comparisons are difficult. In addition, values of the index are usually borrowed from the available US data, or at best calculated for the home country and assumed to apply to the trading partners.

6.3 ECONOMETRIC TESTING

The majority of studies reported in section 6.4 below make use of ordinary least squares (OLS) regression techniques to assess the importance of one or more IVs as determinants of the level of IIT. Cross-section analysis is most common, where the influence of the IVs is tested for several countries or industries within a country. Usually, the analysis of IIT is restricted to the manufacturing industries, as this is where the important factor of product differentiation, and its interaction with economies of scale, come to the fore.

Time-series analysis of trends in IIT has also been conducted in many studies (eg Globerman and Dean, 1990, 1992 and Pryor, 1992), but some of these results should be treated with circumspection as they employ the old practice of comparing GL_i or GL indices between the two years in question. The recently developed measures of marginal IIT (MIIT: see chapter 5, section 5.5) are clearly superior and it is expected that a spate of time series studies using these measures will be published in the next few years.

There are several econometric problems associated with testing the determinants of IIT. Chapter 5 discussed the problems that arise with the measurement and definition of IIT. Section 6.2 above has shown that some of the IVs are difficult to define and to proxy satisfactorily. Because there are many influences on the level of IIT, there are problems with omitted or excluded variables. Including as many relevant variables as possible sounds appealing, but some IVs are correlated with each other. For example, if both scale economies and product differentiation are included as IVs in a regression, the problem of multicollinearity is often encountered. On the other hand, if one of these IVs is omitted, this may cause excluded variable bias.

It should be noted that there are several regression techniques that may be used in analysing the significance of possible determinants of IIT. These include ordinary least squares (OLS), weighted least squares (WLS, where the logit transformation of the DV is used), and non-linear least squares (NLLS).

Accuracy of the available data is another problem. The quality of trade data depends on factors such as collection procedures, the efficiency of customs inspections and the extent of smuggling. In addition, the data may need to be adjusted to include or exclude freight and insurance charges.

Finally, it is as well to note that very few empirical studies of IIT yield regression results that explain more than half the variation in IIT, according to the adjusted R^2 measure of 'goodness of fit'.

6.4 EMPIRICAL RESULTS

In this section, the results of several older studies, as well as many more up-to-date studies, will be considered. Most of the studies were of a cross-sectional nature. The first ten studies are those reported by Greenaway and Milner (1986:134-135). The rest of the table comprises an analysis of twenty-seven subsequent studies. In section 6.4.1, the results are surveyed and presented in tabular form, due to the vast number of significance tests involved in total. The results are then discussed in section 6.4.2.

6.4.1 EMPIRICAL TESTS OF THE DETERMINANTS OF INTRA-INDUSTRY TRADE

In this section, the results of thirty-seven empirical studies into the factors related to IIT are summarised. In table 6.1 below, the columns represent the IVs used in the studies, and the rows are the studies themselves. The key is as follows. IVs are identified as discussed in section 6.2 above.

OLAP	=	Taste overlap; proxied by similarity of per capita incomes
PROD	=	Product differentiation; proxied by number of 4-digit products in each 3-digit SITC industry class, or by the Hufbauer index, or the advertising-sales ratio
ECON	=	Scale economies; proxied by length of production run, minimum efficient scale, or relative value added
STRU	=	Market structure; proxied by concentration ratios
TECH	=	Technological differentiation; proxied by research and development expenditure, or share of technical personnel in labour force
FDI	=	Foreign direct investment; measured as extent of foreign investment or extent of intra-firm exchanges of US MNCs
TRAN	=	Transaction costs; proxied by distance between trading partners, postal rates, or by a dummy for the existence of a common border
TRFF	=	Tariff barriers; that is, average nominal tariffs; or the dispersion of tariff rates
NTB	=	Non-tariff barriers
OPEN	=	Openness of trade orientation; or the existence of some form of economic integration.

The studies whose results are reported in table 6.1 below are numbered as follows:

From Greenaway and Milner (1986:135):

1 = Pagoulatos and Sorenson (1975)
2 = Finger and De Rosa (1979)
3 = Loertscher and Wolter (1980)
4 = Caves (1981)
5 = Lundberg (1982)
6 = Toh (1982)
7 = Bergstrand (1983)
8 = Greenaway and Milner (1984)
9 = Tharakan (1984)
10 = Balassa (1986a)

Others (own analysis):

11 = Drabek and Greenaway (1984)

12 = Balassa (1986b)
13 = Balassa (1986c)
14 = Balassa and Bauwens (1987)
15 = Manrique (1987)
16 = Lundberg (1988)
17 = Gunasekera (1989)
18 = Globerman and Dean (1990)
19 = Nolle (1990)
20 = Siriwardana (1990)
21 = Farrell (1991)
22 = Hamilton and Kniest (1991)
23 = Christodoulou (1992)
24 = Lundberg (1992)
25 = Clark (1993)
26 = Hansson (1991)
27 = Hughes (1993)
28 = Lee and Lee (1993)
29 = Chow, Kellman and Schachmurove (1994)
30 = Greenaway, Hine and Milner (1994)
31 = Hirschberg, Sheldon and Dayton (1994)
32 = Greenaway, Hine and Milner (1995)
33 = Gonzalez and Velez (1995)
34 = Torstensson (1996)
35 = Francois and Kaplan (1996)
36 = Little (1996)
37 = Bernhofen (1998)

The results of the above studies are shown in table 6.1. *Y* indicates that a significant statistical relationship (up to the 10% level of significance) was observed between that IV and IIT; *N* indicates an insignificant statistical relationship; *W* indicates a significant statistical relationship, but a wrongly-signed coefficient (ie contrary to expectations); a dash (-) indicates that an IV was not tested, where this fact is evident from the study; and more than one entry indicates that more than one proxy of that IV was tested. The final column indicates the goodness of fit of the regression used, as measured by the adjusted R^2 statistic. In cases where more than one regression has been run, this is the R^2 for the most important regression; in some other cases, it is the average of several regressions run. In cases where the method employed was not regression analysis, or in cases where more than 10 regressions were run, or where the R^2 statistic was not given, the goodness of fit result is shown as not applicable/not available (denoted by N/A).

Study No.	Independent variables OLAP	PROD	ECON	STRU	TECH	FDI	TRAN	TRFF	NTB	OPEN	R^2
01	Y	YY					Y	Y	Y		0,40
02		Y	Y		W						0,12
03	Y	Y	Y				W				0,07
04		YYWW	Y		Y	WY	W	W			0,27
05		W	Y		YY						0,25
06	Y	Y	Y	YY	Y		W	W	Y		0,32
07			Y				YW	Y			N/A
08	Y	YY		Y	Y						0,50
09	Y	WY					W				0,60
10	Y						YY				0,67
11	-	-	-	-	-	-	-	-	-	Y	N/A
12	Y	-	-	-	-	-	Y	-	-	Y/N*	0,85
13	Y	Y	Y	Y	Y	Y	NY	-	-	Y	0,48
14	Y	Y	Y	-	Y	Y	Y	Y	-	YY	0,44
15	-	Y	N	N	-	-	-	N	-	-	0,41
16	-	Y	-	-	-	-	-	-	-	-	0,17
17	-	-	-	-	-	-	-	Y	-	-	N/A
18	Y	Y	Y	-	-	-	-	-	-	Y	N/A
19	YYY	Y	N	-	-	-	YN	-	-	-	0,35
20	-	Y	-	-	-	-	-	-	-	-	N/A
21	-	Y	NN	Y	-	N	-	-	-	-	N/A
22	-	-	-	-	-	-	-	-	-	Y	N/A
23	Y	Y	Y	Y	N	-	Y	-	-	-	0,45
24	Y	Y	-	-	Y	-	-	-	-	-	0,12
25	-	YW	N	N	N	-	Y	N	Y	-	0,27
26	Y	Y	Y	-	-	-	Y	-	-	Y	0,34
27	-	Y	Y	Y	-	-	-	-	-	-	N/A
28	Y	-	-	-	-	-	Y	-	-	-	0,37
29	N	N	N	-	Y	-	-	-	-	-	N/A
30	Y	-	-	-	-	-	-	-	-	Y	N/A
31	Y	-	-	-	-	-	Y	-	-	Y	N/A
32	-	YN	-	Y	-	N	-	-	-	-	N/A
33	Y	-	-	-	-	-	Y	-	-	-	N/A
34	-	NNNN	NNNN	N	-	N	-	N	N	-	N/A
35	Y	-	-	-	-	-	-	-	-	-	0,70
36	-	-	-	-	-	-	-	-	-	N	N/A
37	Y	-	-	Y	-	-	-	-	-	-	0,55

* Openness was a significant IV for developing countries in study 12, but not for developed countries.

Table 6.1 Significance of the determinants of IIT
(Source: Greenaway and Milner, 1986:135, for entries 1 to 10)

6.4.2 DISCUSSION OF RESULTS

Table 6.1 above shows that most of the commonly used IVs in empirical studies of IIT have performed according to expectations. Table 6.2 below shows how many of the studies in table 6.1 recorded *Y, N* and *W* results for the various IVs. Therefore table 6.2 is a summary of the significance findings in table 6.1. The first row of table 6.2 (*Count of Y*) is the number of studies which found a statistically significant relationship between the IV, in the relevant column, and IIT. The second row (*Count of N*) is the number of studies in which no significant relationship was found between the IV and IIT. The row *Count of W* is the number of studies in which a significant relationship between the IV and IIT was observed, but the coefficient was of the wrong sign.

	Independent variables									
	OLAP	**PROD**	**ECON**	**STRU**	**TECH**	**FDI**	**TRAN**	**TRFF**	**NTB**	**OPEN**
Count of Y	21	21	12	8	7	3	13	6	3	7
Count of N	1	3	6	3	2	3	2	4	1	2
Count of W	0	4	0	0	1	1	5	2	0	0

Table 6.2 Summary of significance findings in table 6.1

Certainly, table 6.2 confirms the importance of the *OLAP, PROD, TRAN* and *OPEN* IVs. Therefore, IIT will be encouraged by the country-specific factors of similarity in per capita income, low transport costs and a liberal trade orientation between pairs of countries considered. The industry-specific factor of product differentiation also tends to be positively related to levels of IIT.

The results have been equivocal, however, for the *ECON, FDI,* and *TRFF* IVs.

It was noted above that scale economies are not expected to be continuously related to IIT, which explains why six studies found no significant relationship between *ECON* and IIT. Then again, *ECON* in some studies is expected to be positively related to IIT (as it indicates the potential for product differentiation), whereas in other studies a negative coefficient is expected for *ECON* (as it may indicate a tendency towards standardised production). For example, Loertscher and Wolter (1980) expected a positive relationship between *ECON* and IIT, but the coefficient turned out to be negative (and statistically significant). They interpreted this result (perhaps too conveniently) as follows (Loertscher and Wolter, 1980:287):

> The most plausible explanation for this phenomenon might be that the scale variable as measured here is an indicator for standardisation rather than for the economies of long production runs in differentiated commodities.

This illustrates the difficulty of obtaining strong empirical support for the importance of scale economies as a determinant of IIT.

Whether *FDI* promotes IIT or is a substitute for IIT is as yet unresolved, which is reflected in the mixed results for the *FDI* IV.

The *TRFF* results can perhaps be explained by the existence of conflicting views on the direction of the relationship between *TRFF* and IIT. Tharakan (1984) thinks that tariff walls help to nurture industries which can then become involved in IIT. Another possible explanation is that IIT occurs largely between developed countries, which do not have very large differences in tariff levels. There is some support (Gunasekera, 1989) for the argument that a decrease in the variation of tariff levels within a country's manufacturing industries will lead to an increase in IIT in these industries.

6.5 CONCLUSION

This chapter has discussed the empirical testing of factors that are related to IIT. The importance of such an exercise is to attempt to confirm or refute some of the theoretical explanations of IIT that were discussed in chapters 3 and 4. The definition and measurement of the dependent variable and some important independent variables were briefly considered. Numerous tests have been carried out to assess the statistical significance of the various determinants of IIT, for different countries and industries. Different approaches have been adopted to deal with the problems involved in this process.

Several determinants of IIT are not amenable to direct measurement, so a variety of proxies have been used instead. There has also been some experimentation with alternative functional forms and regression techniques. The results of the studies were summarised in tabular form, which facilitated the interpretation of such a weight of evidence. Certain conclusions were arrived at. In particular, it was seen that independent variables relating to per capita income, product differentiation, transport costs, and trade orientation proved consistently important in explaining observed levels of IIT. The scale economies, *FDI* and tariff explanatory variables were not, however, consistently related to IIT.

CHAPTER SEVEN

INTRA-INDUSTRY TRADE IN SOUTH AFRICA

In this chapter, selected measures of IIT and marginal IIT (MIIT), as discussed in chapter 5, will be applied to South Africa. The years 1992 and 1997 will be analysed, for the following reasons. The latest available data are for 1997, so these will be used to provide an up-to-date measurement of South African IIT. For purposes of comparison, 1992 was chosen, as it is five years earlier than 1997, and because it was before the 1994 democratic elections in South Africa. Many changes that impact on South Africa's international trade have taken place since 1994, for example sanctions have been lifted, foreign aid and investment flows into the country have increased, and tariff barriers have been lowered. Therefore it should prove interesting to compare trade patterns between the years 1992 and 1997.

7.1 EXPECTATIONS FOR INTRA-INDUSTRY TRADE IN THE CASE OF SOUTH AFRICA

The extent of IIT is expected to be highest in the high-income industrialised countries, and indeed this has been demonstrated in many studies cited in chapter 2. Simson (1987:85) hypothesised that the level of South African IIT would be relatively low due to:

i. South Africa's factor dissimilarity compared to its major trading partners
ii. Relatively low per capita income not warranting the production of many varieties or allowing for economies of scale, and
iii. High transport costs offsetting the possibility of economies of scale from access to large overseas markets.

South Africa is classified as an upper-middle income country by the World Bank (1997). Therefore Simson's argument that South African IIT will be relatively low can be accepted, if it is relative to the industrialised countries. But by the same token, South African IIT can be expected to be relatively higher than that found in the less-developed countries (LDCs).

In addition, there is some evidence (Francois and Kaplan, 1996) that IIT is positively related to income distribution inequality, as measured by the Gini coefficient. The reasoning is that for two identical countries with the same per capita incomes, the country with the more unequal distribution of income may tend to have a larger group of high-income consumers, and therefore a greater demand for differentiated goods. South Africa had the third-highest Gini coefficient (0,58) out of 64 countries surveyed in the World Development Report (World Bank, 1997). This should increase the expected level of South African IIT.

South Africa's participation in the Uruguay round of the GATT negotiations led to a general lowering of tariff protection in 1995. Some of the reductions in tariff protection are still being phased in, but tariff protection in 1997 was lower than it was in 1992. Therefore it will be interesting to see if the lowering of trade barriers has caused an increase in South African IIT or whether the contrary view of Tharakan (1984) is germane. Tharakan (see section 6.2.1) argues that high tariff walls help to nurture industries so that they may eventually participate in IIT.

7.2 MEASURES TO BE USED

Data classified according to the Harmonised System (HS) was used for all calculations. The 4-digit classification was chosen, as categories at this level of aggregation seem to correspond closest to the concept of an industry.

It was decided to treat trade flows as homogeneous from the point of view of IIT; in other words, any opposite-signed trade imbalances at finer levels of disaggregation were ignored (see the argument in chapter 5, section 5.2). Therefore the direct Grubel-Lloyd index (GL_i^D, formula [5.4] in chapter 5) is used to measure IIT in particular industries (see table A1 in the appendix). As is common practice in such studies, analysis of IIT was restricted to manufactured goods. Following the example of Balassa and Bauwens (1987), this was achieved by omitting natural resource products whose manufacture depends on natural resource endowments. Net trade in gold, platinum group metals, coal, oil and the like tends to give a low value to the estimates of IIT in South Africa, due to the substantial share of these commodities in total trade. For example, across-industry IIT (GL^A, 2-digit) was calculated by Parr (1994:401) for South Africa in 1992 as 19%, which rose to 28% when manufactures only were considered.

It was also decided not to adjust the indices for overall trade imbalance. South Africa is still heavily dependent upon primary commodity exports and manufactures imports. This is unlikely to change dramatically in the near future and so the heavy overall trade deficit in manufactures (R26 billion in 1992 and R50 billion in 1997) can hardly be regarded as a temporary disequilibrium situation. Therefore the unadjusted GL_i^D index will be used, rather than the adjusted index, C, in formula [5.6] (see the arguments in section 5.3). The substantial overall trade deficit in manufactures implies that there is a big difference between the unadjusted and the adjusted values of the GL_i^D and GL_i^A indices. Parr (1994:401) found that the value of GL^D (across all industries) for 1992 jumped from 34% to 73% after adjustment, while the change in GL^A was from 19% to 59%. The adjustment procedure more than doubled the respective measures of IIT, because the manufactures trade deficit in 1992 (R26 billion) was more than half the value of total trade in manufactures (R50 billion) in that year.

IIT is also reported in the appendix (table A2) for industries at a more easily recognisable level of aggregation. Calculations based on the 2-digit HS data were performed for all 97 industries for which trade data is classified, excluding arms and ammunition (industry 93), as these data were sensitive and not generally available for 1992. Note that data for industry code 26 excludes trade in uranium; code 27 excludes oil; and code 71 excludes gold and platinum group metals. The excluded commodities mentioned are very important to South African inter-industry trade, and their inclusion in the data set would certainly have decreased the value of the respective IIT measures GL_i^D and the aggregate measure GL^D. However, the exclusion of the mentioned commodities is not considered important to the present study, which is primarily concerned with IIT in the manufacturing industries. The 2-digit calculations by Parr (1994) included estimates of trade in uranium, oil, platinum group metals and gold (the latter from the South African Reserve Bank).

The weighted Grubel-Lloyd (GL) index (denoted by formula [5.2] in chapter 5) will be used in this study to measure aggregate (across-industry) IIT in South Africa for 1992 and 1997 (see table 7.1).

The Michaely index (F, in formula [5.3]) is calculated for 1992 and 1997 to indicate the similarity of trade shares, or intra-industry specialisation, in South Africa (see table 7.1).

The selection of two years for analysis allows for the calculation of changes in IIT. These may be observed by comparing Grubel-Lloyd indices between periods, but this can be misleading (see section 5.5). Therefore the correct methods of measuring marginal IIT (MIIT) will be used to describe the changes in South African trade patterns between 1992 and 1997. The measures devised by Brülhart (1994) are preferred and will be applied to the South African data. Brülhart's A_i and $A2_i$ indices (formulae [5.7] and [5.9]) will be calculated, the former in order to calculate Brülhart's aggregate measure A, and the latter as they indicate which industries South Africa has specialised into or out of between 1992 and 1997. Brülhart's A index (formula [5.8]), which is the weighted average of MIIT measured by the A_i index, is reported in table 7.1, while the $A2_i$ indices for each industry are shown in table A1, but the A_i indices are not reported, as they do not convey any information about the direction of any trade specialisation, whereas the $A2_i$ indices do.

Ideally, trade data for the two periods under analysis should be stated at constant prices. Because of the absence of inflation data at the required level of detail (4-digit HS industries), however, nominal values were used. The reason one should use constant prices is that import prices may have risen at a rate different from export prices, but these differences cancel out in both the A and $A2_i$ indices, as they are both ratios. Furthermore, while it is true that import prices rose by 32% and export prices rose by 51% between 1992 and 1997 (South African Reserve Bank, 1998), changes in exchange rates more than compensated for these inflation rate differentials. It is not considered important for the purposes of this study to disentangle price effects from exchange rate effects (or, for that matter, from the effects of falling tariffs).

7.3 DISCUSSION OF RESULTS

The measures chosen in section 7.2 above were applied to the 2-digit and 4-digit HS data series for the years 1992 and 1997. The following measures were calculated.

First, using the 4-digit HS data, the direct Grubel-Lloyd index of IIT (GL_i^D), as well as

Brülhart's A_i and $A2_i$ indices of MIIT, were calculated for each of 742 manufacturing industries, for 1992 and 1997. In terms of aggregate measures (across industries), the weighted GL^D index was calculated, as well as the Michaely F index and Brülhart's A index.

Secondly, the 2-digit HS data were used to calculate the GL_i^D index for each industry (codes 1 to 97, excluding code 93) for 1992 and 1997. The weighted GL^D index was also calculated for those two years.

Table 7.1 below shows the aggregate measures of IIT (GL^D index), intra-industry specialisation (F index) and MIIT (A index). The results for individual 4-digit industries (GL_i^D and $A2_i$ indices) are to be found in table A1 of the appendix, while the 2-digit HS results are shown in table A2 of the appendix.

Year	Index and HS level	Value (%)
1992	GL^D, 4-digit	28,0
1992	F (Michaely), 4-digit	43,1
1992	GL^D, 2-digit	32,2
1997	GL^D, 4-digit	36,7
1997	F (Michaely), 4-digit	45,9
1997	GL^D, 2-digit	42,1
1992/1997	A (Brülhart), 4-digit	34,2
1992/1997	A (Brülhart), 2-digit	37,1

Table 7.1 South African IIT and MIIT: summary statistics

It was decided that the 4-digit level of aggregation is most consistent with the definition of an industry; therefore the 4-digit results are regarded as more important than the 2-digit results. Across-industry IIT in 1997 was 37% (for manufactures), which is relatively low compared with the industrialised countries, as expected for South Africa. Nevertheless the value is relatively higher than those for many less-developed countries (see Hoekman and Djankov, 1996, for example), which is also in accordance with expectations.

It is notable that overall IIT has increased from 28% in 1992 to 37% in 1997. But, as was explained in section 5.5, such comparative-static comparisons can be misleading. A more reliable indicator of MIIT is Brülhart's *A* index, which shows that MIIT comprised 34% of the change in total trade from 1992 to 1997. This result is neither here nor there - it seems that new IIT is roughly as important as existing IIT, on an aggregate basis. One might therefore conclude that there is no discernible dynamic trend in overall South African IIT.

The Michaely *F* index of 46% is barely changed from the value calculated for 1992. A value of 46% is rather higher than expected for South Africa, and indicates a fairly high level of intra-industry trade specialisation. In other words, South Africa's import and export shares are quite similar across all manufacturing industries. The import and export shares are relative to total imports and total exports respectively. Total imports and total exports are the totals for only the 742 manufacturing industries considered.

The 2-digit GL^D index for 1997 (42%) is also higher than the 1992 value of 32%. The 2-digit calculations were performed for all industries, whereas the 4-digit calculations involved only the manufacturing industries. The rise in 2-digit overall IIT between 1992 and 1997 suggests a move away from traditional inter-industry trade. Certainly, Brülhart's *A* index, based on the 2-digit data, is rather high (37%), possibly indicating that the overall trend in IIT is slightly upwards. As noted above, the 2-digit data are too highly aggregated for the individual categories to conform to the concept of an industry. Table A2 is nevertheless included for reasons of exposition, as one can easily identify the 2-digit categories, although strictly speaking each one may in fact include several industries from a theoretical perspective.

As to the 4-digit HS, industry-by-industry results in table A1, these may be interpreted as follows. The first four columns show the rand values of imports and exports for the years 1992 and 1997. They are important to indicate the absolute size of trade in each category, as the IIT and MIIT indices based on the trade data are ratios, with values from 0 to 1 (GL_i^D index) and from -1 to 1 (Brülhart's $A2_i$ index). The GL_i^D index is the value of IIT per industry, shown for 1992 and 1997. Brülhart's $A2_i$ index shows the proportion of new trade that is IIT, where new trade is the difference between the 1997 and the 1992 data on imports and exports. It is important to remember that MIIT is at a maximum when $A2_i$ is zero, and inter-industry trade growth is at a maximum when $A2_i$ is equal to -1 or 1. A value of -1 indicates that South Africa has specialised out of the relevant industry, while a value of 1 indicates a specialisation into that industry. Values close to zero indicate that increases or decreases in exports have been matched by similar changes in imports (marginal IIT is important).

Two rather sensitive sectors of the South African economy deserve special attention among the 4-digit results presented in table A1. First, there are many industry categories within the clothing and textiles sector (codes 5101 to 6704) for which MIIT, as measured by the $A2_i$ index, is negative, which indicates specialisation out of those industries. In fact, of the 162 industries in this broadly defined sector of the economy, there were 102 in which Brülhart's $A2_i$ index was negative. In other words, much new trade since 1992 has been inter-industry trade. A closer inspection of the trade data in these categories reveals that, in the main, imports of clothing and textiles have increased, at the expense of South African exports.

Secondly, in the vehicles sector (industry categories 8701 to 8716), the $A2_i$ index was negative for only 8 of the 16 industries. Importantly, there were 4 industries for which the $A2_i$ index was equal to 1. This means that all new trade in those industries was inter-industry trade, favouring South African exporters at the expense of imports. The implications of these results are illuminating. In those 4 industries for which the $A2_i$ index was equal to 1, none of the total change in trade between 1992 and 1997 was IIT (because exports rose while imports fell - there was no new matched trade). However, all four industries were net importers in 1992, so the changes that took place until 1997 eroded the trade deficits in those 4 industries. The result was that, by 1997, all 4 industries had a higher static level of IIT, as measured by GL_i^D scores.

For industry 8702 (public transport type passenger vehicles), there was a status switch. The industry was a net importer in 1992, with imports of R100 million and exports of R16,5 million. By 1997, imports had shrunk (in nominal terms) to just R57,5 million and exports had risen almost fivefold to over R80 million. According to the GL_i^D measure, IIT rose from 28% in 1992, to 84% in 1997, despite the fact that the $A2_i$ index was equal to 1 for industry category 8702. As noted above, a value of -1 or 1 indicates zero marginal IIT. This seemingly anomalous result demonstrates that changes over time in the static measure of IIT, GL_i^D, do not necessarily bear any meaningful relationship to MIIT, as measured by the

$A2_i$ index, for the same period. In industry category 8702, IIT was greater in 1997 than it was in 1992, but the change in total trade was brought about exclusively by changes in inter-industry trade - there were no intra-industry trade adjustments whatsoever.

The example of the vehicle industries shows the relationship between the data and the measures of IIT and MIIT presented in table A1. For each 4-digit HS industry that is of interest to the reader, the interpretation of the table is as follows. The first four columns are the raw trade data and indicate, for both 1992 and 1997, the volumes of exports and imports (in nominal rand terms), from which it can be seen whether there was a trade deficit or surplus in that industry. The next two columns are the GL_i^P measures of IIT for 1992 and 1997. These indicate the levels of IIT in each year. The final column is the $A2_i$ measure of MIIT between 1992 and 1997. This indicates how the change in GL_i^P that occurred between 1992 and 1997 was brought about - whether by inter-industry adjustments, or by intra-industry adjustments.

At the aggregate level for South Africa, the process of moving towards a more balanced overall pattern of trade in manufactured goods need not predominantly involve intra-industry adjustments. In most manufacturing industries, South Africa has a trade deficit. The net export industries will therefore be ignored for the moment. In the extreme case, when all changes in total trade are inter-industry changes, the following might occur. For all net import industries, an increase in exports takes place, together with no change or a decrease in imports. We assume that there are no status switches. By the end of the period of adjustment, each affected industry will have a higher level of IIT, which is achieved purely by inter-industry changes in trade. These changes are painless from a South African perspective, as domestic production and/or employment will rise in the industries concerned.

The changes just described are, however, unlikely to occur in many manufacturing industries. It is just as likely that a period of painful inter-industry adjustments will lead to decreased levels of IIT. If we again consider only net import industries, then inter-industry adjustments might comprise an increase in imports, coupled with no change or a decrease in exports. Falling exports will lead to decreased employment and the possible demise of certain manufacturing industries. Therefore, it is clear that inter-industry adjustments can be very disruptive to an economy.

There have been fears that the fairly rapid trade liberalisation undertaken by South Africa in the last five years will render much of South African industry uncompetitive. As has been seen above, inter-industry changes in trade in response to such a shock can lead to severe adjustment costs. It has been argued by Balassa (1979), Caves (1981) and Krugman (1981) that adjustment costs to trade liberalisation are lower when new trade is of the intra-industry variety, because displaced resources can be transferred more easily within individual industries than between industries. When new trade is predominantly IIT (ie the $A2_i$ index of MIIT is close to 0), then increases in imports are usually matched by increases in exports within each industry. This would correspond to a greater specialisation by domestic producers in certain product varieties, whereas the production of other varieties would be curtailed and those varieties would be imported. The benefits would be a greater exploitation of economies of scale, and little or no effect on employment.

Hamilton and Kniest (1991) found some evidence for Australia and New Zealand that structural adjustment is greater in industries with low levels of IIT. While aggregate IIT for South Africa is still relatively low, it has increased since 1992. Therefore the remaining adjustments to the process of trade liberalisation currently underway in South Africa can at least partially be accomplished by intra-industry and intra-firm transfers of productive resources.

7.4 CONCLUSION

extent of IIT in manufactured goods in the case of South Africa was, as expected, tively low in comparison with the industrialised countries, but relatively higher than ls recorded in many less-developed countries. The GL^D index for 1997 was 37%, an ease from 23% in 1992. Certainly, the extent of IIT was higher in 1997 than it was in 2. But according to Brülhart's $A2_i$ measure of MIIT (34%), this change in static levels T was only partially brought about by intra-industry adjustments.

An alternative measure, the Michaely index, shows that South Africa's intra-industry specialisation is rather higher than anticipated, at 46% in 1997.

The 2-digit HS data were used to calculate IIT for all industries. IIT as measured by the GL^D index increased from 32% in 1992 to 42% in 1997. These results imply that IIT has intensified slightly in South Africa between 1992 and 1997. The relatively high value of Brülhart's *A* index (37%) seems to confirm this finding.

The 4-digit data indicate that the level of IIT for South African manufacturing industries increased slightly between 1992 and 1997, but MIIT was no greater than existing levels of IIT. Thus it may be concluded that South African IIT is relatively low and relatively stable, although perhaps tending to increase slightly.

CONCLUSION

The importance of intra-industry trade was first noted in the 1960s, and since then it has been exhaustively researched. In the industrialised countries, intra-industry trade constitutes a larger share of total trade than does inter-industry trade (trade in different goods). The prevalence of intra-industry trade has also been confirmed in the newly-industrialised countries and in the developing countries.

Traditional trade theory did not, however, admit the possibility of intra-industry trade. The principle of comparative advantage, developed by Ricardo (1817 [1963]), was intended to show why trade in different goods was beneficial to both countries considered. The factor proportions theory of Heckscher (1949) and Ohlin (1933) predicted that comparative advantage would be determined by a country's relative resource endowments. A country would export that good whose production used its abundant factor intensively and import the good whose production used its scarce factor intensively. Hence, two countries with different resource endowments would engage in trade of different goods with each other.

The bulk of world trade is now conducted between the industrialised countries, and it is dominated by the intra-industry exchange of similar manufactured goods. The industrialised countries are abundantly endowed with capital and skilled labour. Therefore, two-way trade in similar goods takes place, between trading partners which have similar resource endowments. As discussed in chapter 1 of this paper, traditional trade theory predicted the exchange of different goods between countries with different resource endowments. Admittedly, there is still much trade of this nature about. But inter-industry trade is important only in the trade patterns of the less-developed countries, many of which rely on natural resource-intensive exports and depend on imports of manufactured goods.

The empirical studies reviewed in chapter 2 confirm the pervasiveness of intra-industry trade worldwide. In the light of these findings, the nature of intra-industry trade is analysed.

In chapter 3, different types of intra-industry trade are identified by considering circumstances that are conducive to intra-industry trade. This approach involves the selective relaxation of various assumptions of the Heckscher-Ohlin theory, in order to create conditions under which intra-industry trade might arise. Many different types of intra-industry trade are generated in the process, some of which are expected to be empirically important, while others are of minor relevance.

If the assumption that costs of transport, storage, selling or information are zero is relaxed, several types of intra-industry trade may emerge. Border trade in heavy, high volume goods may be due to transport costs. Periodic trade was seen to be the result of seasonal differences in the availability of mainly agricultural goods. Entrepôt trade and re-exports are often caused by the costs of storage, packaging or selling, while bilateral trade agreements may temporarily lead to otherwise anomalous intra-industry trade according to the provisions of and concessions in such agreements. Joint-product trade sometimes occurs if products are differentiated according to end-use, rather than conforming to the traditional assumption that goods are homogeneous with respect to end-use. All of these types of intra-industry trade are of limited importance worldwide, but they may account for substantial amounts of intra-industry trade in particular regions. For example, entrepôt trade and re-exports are the mainstays of the economies of Hong Kong and Oman.

Of more importance empirically is intra-industry trade in goods differentiated according to their production functions. These types of intra-industry trade result from relaxing the Heckscher-Ohlin assumption that production functions are homogeneous across countries. Innovations in production processes can lead to the opening up of a technological gap by the innovating producer. Intra-industry trade in that country might then comprise the export of that good and the import of another variety of the same good, but produced with obsolescent technology. Product innovations which are not immediately disseminated to all countries may also lead to so-called product-cycle trade, whereby the latest, improved variety is exported and other varieties are imported. Finally, foreign processing trade involves intra-industry trade of goods at different stages in the production process. As long as these goods are classified in the same industry category, then intra-industry trade is recorded. Foreign processing trade is however quite compatible with the factor proportions theory, as assembly processes are often labour-intensive, while production processes generally require more capital-intensive methods.

Intra-industry trade in functionally differentiated products is extremely pervasive, both in intermediate and final manufactured goods. Chapter 3 considers intra-industry trade in products that are differentiated horizontally (according to style) and vertically (according to quality). The Heckscher-Ohlin assumption that goods are homogeneous with respect to all functional characteristics, is relaxed. It is often necessary to assume that economies of scale are present, which means that the traditional assumption that production functions are linearly homogeneous must be relaxed. The interaction between economies of scale and product differentiation is responsible for the possibility of intra-industry trade in product varieties.

Strictly speaking, the relaxation of the Heckscher-Ohlin assumptions regarding functionally homogeneous goods and linearly homogeneous production functions is not consistent with maintaining the Heckscher-Ohlin assumption of perfect competition. The relaxation of the assumption of perfect competition allows the consideration of market structures in which economies of scale and product differentiation can occur. The analysis of intra-industry trade in such conditions is a new branch of trade theory, far removed from the assumptions of the Heckscher-Ohlin theory. Models of intra-industry trade under conditions of imperfect competition are examined in chapter 4. There they are divided into large numbers cases and small numbers cases.

Large numbers cases assume a large number of producers and certain features of imperfect competition, such as scale economies and product differentiation. Neo-Chamberlinian models of monopolistic competition (eg Krugman, 1980) incorporate the love of variety approach to the modelling of preference diversity among consumers. The neo-Hotelling models (eg Lancaster, 1980) are similar, but preference diversity is modelled according to the ideal or favourite variety approach. Both types of model generate intra-industry trade in different varieties of similar products. Small numbers cases analyse intra-industry trade in oligopolistic market structures. Various models are considered, in which intra-industry trade in identical goods, vertically differentiated goods and horizontally differentiated goods is predicted. The analysis of intra-industry trade is extended to cover multi-product and multi-national firms, and the role of foreign direct investment as a substitute for or a complement to intra-industry trade is considered.

Models of intra-industry trade in a Heckscher-Ohlin or Heckscher-Ohlin-Ricardo setting are also discussed. These models are attempts to reconcile intra-industry trade with traditional trade theory, and explain modern trade patterns without relaxing the Heckscher-Ohlin assumptions.

The measurement of intra-industry trade is discussed in chapter 5. The alternative measures and methods of adjustment were evaluated, and it was decided that for the purposes of this study, three measures in particular are appropriate. The first is the Grubel-Lloyd index, as used in the vast majority of studies on the subject, and the second is the Michaely index of intra-industry specialisation. Finally, after reviewing the recently-developed measures of marginal intra-industry trade, it was decided to use Brülhart's measures, as these are the simplest to apply, and give consistent results.

The factors associated with intra-industry trade are discussed in chapter 6. Problems of measurement of these explanatory variables were noted, as was the need to use proxy variables in some instances. Previous empirical studies were examined for evidence on the determinants of intra-industry trade levels. It was found that similarity of per capita incomes between trading partners is an important determinant of high levels of bilateral intra-industry trade. This result is in accordance with the Linder hypothesis (Linder, 1961). There is consistent evidence that the extent of product differentiation is positively related to intra-industry trade. The independent variables proxying transport costs are also statistically significant in a number of studies, indicating that intra-industry trade is negatively affected by high transport costs. Proxy variables for trade orientation strongly suggest that intra-industry trade is stimulated by a liberal trade orientation between pairs of countries considered.

Intra-industry trade in South Africa is examined in chapter 7. The expectation was that levels of intra-industry trade would be lower than in the industrial countries, due to low levels of per capita income, high transport costs to major markets, and the country's dependence on the exports of natural resource-intensive industries. Taking into account the deliberations in chapter 3, it was decided not to adjust the indices of intra-industry trade for overall trade imbalance. The 4-digit level of aggregation of the Harmonised System (HS) data set was used in this study, as its categories seem to correspond closely to the theoretical idea of an industry. South African intra-industry trade was calculated for each of 742 manufacturing industries at the 4-digit level of aggregation of the HS data set. Overall, the Grubel-Lloyd index of intra-industry trade was 37% for 1997, which is in line with the expected value. The Michaely index of 46% in 1997 indicates that South African import and export shares are quite similar. The increase in intra-industry trade since its 1992 value of 28% is not considered substantial, in light of the value of the Brülhart index of marginal intra-industry trade. Brülhart's A index of 34% indicates that marginal intra-industry trade in South Africa is no higher than existing, static levels of intra-industry trade.

South African manufacturing industries are being forced, through progressively lower tariffs, to adapt to increasing integration with the world economy. In certain industries, increased competition from imports is being experienced. One way for local manufacturers to deal with this threat is to narrow the product range on offer, and attempt to reap economies of scale on longer production runs of the remaining product varieties. The success of this strategy depends on South Africa's ability to expand sales of locally-produced varieties into foreign markets. In turn, local manufacturers will have to accept that certain product varieties will be imported.

The existence of high levels of intra-industry trade, in advance of these changes, indicates that the affected industries are already accustomed to producing differentiated products. Therefore, once competition from imports becomes more intense, such industries should be able to concentrate on producing their most competitive varieties, absorbing labour and other resources from the production of other varieties. These intra-industry adjustments to production processes are easier to achieve than inter-industry changes. A struggling industry would need to retrench workers, who would have to be re-trained before they could be absorbed by a prospering industry, in order to augment its production.

It appears that current levels of South African intra-industry trade in many industries are high enough to ensure that the necessary adjustments can be accomplished without too much damage being inflicted on domestic levels of production and employment. Certainly, there is hope that in affected industries, a sizeable share of the transfers of productive resources can take place within rather than between industries.

APPENDIX

The results of the calculations of South African IIT are shown in this appendix, which consists of two tables. On pages 126-43, the following table appears:

Table A1 South African 4-digit IIT and MIIT, 1992 and 1997

Thereafter, on pages 144-45:

Table A2 South African 2-digit IIT and MIIT, 1992 and 1997

For the calculations for the right hand three columns, see equation [5.4] in section 5.2 and equation [5.9] in section 5.5.1. The calculations were performed using the import and export data for 1992 and 1997. For example, in table A1, the GL_i^D index for HS industry category 2801 is calculated for 1997 as follows.

$$GL_i^D = \frac{\Sigma_j(X_{ij} + M_{ij}) - |\Sigma_j X_{ij} - \Sigma_j M_{ij}|}{\Sigma_j(X_{ij} + M_{ij})} \qquad [5.4]$$

where $\Sigma_j(X_{ij} + M_{ij})$ = R7 038 334 + R2 207 828

= R9 246 162 and

$|\Sigma_j X_{ij} - \Sigma_j M_{ij}|$ = R7 038 334 - R2 207 828

= R4 830 506.

Thus, GL_i^D = (R9 246 162 - R4 830 506) ÷ R9 246 162

= R4 415656 ÷ R9 246 162

= 0,4776

= 48%

An example of how the $A2_i$ index of MIIT is calculated for industry 2801 is as follows.

$$A2_i = \frac{\Delta X_i - \Delta M_i}{|\Delta X_i| + |\Delta M_i|} \qquad [5.9]$$

where $\Delta X_i = X_{ij}\,(1997) - X_{ij}\,(1992)$

= R7 038 334 - R2 754 162

= R4 284 172;

$\Delta M_i = M_{ij}\,(1997) - M_{ij}\,(1992)$

= R2 207 828 - R1 216 112

= R991 716; and in this case,

$|\Delta X_i|$ = R4 284 172 and

$|\Delta M_i|$ = R991 716.

Thus, $A2_i$ = (R4 284 172 - R991 716) ÷ (R4 284 172 + R991 716)

= R3 292 456 ÷ R5 275 888

= 0,624.

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
2801	FLUORINE, CHLORINE,	1,216,112	2,754,162	2,207,828	7,038,334	61	48	0.624
2802	SULPHUR, SUBLIMED	245,348	131,809	1,527,471	263,652	70	29	-0.814
2803	CARBON (CARBON BL	6,611,582	17,145,338	28,142,230	37,676,521	56	86	-0.024
2804	HYDROGEN, RARE GA	7,144,130	131,937,087	42,479,279	234,349,602	10	31	0.487
2805	ALKALI OR ALKALINE-	3,292,772	41,345	4,389,736	973,907	2	36	-0.081
2806	HYDROGEN CHLORIDE	143,469	1,785,912	656,659	3,926,227	15	29	0.613
2807	SULPHURIC ACID, OLE	161,056	13,025,955	4,946,034	102,443,230	2	9	0.898
2808	NITRIC ACID, SULPHON	99,276	664,760	318,563	1,390,333	26	37	0.536
2809	DIPHOSPHOROUS PEN	927,337	149,594,184	1,301,952	337,325,669	1	1	0.996
2810	OXIDES OF BORON, BO	1,687,037	155,919	5,010,786	249,696	17	9	-0.945
2811	OTHER INORGANIC ACI	28,829,666	2,224,261	56,588,134	13,656,975	14	39	-0.417
2812	HALIDES AND HALIDE	1,786,196	341,744	5,654,621	81,687	32	3	-1.000
2813	SULPHIDES OF NON-M	1,626,495	10,569,874	6,599,588	711,594	27	19	-1.000
2814	AMMONIA, ANHYDROU	11,177,021	10,176,571	40,793,678	37,980,953	95	96	-0.032
2815	SODIUM HYDROXIDE (	9,810,232	11,142,425	58,138,117	15,585,246	94	42	-0.832
2816	HYDROXIDE AND PERO	432,723	33,520	1,354,081	8,803,654	14	27	0.810
2817	ZINC OXIDE; ZINC PER	2,150,235	333,292	1,827,444	6,203,768	27	46	1.000
2818	ARTIFICIAL CORUNDU	173,007,987	228,774	1,269,928,589	1,925,995	0	0	-0.997
2819	CHROMIUM OXIDES AN	3,987,022	426,287	17,501,292	1,456,054	19	15	-0.858
2820	MANGANESE OXIDES	12,705,789	37,088,533	14,611,061	144,311,569	51	18	0.965
2821	IRON OXIDES AND HYD	26,369,392	1,389,808	42,216,157	2,684,955	10	12	-0.849
2822	COBALT OXIDES AND	1,849,915	1,676,725	711,124	1,497,273	95	64	0.728
2823	TITANIUM OXIDES	7,563,617	331,939,964	13,198,496	1,322,382,208	4	2	0.989
2824	LEAD OXIDES; RED LE	1,132,918	2,313,604	2,085,195	4,855,282	66	60	0.455
2825	HYDRAZINE AND HYDR	17,305,164	91,328,951	73,371,156	330,309,305	32	36	0.620
2826	FLUORIDES; FLUOROSI	32,277,051	232,076	57,558,530	11,029,363	1	32	-0.401
2827	CHLORIDES, CHLORID	21,843,449	278,755,458	29,274,614	19,876,081	15	81	-1.000
2828	HYPOCHLORITES; CO	1,122,366	21,446,951	3,646,692	12,228,481	10	46	-1.000
2829	CHLORATES AND PER	9,467,625	577,970	31,309,398	510,371	12	3	-1.000
2830	SULPHIDES; POLYSUL	6,916,882	2,841,287	8,712,882	3,098,325	58	52	-0.750
2831	DITHIONITES AND SUL	10,570,168	159,820	18,309,642	361,714	3	4	-0.949
2832	SULPHITES; THIOSULP	11,228,712	1,423,899	27,821,232	6,096,313	23	36	-0.561
2833	SULPHATES; ALUMS; P	12,892,002	89,819,948	24,669,598	256,566,730	25	18	0.868
2834	NITRITES; NITRATES	22,896,453	4,291,640	63,977,648	11,566,445	32	31	-0.699
2835	PHOSPHINATES (HYPO	33,056,367	165,286,220	74,672,194	307,898,589	33	39	0.548
2836	CARBONATES; PEROX	78,265,418	9,283,718	137,022,413	155,399,985	21	94	0.426
2837	CYANIDES, CYANIDE O	5,285,746	61,422,223	8,830,576	223,365,418	16	8	0.957
2838	FULMINATES, CYANAT	828,261	136,519	3,882,010	110,143	28	6	-1.000
2839	SILICATES; COMMERC	4,215,969	4,137,412	12,634,037	6,802,128	99	70	-0.519
2840	BORATES; PEROXOBO	11,712,212	340,032	18,367,449	983,962	6	10	-0.824
2841	SALTS OF OXOMETAL	20,927,232	7,916,092	34,590,794	4,312,782	55	22	-1.000
2842	OTHER SALTS OF INOR	981,890	45,915	677,251	523,621	9	87	1.000

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
2843	COLLOIDAL PRECIOUS	6,217,791	5,278,107	37,286,468	20,533,766	92	71	-0.341
2844	RADIOACTIVE CHEMIC	25,437,421	279,526,044	26,048,387	371,707,369	17	13	0.987
2845	ISOTOPES (EXCLUDIN	110,004	11,463	1,127,251	15,442,449	19	14	0.876
2846	COMPOUNDS, INORGA	3,347,785	45,264	22,942,956	238,629	3	2	-0.980
2847	HYDROGEN PEROXIDE,	2,452,361	2,490,304	3,441,026	8,891,111	99	56	0.732
2848	PHOSPHIDES, WHETHE	2,097,041	0	766,993	8,352	0	2	1.000
2849	CARBIDES, WHETHER	11,180,094	14,107,682	46,757,449	30,251,438	88	79	-0.376
2850	HYDRIDES, NITRIDES,	2,383,836	36,879,948	4,877,221	135,144,803	12	7	0.951
2851	OTHER INORGANIC CO	612,974	1,001,765	488,508	1,338,690	76	53	1.000
2901	ACYCLIC HYDROCARB	48,526,179	1,907,000	91,014,383	197,061,082	8	63	0.642
2902	CYCLIC HYDROCARBO	48,535,476	1,405,212	126,884,537	12,698,858	6	18	-0.748
2903	HALOGENATED DERIV	55,639,098	14,372,439	124,999,276	30,377,828	41	39	-0.625
2904	SULPHONATED, NITRA	11,898,832	1,906,032	15,006,400	9,864,447	28	79	0.438
2905	ACYCLIC ALCOHOLS A	129,739,725	45,149,903	344,885,999	130,310,537	52	55	-0.433
2906	CYCLIC ALCOHOLS AN	4,306,580	9,843,547	9,625,869	2,867,083	61	46	-1.000
2907	PHENOLS; PHENOL-AL	21,301,726	22,099,849	41,645,449	74,818,786	98	72	0.443
2908	HALOGENATED, SULP	7,708,695	272,201	11,907,159	795,660	7	13	-0.778
2909	ETHERS, ETHER-ALCO	31,539,442	1,958,330	63,433,768	3,544,697	12	11	-0.905
2910	EPOXIDES, EPOXYALC	35,826,688	119,206	59,806,956	354,888	1	1	-0.981
2911	ACETALS AND HEMIAC	101,535	51,556	1,813,211	39,828	67	4	-1.000
2912	ALDEHYDES, WHETHE	10,376,032	1,300,352	22,252,634	4,475,763	22	33	-0.578
2913	HALOGENATED, SULP	52,953	167,083	527,533	10,497	48	4	-1.000
2914	KETONES AND QUINON	9,019,682	100,319,188	22,552,919	272,253,495	16	15	0.854
2915	SATURATED ACYCLIC	56,568,530	5,089,775	157,107,918	16,637,879	17	19	-0.794
2916	UNSATURATED ACYCL	73,420,380	1,579,806	195,112,332	3,201,262	4	3	-0.974
2917	POLYCARBOXYLIC ACI	124,394,221	7,174,958	256,746,038	22,576,270	11	16	-0.792
2918	CARBOXYLIC ACIDS WI	67,668,458	8,865,556	94,052,630	11,658,013	23	22	-0.809
2919	PHOSPHORIC ESTERS	12,642,444	368,847	30,540,039	104,224,230	6	45	0.706
2920	ESTERS OF OTHER INO	8,622,069	50,666	19,639,242	863,064	1	8	-0.863
2921	AMINE-FUNCTION COM	80,638,171	3,496,700	127,492,449	37,606,899	8	46	-0.157
2922	OXYGEN-FUNCTION A	77,896,861	2,984,912	219,080,558	63,543,834	7	45	-0.400
2923	QUATERNARY AMMON	15,443,663	383,101	38,807,142	1,809,706	5	9	-0.885
2924	CARBOXYMIDE-FUNCT	59,105,386	4,138,336	116,557,475	38,013,348	13	49	-0.258
2925	CARBOXYMIDE-FUNCT	14,725,844	181,241	28,837,122	7,049,755	2	39	-0.345
2926	NITRILE-FUNCTION CO	14,827,525	441,444	45,909,006	111,984,034	6	58	0.564
2927	DIAZO-, AZO- OR AZOX	2,503,837	442,922	6,562,000	1,439,363	30	36	-0.606
2928	ORGANIC DERIVATIVE	2,064,534	113,908	7,672,527	378,951	10	9	-0.910
2929	COMPOUNDS WITH OT	86,374,732	2,662,228	195,270,618	9,306,892	6	9	-0.885
2930	ORGANO-SULPHUR CO	74,486,692	14,421,040	139,403,483	17,172,418	32	22	-0.919
2931	OTHER ORGANO-INOR	34,492,365	1,016,932	97,152,583	4,887,965	6	10	-0.884
2932	HETEROCYCLIC COMP	23,195,337	38,294,998	91,054,948	78,256,816	75	92	-0.259
2933	HETEROCYCLIC COMP	247,322,483	23,119,373	379,151,552	57,829,319	17	26	-0.583

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
2934	OTHER HETEROCYCLI	54,697,966	10,344,982	72,972,413	37,628,706	32	68	0.198
2935	SULPHONAMIDES	10,114,765	3,856,056	17,465,404	8,651,576	55	66	-0.210
2936	PROVITAMINS AND VIT	59,850,024	3,374,922	111,932,707	22,126,792	11	33	-0.471
2937	HORMONES, NATURAL	46,019,065	829,496	79,421,747	128,210	4	0	-1.000
2938	GLYCOSIDES, NATURA	2,305,039	20,460	5,977,327	16,765	2	1	-1.000
2939	VEGETABLE ALKALOID	14,856,187	3,000,490	28,193,777	3,282,293	34	21	-0.959
2940	SUGARS, CHEMICALLY	3,313,836	110,345	2,993,541	99,437	6	6	0.934
2941	ANTIBIOTICS	102,585,065	691,217	123,918,452	2,606,022	1	4	-0.835
2942	OTHER ORGANIC COM	5,155,632	741,425	4,331,036	1,282,341	25	46	1.000
3001	GLANDS AND OTHER O	4,263,935	135,867	9,340,140	186,126	6	4	-0.980
3002	HUMAN BLOOD; ANIMA	84,944,484	20,752,611	236,932,056	47,629,482	39	33	-0.699
3003	MEDICAMENTS (EXCL	35,828,250	19,899,260	102,103,296	37,444,884	71	54	-0.581
3004	MEDICAMENTS (EXCL	638,785,273	42,718,805	1,893,601,443	175,732,662	13	17	-0.808
3005	WADDING, GAUZE, BA	18,753,545	5,823,952	70,885,691	33,606,497	47	64	-0.305
3006	PHARMACEUTICAL GO	76,152,298	9,313,133	170,292,267	21,970,018	22	23	-0.763
3101	ANIMAL OR VEGETABL	1,121,203	1,301,229	1,199,220	334,137	93	44	-1.000
3102	MINERAL OR CHEMICA	40,114,862	98,144,194	119,673,767	224,878,736	58	69	0.229
3103	MINERAL OR CHEMICA	6,310,714	10,327,678	306,955	48,370,862	76	1	1.000
3104	MINERAL OR CHEMICA	78,860,186	6,443,341	151,384,104	7,175,135	15	9	-0.980
3105	MINERAL OR CHEMICA	14,751,383	99,610,275	40,409,306	389,988,349	26	19	0.838
3201	TANNING EXTRACTS O	677,233	91,518,397	3,099,557	130,789,417	1	5	0.884
3202	SYNTHETIC ORGANIC	9,217,089	2,909,734	17,906,113	24,826,069	48	84	0.432
3203	COLOURING MATTER	2,314,394	728,799	7,632,049	605,235	48	15	-1.000
3204	SYNTHETIC ORGANIC	243,098,064	12,334,478	450,840,422	39,430,110	10	16	-0.769
3205	COLOUR LAKES; PREP	1,963,357	13,673	7,795,572	291,050	1	7	-0.909
3206	OTHER COLOURING M	51,592,240	29,206,431	130,044,776	98,119,094	72	86	-0.065
3207	PREPARED PIGMENTS,	13,663,314	5,023,768	57,210,885	9,423,466	54	28	-0.816
3208	PAINTS AND VARNISHE	22,604,994	11,341,286	60,942,612	28,576,018	67	64	-0.380
3209	PAINTS AND VARNISHE	9,635,602	2,492,370	13,774,350	12,899,321	41	97	0.431
3210	OTHER PAINTS AND VA	4,204,999	1,705,501	13,733,128	7,274,015	58	69	-0.262
3211	PREPARED DRIERS.	169,245	1,440,720	1,262,936	10,193,918	21	22	0.778
3212	PIGMENTS (INCLUDING	12,034,633	7,675,593	35,894,510	6,066,434	78	29	-1.000
3213	ARTISTS' STUDENTS'	2,686,526	29,787	6,917,578	291,470	2	8	-0.884
3214	GLAZIERS' PUTTY, GR	27,064,886	2,826,015	72,752,051	9,026,722	19	22	-0.761
3215	PRINTING INK, WRITIN	27,078,669	3,335,062	89,704,397	8,235,078	22	17	-0.855
3301	ESSENTIAL OILS (TERP	14,542,909	14,351,664	30,100,421	26,165,432	99	93	-0.137
3302	MIXTURES OF ODORIF	150,088,346	4,301,407	309,923,572	166,916,608	6	70	0.009
3303	PERFUMES AND TOILE	7,529,698	1,044,155	37,391,155	8,101,055	24	36	-0.618
3304	BEAUTY OR MAKE-UP	21,986,283	14,020,457	113,212,294	78,566,866	78	82	-0.171
3305	PREPARATIONS FOR U	5,589,251	9,266,037	27,460,289	31,960,534	75	92	0.018
3306	PREPARATIONS FOR O	7,009,757	20,507,406	34,569,488	36,530,386	51	97	-0.265
3307	PRE-SHAVE, SHAVING	10,837,773	24,047,715	42,781,045	28,457,713	62	80	-0.757

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
3401	SOAP; ORGANIC SURF	9,463,622	36,913,435	19,583,321	111,899,558	41	30	0.762
3402	ORGANIC, SURFACE-A	98,626,451	19,691,195	212,985,973	83,011,398	33	56	-0.287
3403	LUBRICATING PREPAR	26,321,200	6,170,201	67,931,516	13,656,276	38	33	-0.695
3404	ARTIFICIAL WAXES AN	16,626,344	4,782,988	30,277,251	12,801,553	45	59	-0.260
3405	POLISHES AND CREAM	4,170,308	3,077,584	10,482,847	10,272,729	85	99	0.065
3406	CANDLES, TAPERS AN	409,631	6,128,965	6,797,493	24,191,273	13	44	0.477
3407	MODELLING PASTES, I	3,340,768	70,153	5,190,387	137,465	4	5	-0.930
3501	CASEIN, CASEINATES	23,957,803	87,198	46,941,730	797,139	1	3	-0.940
3502	ALBUMINS (INCLUDING	1,493,267	408,839	3,227,361	89,643	43	5	-1.000
3503	GELATIN (INCLUDING	4,236,526	8,277,816	14,920,039	3,044,760	68	34	-1.000
3504	PEPTONES AND THEIR	35,811,747	8,076	98,852,580	1,380,915	0	3	-0.957
3505	DEXTRINS AND OTHER	26,560,852	1,837,034	68,306,453	2,872,249	13	8	-0.952
3506	PREPARED GLUES AN	15,873,858	4,942,485	47,446,924	15,715,769	47	50	-0.491
3507	ENZYMES, PREPARED	22,995,344	12,469,410	53,512,213	28,108,436	70	69	-0.322
3601	PROPELLENT POWDER	679,892	418,326	5,510,063	8,071,725	76	81	0.226
3602	PREPARED EXPLOSIVE	1,137,760	26,489,559	12,864,290	48,220,790	8	42	0.299
3603	SAFETY FUSES, DETO	6,593,774	36,749,554	37,721,294	64,081,562	30	74	-0.065
3604	FIREWORKS, SIGNALLI	7,302,158	221,632	15,404,397	1,885,474	6	22	-0.659
3605	MATCHES, OTHER THA	3,321,776	3,197,148	2,641,668	23,736,017	98	20	1.000
3606	FERRO-CERIUM AND O	583,897	234,225	1,756,777	201,044	57	21	-1.000
3701	PHOTOGRAPHIC PLAT	61,248,156	2,968,882	101,712,005	14,924,489	9	26	-0.544
3702	PHOTOGRAPHIC FILM I	108,814,518	2,086,656	179,417,357	10,142,137	4	11	-0.795
3703	PHOTOGRAPHIC PAPE	44,118,924	2,609,855	72,974,269	10,302,926	11	25	-0.579
3704	PHOTOGRAPHIC PLAT	354,976	872,594	587,160	4,381,737	58	24	0.876
3705	PHOTOGRAPHIC PLAT	5,253,978	1,031,373	7,737,269	1,679,721	33	36	-0.586
3706	CINEMATOGRAPHIC FI	7,870,886	3,149,283	16,708,612	4,674,567	57	44	-0.706
3707	CHEMICAL PREPARATI	64,502,662	2,166,159	87,226,543	6,865,589	6	15	-0.657
3801	ARTIFICIAL GRAPHITE;	15,805,829	5,057,339	40,121,070	24,746,701	48	76	-0.105
3802	ACTIVATED CARBON;	33,729,750	16,274,856	55,221,270	5,001,019	65	17	-1.000
3803	TALL OIL, WHETHER O	691,814	597,526	6,501,453	1,710,174	93	42	-0.679
3804	RESIDUAL LYES FROM	649,505	233,704	3,515,109	2,474,377	53	83	-0.122
3805	GUM, WOOD OR SULPH	2,733,322	509,149	8,358,476	1,925,390	31	37	-0.598
3806	ROSIN AND RESIN ACI	9,769,460	1,098,227	22,322,780	3,676,529	20	28	-0.659
3807	WOOD TAR; WOOD TA	452,314	851,682	596,121	682,949	69	93	-1.000
3808	INSECTICIDES, RODEN	189,873,765	178,015,107	513,096,604	717,152,114	97	83	0.250
3809	FINISHING AGENTS, DY	27,865,802	6,241,481	88,771,505	19,822,819	37	37	-0.635
3810	PICKLING PREPARATI	5,218,281	3,191,727	10,580,220	7,240,338	76	81	-0.140
3811	ANTI-KNOCK PREPARA	349,585,701	25,117,288	574,623,365	55,978,406	13	18	-0.759
3812	PREPARED RUBBER A	11,197,584	4,170,033	46,829,517	11,973,107	54	41	-0.641
3813	PREPARATIONS AND C	1,347,045	1,026,126	1,390,219	1,964,286	86	83	0.912
3814	ORGANIC COMPOSITE	6,566,599	5,414,580	2,959,029	92,204,553	90	6	1.000
3815	REACTION INITIATORS,	74,160,931	11,003,721	171,940,909	61,992,707	26	53	-0.315

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
3816	REFRACTORY CEMEN	26,037,086	9,144,739	41,051,370	19,113,921	52	64	-0.202
3817	MIXED ALKYLBENZEN	63,265	3,291,011	261,114	11,091,626	4	5	0.951
3818	CHEMICAL ELEMENTS	2,344,274	246,346	3,383,667	2,030,251	19	75	0.264
3819	HYDRAULIC BRAKE FL	1,063,779	1,701,963	3,001,052	6,413,235	77	64	0.417
3820	ANTI-FREEZING PREPA	3,588,761	125,928	3,503,516	589,571	7	29	1.000
3821	PREPARED CULTURE	2,450,240	17,954	6,873,677	73,885	1	2	-0.975
3822	COMPOSITE DIAGNOS	28,261,462	1,650,359	110,768,546	22,510,599	11	34	-0.596
3823	PREPARED BINDERS F	224,840,150	44,173,706	128,304,015	14,722,882	33	21	0.532
3901	POLYMERS OF ETHYL	124,932,767	120,281,645	437,557,487	157,252,804	98	53	-0.788
3902	POLYMERS OF PROPY	28,897,402	172,649,428	48,506,413	243,961,584	29	33	0.569
3903	POLYMERS OF STYRE	89,106,234	9,115,244	231,293,392	12,370,571	19	10	-0.955
3904	POLYMERS OF VINYL	101,136,160	88,535,104	205,214,305	26,506,284	93	23	-1.000
3905	POLYMERS OF VINYL	33,051,890	7,362,727	65,697,607	14,015,965	36	35	-0.661
3906	ACRYLIC POLYMERS I	91,512,952	6,958,633	209,888,593	18,354,697	14	16	-0.824
3907	POLYACETALS, OTHER	141,554,124	21,522,238	352,300,868	90,564,570	26	41	-0.506
3908	POLYAMIDES IN PRIMA	146,245,612	715,321	273,481,417	7,794,293	1	6	-0.895
3909	AMINO-RESINS, PHENO	68,011,820	7,848,462	199,584,385	22,635,148	21	20	-0.798
3910	SILICONES IN PRIMAR	32,744,917	768,915	57,236,110	3,888,792	5	13	-0.774
3911	PETROLEUM RESINS,	27,752,450	2,021,008	52,025,871	1,546,864	14	6	-1.000
3912	CELLULOSE AND ITS C	37,608,695	2,274,280	92,124,364	8,704,788	11	17	-0.789
3913	NATURAL POLYMERS (	10,451,134	4,061,792	10,226,663	2,736,058	56	42	-0.710
3914	ION-EXCHANGERS BAS	11,947,075	285,741	26,987,477	271,351	5	2	-1.000
3915	WASTE, PARINGS AND	1,017,911	932,744	2,695,023	992,704	96	54	-0.931
3916	MONOFILAMENT OF W	12,535,374	2,237,354	24,327,373	4,047,345	30	29	-0.734
3917	TUBES, PIPES AND HO	65,434,123	13,441,775	140,540,198	43,656,213	34	47	-0.426
3918	FLOOR COVERINGS OF	19,401,962	5,653,503	49,643,767	9,884,580	45	33	-0.755
3919	SELF-ADHESIVE PLATE	55,625,805	2,870,467	157,593,540	13,745,938	10	16	-0.807
3920	OTHER PLATES, SHEE	147,550,137	15,733,537	400,753,231	49,522,939	19	22	-0.765
3921	OTHER PLATES, SHEE	88,818,503	17,042,390	198,380,534	48,029,321	32	39	-0.559
3922	BATHS, SHOWER-BAT	6,547,704	12,935,901	5,188,086	57,162,767	67	17	1.000
3923	ARTICLES FOR THE CO	43,194,130	37,903,756	144,306,178	218,665,280	93	80	0.283
3924	TABLEWARE, KITCHEN	21,086,347	5,833,066	76,229,868	25,241,685	43	50	-0.479
3925	BUILDERS' WARE OF P	3,718,195	3,744,103	8,658,238	10,114,354	100	92	0.126
3926	OTHER ARTICLES OF P	93,907,938	27,780,499	215,898,067	119,354,272	46	71	-0.142
4001	NATURAL RUBBER, BA	130,895,116	603,634	302,478,923	18,966,654	1	12	-0.807
4002	SYNTHETIC RUBBER A	78,986,021	13,265,463	145,617,182	108,225,135	29	85	0.175
4003	RECLAIMED RUBBER I	14,461	991,600	1,875,959	1,638,686	3	93	-0.484
4004	WASTE, PARINGS AND	104,530	472,880	1,152,019	1,539,407	36	86	0.009
4005	COMPOUNDED RUBBE	4,823,847	782,818	4,589,466	6,156,475	28	85	1.000
4006	OTHER FORMS (FOR E	527,797	733,079	1,501,488	2,407,807	84	77	0.265
4007	VULCANISED RUBBER	1,679,642	769,435	4,668,290	1,543,988	63	50	-0.588
4008	PLATES, SHEETS, STRI	22,392,513	2,521,147	35,376,207	19,291,809	20	71	0.127

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
4009	TUBES, PIPES AND HO	46,802,632	5,304,223	100,702,353	28,855,692	20	45	-0.392
4010	CONVEYOR OR TRANS	80,455,494	10,319,672	110,699,894	36,874,419	23	50	-0.065
4011	NEW PNEUMATIC TYR	205,711,013	94,589,362	514,189,596	399,961,953	63	88	-0.005
4012	RETREADED OR USED	30,027,333	2,298,268	79,918,858	5,892,347	14	14	-0.866
4013	INNER TUBES, OF RUB	13,289,011	3,719,343	31,541,120	13,723,890	44	61	-0.292
4014	HYGIENIC OR PHARMA	9,105,408	949,213	33,995,871	3,902,982	19	21	-0.788
4015	ARTICLES OF APPARE	8,266,655	1,049,625	31,601,950	7,091,904	23	37	-0.589
4016	OTHER ARTICLES OF V	133,807,148	10,996,950	302,047,129	50,629,511	15	29	-0.619
4017	HARD RUBBER (FOR E	162,076	245,801	1,657,991	352,688	79	35	-0.867
4101	RAW HIDES AND SKINS	3,511,886	80,946,511	120,708,864	171,338,575	8	83	-0.129
4102	RAW SKINS OF SHEEP	757,926	121,626,807	2,235,841	258,854,167	1	2	0.979
4103	OTHER RAW HIDES AN	256,270	6,259,692	1,054,364	37,771,718	8	5	0.951
4104	LEATHER OF BOVINE O	117,571,090	65,875,290	355,275,321	216,853,789	72	76	-0.223
4105	SHEEP OR LAMB SKIN	5,415,670	2,639,410	1,459,370	61,119,614	66	5	1.000
4106	GOAT OR KID SKIN LE	25,626,276	749,121	23,926,117	1,267,418	6	10	1.000
4107	LEATHER OF OTHER A	4,959,209	109,766,800	20,825,937	371,781,722	9	11	0.886
4108	CHAMOIS (INCLUDING	33,855	1,244,741	98,018	39,406	5	57	-1.000
4109	PATENT LEATHER AND	903,249	218,181	7,199,695	337,620	39	9	-0.963
4110	PARINGS AND OTHER	501,172	118,490	883	4,029,025	38	0	1.000
4111	COMPOSITION LEATHE	2,267,772	427,372	2,514,461	1,381,583	32	71	0.589
4201	SADDLERY AND HARN	1,061,842	421,691	3,515,628	625,099	57	30	-0.847
4202	TRUNKS, SUIT-CASES,	77,246,209	12,798,130	208,358,370	43,564,173	28	35	-0.620
4203	ARTICLES OF APPARE	14,572,941	3,451,519	50,963,798	16,454,812	38	49	-0.473
4204	ARTICLES OF LEATHE	2,617,594	100,110	1,927,291	188,511	7	18	1.000
4205	OTHER ARTICLES OF L	1,162,980	4,628,313	11,768,135	43,075,765	40	43	0.568
4206	ARTICLES OF GUT (OT	1,844,699	2,738,371	1,440,003	16,653,602	81	16	1.000
4301	RAW FURSKINS (INCLU	2,536	167,641	6,930	33,661	3	34	-1.000
4302	TANNED OR DRESSED	50,261	2,743,975	802,007	5,138,511	4	27	0.522
4303	ARTICLES OF APPARE	96,529	816,545	403,653	933,885	21	60	-0.447
4304	ARTIFICIAL FUR AND A	135,256	160,163	73,983	9,631	92	23	-0.421
4401	FUEL WOOD, IN LOGS, I	1,224,786	445,053	1,842,120	576,625,267	53	1	0.998
4402	WOOD CHARCOAL (INC	2,571,316	24,102,136	5,836,135	39,880,496	19	26	0.657
4403	WOOD IN THE ROUGH,	21,720,300	22,492,936	35,775,862	82,093,365	98	61	0.618
4404	HOOPWOOD, SPLIT PO	218,039	122,627,521	269,861	1,441,660	0	32	-1.000
4405	WOOD WOOL, WOOD F	202,585	200,265	363,985	12,719	99	7	-1.000
4406	RAILWAY OR TRAMWA	1,994,151	454,004	1,326,975	349,782	37	42	0.730
4407	WOOD SAWN OR CHIPP	241,129,172	25,861,118	448,557,041	60,015,725	19	24	-0.717
4408	VENEER SHEETS AND	21,028,913	33,725,907	59,234,295	43,218,812	77	84	-0.602
4409	WOOD (INCLUDING ST	1,693,836	10,513,408	37,077,700	4,490,226	28	22	-1.000
4410	PARTICLE BOARD AND	8,731,450	30,090,668	22,140,754	14,999,220	45	81	-1.000
4411	FIBREBOARD OF WOO	2,599,120	21,950,597	36,728,711	62,686,092	21	74	0.088
4412	PLYWOOD, VENEERED	21,695,388	2,738,684	49,525,401	4,418,177	22	16	-0.886

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
4413	DENSIFIED WOOD, IN B	47,334	551,691	131,182	565,668	16	38	-0.714
4414	WOODEN FRAMES FOR	531,024	97,878	3,559,096	1,645,218	31	63	-0.324
4415	PACKING CASES, BOX	361,548	3,320,165	14,207,303	55,592,922	20	41	0.581
4416	CASKS, BARRELS, VAT	16,904,867	774,055	89,261,859	888,900	9	2	-0.997
4417	TOOLS, TOOL BODIES,	366,446	895,368	1,176,698	909,128	58	87	-0.967
4418	BUILDERS' JOINERY A	6,034,295	50,887,963	22,277,636	110,664,068	21	34	0.573
4419	TABLEWARE AND KITC	1,771,195	235,235	3,152,006	2,247,871	23	83	0.186
4420	WOOD MARQUETRY A	2,041,409	5,367,033	4,380,399	12,837,265	55	51	0.523
4421	OTHER ARTICLES OF	13,340,226	23,665,851	31,257,532	13,248,891	72	60	-1.000
4801	NEWSPRINT, IN ROLLS	2,202,333	185,083,930	6,110,035	209,260,857	2	6	0.722
4802	UNCOATED PAPER AN	91,511,194	76,104,941	218,535,179	286,950,858	91	86	0.248
4803	TOILET OR FACIAL TIS	2,003,651	28,001,024	6,316,922	52,763,218	13	21	0.703
4804	UNCOATED KRAFT PA	67,007,051	278,380,316	132,264,711	272,288,168	39	65	-1.000
4805	OTHER UNCOATED PA	46,766,469	56,266,995	78,478,552	241,296,769	91	49	0.707
4806	VEGETABLE PARCHME	43,037,642	541,209	114,395,544	2,816,551	2	5	-0.938
4807	COMPOSITE PAPER AN	4,495,903	814,623	18,408,011	1,046,966	31	11	-0.967
4808	PAPER AND PAPERBO	15,457,621	594,810	29,940,703	5,682,607	7	32	-0.480
4809	CARBON PAPER, SELF-	49,709,999	3,466,369	75,292,501	2,910,627	13	7	-1.000
4810	PAPER AND PAPERBO	288,359,169	7,395,264	596,707,810	70,951,867	5	21	-0.658
4811	PAPER, PAPERBOARD,	245,111,565	7,649,814	421,714,507	17,946,840	6	8	-0.890
4812	FILTER BLOCKS, SLAB	1,802,015	140,477	4,326,525	765,296	14	30	-0.603
4813	CIGARETTE PAPER, W	32,851,271	1,200,410	52,494,863	8,226,014	7	27	-0.473
4814	WALLPAPER AND SIMI	5,356,641	357,818	13,806,273	2,582,623	13	32	-0.583
4815	FLOOR COVERINGS ON	190	18,128	201,693	380,108	2	69	0.285
4816	CARBON PAPER, SELF-	26,808,493	1,919,704	43,035,953	1,523,584	13	7	-1.000
4817	ENVELOPES, LETTER	1,133,388	9,177,515	2,481,942	17,303,653	22	25	0.715
4818	TOILET PAPER, HANDK	7,080,247	14,723,391	101,256,043	35,518,682	65	52	-0.638
4819	CARTONS, BOXES, CA	9,900,052	69,151,621	25,192,085	159,322,247	25	27	0.710
4820	REGISTERS, ACCOUNT	16,306,814	9,574,794	35,376,419	35,768,665	74	99	0.157
4821	PAPER OR PAPERBOA	7,888,246	2,296,856	14,856,925	36,383,841	45	58	0.661
4822	BOBBINS, SPOOLS, CO	746,385	514,464	2,451,156	5,163,360	82	64	0.463
4823	OTHER PAPER, PAPER	39,764,447	17,728,324	83,841,262	65,749,145	62	88	0.043
4901	PRINTED BOOKS, BRO	384,235,293	18,089,600	546,835,595	68,400,418	9	22	-0.527
4902	NEWSPAPERS, JOURN	22,518,420	2,079,147	77,084,082	23,248,770	17	46	-0.441
4903	CHILDREN'S PICTURE,	2,533,711	63,594	10,821,765	746,931	5	13	-0.848
4904	MUSIC, PRINTED OR IN	1,016,747	11,200	1,507,058	16,662	2	2	-0.978
4905	MAPS AND HYDROGRA	3,697,920	448,679	4,750,757	1,521,672	22	49	0.009
4906	PLANS AND DRAWINGS	2,287,389	431,767	5,048,737	273,859	32	10	-1.000
4907	UNUSED POSTAGE, RE	4,936,058	1,183,041	41,008,422	10,173,717	39	40	-0.601
4908	TRANSFERS (DECALC	9,317,757	379,762	17,839,440	973,981	8	10	-0.870
4909	PRINTED OR ILLUSTRA	2,108,904	1,157,935	10,585,478	2,172,467	71	34	-0.786
4910	CALENDARS OF ANY K	2,365,061	997,666	4,315,826	2,483,310	59	73	-0.135

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
4911	OTHER PRINTED MATT	55,900,696	5,653,422	92,918,721	30,262,016	18	49	-0.201
5101	WOOL, NOT CARDED O	15,158,155	312,435,048	69,383,968	329,731,516	9	35	-0.516
5102	FINE OR COARSE ANIM	62,942	46,526,774	5,293,555	64,230,938	0	15	0.544
5103	WASTE OF WOOL OR O	562,172	17,945,660	1,575,056	25,352,145	6	12	0.759
5104	GARNETTED STOCK O	275,995	151,306	12,399	0	71	0	0.271
5105	WOOL AND FINE OR C	5,631,221	410,289,306	7,024,327	527,288,325	3	3	0.976
5106	YARN OF CARDED WO	6,523,561	1,958,221	23,937,491	1,769,258	46	14	-1.000
5107	YARN OF COMBED WO	523,173	5,894,231	1,638,588	8,497,902	16	32	0.400
5108	YARN OF FINE ANIMAL	1,208,118	1,183	863,140	5,896,484	0	26	1.000
5109	YARN OF WOOL OR OF	620,327	75,966	367,332	928,658	22	57	1.000
5110	YARN OF COARSE ANI	69	0	0	112,516	0	0	1.000
5111	WOVEN FABRICS OF C	7,574,240	96,533	8,766,818	1,474,324	3	29	0.072
5112	WOVEN FABRICS OF C	7,586,225	10,843,018	12,734,935	22,496,845	82	72	0.387
5113	WOVEN FABRICS OF C	32,923	0	7,032	0	0	0	1.000
5201	COTTON, NOT CARDED	140,983,784	10,196,745	334,747,518	26,840,708	13	15	-0.842
5202	COTTON WASTE (INCL	1,294,925	1,408,996	4,117,465	4,095,008	96	100	-0.025
5203	COTTON, CARDED OR	1,996,117	560,833	7,066,807	2,225,877	44	48	-0.506
5204	COTTON SEWING THR	647,633	367,302	1,329,715	1,118,912	72	91	0.048
5205	COTTON YARN (EXCLU	24,429,700	42,344,394	51,714,145	53,436,874	73	98	-0.422
5206	COTTON YARN (EXCLU	11,463,616	1,645,115	7,434,113	774,205	25	19	0.645
5207	COTTON YARN (EXCLU	1,178,419	1,059,722	3,042,008	1,015,869	95	50	-1.000
5208	WOVEN FABRICS OF C	79,080,578	25,194,263	148,474,332	59,366,360	48	57	-0.340
5209	WOVEN FABRICS OF C	39,970,609	18,316,264	89,472,927	48,635,510	63	70	-0.240
5210	WOVEN FABRICS OF C	8,113,899	147,932	19,542,928	6,973,285	4	53	-0.252
5211	WOVEN FABRICS OF C	8,077,601	6,908,350	22,544,282	4,709,784	92	35	-1.000
5212	OTHER WOVEN FABRI	18,100,529	3,028,866	5,982,835	1,510,069	29	40	0.777
5301	FLAX, RAW OR PROCE	288,663	7,546	988,996	57,893	5	11	-0.866
5302	TRUE HEMP (CANNABI	0	0	9,454	12,950	ERR	84	0.156
5303	JUTE AND OTHER TEX	0	0	981,659	262,722	ERR	42	-0.578
5304	SISAL AND OTHER TEX	798,521	144,073	5,546,919	59,504	31	2	-1.000
5305	COCONUT, ABACA (MA	2,700,382	13,662	9,205,583	55,931	1	1	-0.987
5306	FLAX YARN	2,384,815	41,107	1,944,284	175,993	3	17	1.000
5307	YARN OF JUTE OR OF	0	0	13,868,662	219,396	ERR	3	-0.969
5308	YARN OF OTHER VEGE	83,862	42,110	85,732	58,298	67	81	0.793
5309	WOVEN FABRICS OF F	14,855,206	91,120	39,287,961	100,731	1	1	-0.999
5310	WOVEN FABRICS OF J	13,579,817	2,864	13,996,982	245,546	0	3	-0.264
5311	WOVEN FABRICS OF O	5,026,868	323,608	52,544,591	226,262	12	1	-1.000
5401	SEWING THREAD OF M	5,090,304	4,060,155	14,784,645	5,436,409	89	54	-0.751
5402	SYNTHETIC FILAMENT	80,468,038	120,623,267	206,736,722	317,141,974	80	79	0.218
5403	ARTIFICIAL FILAMENT	31,838,759	137,387	26,909,547	228,103	1	2	1.000
5404	SYNTHETIC MONOFILA	12,872,716	2,349,251	17,730,281	639,131	31	7	-1.000
5405	ARTIFICIAL MONOFILA	2,488,315	0	3,501,395	214,220	0	12	-0.651

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
5406	MAN-MADE FILAMENT	388,617	138,017	1,094,280	66,558	52	11	-1.000
5407	WOVEN FABRICS OF S	234,916,452	10,770,951	446,478,639	29,250,282	9	12	-0.839
5408	WOVEN FABRICS OF A	35,798,366	184,256	27,852,759	1,251,108	1	9	1.000
5501	SYNTHETIC FILAMENT	39,763,492	75,141	66,629,682	3,427,866	0	10	-0.778
5502	ARTIFICIAL FILAMENT	56,802,592	0	77,545,567	239,857	0	1	-0.977
5503	SYNTHETIC STAPLE FI	86,178,637	10,072,496	126,521,050	180,586,714	21	82	0.617
5504	ARTIFICIAL STAPLE FI	29,598,436	6,257	38,093,559	217,630	0	1	-0.951
5505	WASTE (INCLUDING NO	10,075,260	9,217,769	11,643,330	10,414,405	96	94	-0.134
5506	SYNTHETIC STAPLE FI	8,707,131	400,983	33,200,264	414,244	9	2	-0.999
5507	ARTIFICIAL STAPLE FI	83,540	0	458,980	17,300	0	7	-0.912
5508	SEWING THREAD OF M	878,418	2,913,767	1,780,482	1,460,585	46	90	-1.000
5509	YARN (EXCLUDING SE	28,627,478	10,487,843	84,378,960	36,374,531	54	60	-0.366
5510	YARN (EXCLUDING SE	5,509,897	147,545	4,848,480	671,917	5	24	1.000
5511	YARN (EXCLUDING SE	376,467	7,340,516	381,981	151,355	10	57	-1.000
5512	WOVEN FABRICS OF S	13,624,480	679,681	20,707,933	21,478,920	10	98	0.492
5513	WOVEN FABRICS OF S	76,126,206	10,579,918	68,115,324	3,411,590	24	10	0.056
5514	WOVEN FABRICS OF S	3,915,724	2,942,208	13,580,886	9,823,259	86	84	-0.168
5515	OTHER WOVEN FABRI	66,447,069	1,495,330	123,428,943	6,748,368	4	10	-0.831
5516	WOVEN FABRICS OF A	236,331,807	4,746,485	166,285,597	4,440,506	4	5	0.991
5601	WADDING OF TEXTILE	4,686,839	719,411	30,928,246	3,329,225	27	19	-0.819
5602	FELT, WHETHER OR N	2,185,250	2,920,397	9,947,513	5,314,754	86	70	-0.529
5603	NONWOVENS, WHETHE	46,766,531	9,073,948	77,809,427	22,952,110	32	46	-0.382
5604	RUBBER THREAD AND	376,431	77,502	562,269	811,584	34	82	0.596
5605	METALLISED YARN, W	714,224	4,654	1,858,639	222,010	1	21	-0.681
5606	GIMPED YARN, AND ST	55,404	7,701	1,423,892	30,368	24	4	-0.967
5607	TWINE, CORDAGE, RO	8,513,031	3,446,512	15,194,113	6,170,143	58	58	-0.421
5608	KNOTTED NETTING OF	1,571,328	2,605,102	3,559,364	1,289,280	75	53	-1.000
5609	ARTICLES OF YARN, S	702,145	171,812	1,629,787	454,736	39	44	-0.533
5701	CARPETS AND OTHER	11,941,895	3,029,654	12,910,360	6,447,070	40	67	0.558
5702	CARPETS AND OTHER	15,275,530	18,275,885	33,026,016	34,263,370	91	98	-0.052
5703	CARPETS AND OTHER	15,771,166	9,771,313	44,017,286	35,930,187	77	90	-0.038
5704	CARPETS AND OTHER	1,049,988	4,576,127	3,286,278	14,873,672	37	36	0.643
5705	OTHER CARPETS AND	3,794,826	3,521,865	5,622,165	5,734,833	96	99	0.095
5801	WOVEN PILE FABRICS	25,093,794	758,147	150,938,067	3,100,734	6	4	-0.963
5802	TERRY TOWELLING AN	736,284	242,633	411,355	542,621	50	86	1.000
5803	GAUZE (EXCLUDING N	96,672	21,166	857,464	235,222	36	43	-0.561
5804	TULLE AND OTHER NE	7,254,109	127,926	8,132,151	539,469	3	12	-0.362
5805	HAND-WOVEN TAPEST	241,408	350,072	1,043,627	202,221	82	32	-1.000
5806	NARROW WOVEN FAB	10,582,584	665,873	18,189,504	9,052,759	12	66	0.049
5807	LABELS, BADGES AND	2,856,769	518,347	11,038,467	1,230,484	31	20	-0.840
5808	BRAIDS IN THE PIECE;	3,146,358	18,548,537	3,747,518	54,011,306	29	13	0.967
5809	WOVEN FABRICS OF M	395,554	24,523	2,086,699	136,568	12	12	-0.876

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
5810	EMBROIDERY IN THE P	15,221,170	558,673	31,894,439	320,329	7	2	-1.000
5811	QUILTED TEXTILE PRO	1,762,466	233,477	4,930,344	435,033	23	16	-0.880
5901	TEXTILE FABRICS COA	1,977,765	2,001,218	4,008,720	312,054	99	14	-1.000
5902	TYRE CORD FABRIC O	8,922,056	2,226,021	35,031,311	4,921,864	40	25	-0.813
5903	TEXTILE FABRICS IMP	35,041,249	6,895,978	108,026,307	16,455,901	33	26	-0.768
5904	LINOLEUM, WHETHER	367,574	11,155	1,792,391	105,051	6	11	-0.876
5905	TEXTILE WALL COVERI	747,459	229,300	416,444	49,605	47	21	0.296
5906	RUBBERISED TEXTILE	13,662,001	1,060,241	40,972,086	9,501,484	14	38	-0.528
5907	TEXTILE FABRICS OTH	26,491,788	1,659,987	25,427,501	4,595,561	12	31	1.000
5908	TEXTILE WICKS, WOVE	1,365,690	40,958	1,680,788	259,396	6	27	-0.181
5909	TEXTILE HOSEPIPING	917,286	182,062	1,591,865	478,508	33	46	-0.389
5910	TRANSMISSION OR CO	4,312,660	487,339	10,348,919	2,133,413	20	34	-0.571
5911	TEXTILE PRODUCTS A	91,461,867	5,502,188	154,269,012	10,046,403	11	12	-0.865
6001	PILE FABRICS, INCLUDI	7,503,400	24,302,252	43,501,826	5,904,907	47	24	-1.000
6002	OTHER KNITTED OR C	93,212,401	14,428,103	228,101,766	56,035,976	27	39	-0.529
6101	MEN'S OR BOYS' OVER	3,553,453	6,045,237	3,764,450	870,879	74	38	-1.000
6102	WOMEN'S OR GIRLS' O	1,791,712	289,713	1,311,025	1,842,563	28	83	1.000
6103	MEN'S OR BOYS' SUIT	4,906,146	10,968,313	11,759,511	11,017,283	62	97	-0.986
6104	WOMEN'S OR GIRLS' S	14,558,659	16,702,590	16,792,435	13,548,500	93	89	-1.000
6105	MEN'S OR BOYS' SHIR	15,483,980	13,795,426	34,473,662	36,147,276	94	98	0.081
6106	WOMEN'S OR GIRLS' B	4,063,173	16,672,122	8,558,082	60,503,729	39	25	0.814
6107	MEN'S OR BOYS' UNDE	3,701,774	2,651,859	14,101,199	2,380,261	83	29	-1.000
6108	WOMEN'S OR GIRLS' S	6,593,300	6,731,690	19,063,548	45,382,456	99	59	0.512
6109	T-SHIRTS, SINGLETS A	13,748,181	13,754,169	82,177,061	103,939,341	100	88	0.137
6110	JERSEYS, PULLOVERS	41,454,619	14,255,379	25,187,804	30,141,551	51	91	1.000
6111	BABIES' GARMENTS A	22,784,353	902,138	33,986,866	2,635,870	8	14	-0.732
6112	TRACK SUITS, SKI SUI	16,113,803	14,884,526	25,396,965	24,585,925	96	98	0.022
6113	GARMENTS, MADE UP	1,340,500	1,953	594,295	102,662	0	29	1.000
6114	OTHER GARMENTS, K	1,278,006	2,187,487	7,969,155	5,660,225	74	83	-0.317
6115	PANTY HOSE, TIGHTS,	6,776,438	10,072,360	40,938,475	22,549,961	80	71	-0.465
6116	GLOVES, MITTENS AN	3,580,337	1,396,067	14,105,244	2,164,815	56	27	-0.864
6117	OTHER MADE UP CLOT	2,030,882	803,451	2,288,776	2,199,176	57	98	0.688
6201	MEN'S OR BOYS' OVER	18,825,362	1,209,774	25,456,857	11,393,690	12	62	0.211
6202	WOMEN'S OR GIRLS' O	3,766,037	806,884	8,090,285	1,003,131	35	22	-0.913
6203	MEN'S OR BOYS' SUIT	32,710,784	150,337,504	71,003,180	184,073,692	36	56	-0.063
6204	WOMEN'S OR GIRLS' S	52,470,226	74,842,697	97,540,466	68,878,407	82	83	-1.000
6205	MEN'S OR BOYS' SHIR	13,925,325	62,719,861	98,220,799	39,902,392	36	58	-1.000
6206	WOMEN'S OR GIRLS' B	17,553,442	13,851,713	50,485,532	9,034,573	88	30	-1.000
6207	MEN'S OR BOYS' SING	515,140	3,351,684	2,839,362	2,330,825	27	90	-1.000
6208	WOMEN'S OR GIRLS' SI	929,552	4,202,875	5,030,205	5,068,094	36	100	-0.652
6209	BABIES' GARMENTS A	17,975,639	1,006,610	13,006,873	6,516,578	11	67	1.000
6210	GARMENTS, MADE UP	10,653,363	496,078	3,711,573	2,051,139	9	71	1.000

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
6211	TRACKSUITS, SKI SUIT	18,654,886	22,140,464	21,658,049	9,534,246	91	61	-1.000
6212	BRASSIERES, GIRDLES	2,808,354	1,449,467	7,830,274	109,904,158	68	13	0.911
6213	HANDKERCHIEFS	1,104,466	14,278	452,308	594,399	3	86	1.000
6214	SHAWLS, SCARVES, M	14,267,315	1,075,676	12,715,787	1,909,398	14	26	1.000
6215	TIES, BOW TIES AND C	953,852	760,502	3,475,215	2,045,012	89	74	-0.325
6216	GLOVES, MITTENS AN	1,423,958	40,601	4,037,638	316,989	6	15	-0.809
6217	OTHER MADE UP CLOT	2,530,150	4,206,505	2,509,050	10,751,882	75	38	1.000
6301	BLANKETS (EXCLUDIN	24,740,162	2,639,198	55,565,083	38,983,503	19	82	0.082
6302	BED LINEN, TABLE LIN	49,911,943	6,674,421	82,604,801	26,668,404	24	49	-0.241
6303	CURTAINS (INCLUDING	2,854,739	10,385,867	5,009,935	23,945,805	43	35	0.726
6304	OTHER FURNISHING A	2,865,535	2,418,636	5,489,632	821,267	92	26	-1.000
6305	SACKS AND BAGS, OF	0	0	27,581,130	21,966,490	ERR	89	-0.113
6306	TARPAULINS, AWNING	4,613,662	2,809,264	27,224,905	100,733,062	76	43	0.625
6307	OTHER MADE UP ARTI	20,242,687	12,355,010	50,851,528	9,236,774	76	31	-1.000
6308	SETS CONSISTING OF	127,051	5,130	485,252	100,126	8	34	-0.581
6309	WORN CLOTHING AND	11,219,097	2,061,231	29,068,014	2,097,073	31	13	-0.996
6310	USED OR NEW RAGS, S	18,372,679	705,649	8,378,118	2,640,313	7	48	1.000
6401	WATERPROOF FOOTW	868,769	1,470,493	2,428,517	8,391,073	74	45	0.632
6402	OTHER FOOTWEAR WI	48,074,155	5,073,130	188,292,621	15,779,540	19	15	-0.858
6403	FOOTWEAR, WITH OUT	109,151,063	24,927,063	499,412,370	56,095,286	37	20	-0.852
6404	FOOTWEAR WITH OUT	67,681,967	3,835,736	169,831,396	11,796,292	11	13	-0.855
6405	OTHER FOOTWEAR	8,178,237	6,686,892	14,928,357	4,385,182	90	45	-1.000
6406	PARTS OF FOOTWEAR,	43,180,225	1,398,627	49,910,699	4,978,933	6	18	-0.306
6501	HAT-FORMS, HAT BODI	453,486	1,123,136	259,224	486,024	58	70	-0.533
6502	HAT-SHAPES, PLAITED	921,243	2,880	1,195,357	112,457	1	17	-0.429
6503	FELT HATS AND OTHE	24,623	108,594	64,205	916,311	37	13	0.907
6504	HATS AND OTHER HEA	997,161	301,085	7,510,394	761,580	46	18	-0.868
6505	HATS AND OTHER HEA	8,640,066	2,533,556	40,206,354	10,142,583	45	40	-0.612
6506	OTHER HEADGEAR, W	4,166,774	1,686,233	20,204,742	4,621,075	58	37	-0.691
6507	HEAD-BANDS, LININGS,	589,655	62,795	1,141,180	163,503	19	25	-0.691
6601	UMBRELLAS AND SUN	2,784,262	2,888,471	16,319,518	17,920,955	98	95	0.052
6602	WALKING-STICKS, SEA	172,942	25,907	486,631	157,804	26	49	-0.408
6603	PARTS, TRIMMINGS AN	6,692,375	158,711	5,036,242	255,850	5	10	1.000
6701	SKINS AND OTHER PA	161,355	533,075	125,461	3,584,278	46	7	1.000
6702	ARTIFICIAL FLOWERS,	2,714,060	321,309	15,320,449	687,102	21	9	-0.944
6703	HUMAN HAIR, DRESSE	1,477,079	56,823	4,367,133	215,853	7	9	-0.896
6704	WIGS, FALSE BEARDS,	834,082	119,891	858,558	7,648,977	25	20	0.994
8201	HAND TOOLS, THE FOL	11,279,168	6,622,401	22,891,457	16,241,515	74	83	-0.094
8202	HAND SAWS, BLADES	27,912,039	5,473,662	63,575,930	19,551,488	33	47	-0.434
8203	FILES, RASPS, PLIERS	16,830,826	970,503	36,973,376	3,358,608	11	17	-0.788
8204	HAND-OPERATED SPA	18,899,790	3,023,580	40,969,088	10,831,892	28	42	-0.477
8205	HAND TOOLS (INCLUDI	65,376,288	13,811,036	119,387,001	37,778,705	35	48	-0.385

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
8206	TOOLS OF TWO OR MO	4,371,666	1,775,606	9,332,589	6,874,519	58	85	0.014
8207	INTERCHANGEABLE T	151,462,281	100,611,960	270,816,416	225,895,094	80	91	0.024
8208	KNIVES AND CUTTING	29,515,752	4,787,258	66,525,989	10,601,270	28	27	-0.728
8209	PLATES, STICKS, TIPS	20,455,748	7,667,166	52,462,188	41,440,220	55	88	0.027
8210	HAND-OPERATED MEC	6,036,847	101,883	7,448,895	368,320	3	9	-0.683
8211	KNIVES WITH CUTTING	28,640,872	3,746,764	44,959,145	11,016,378	23	39	-0.384
8212	RAZORS AND RAZOR B	27,096,571	843,984	59,359,672	8,587,711	6	25	-0.613
8213	SCISSORS, TAILORS' S	7,671,331	45,803	13,698,932	289,202	1	4	-0.922
8214	OTHER ARTICLES OF C	5,012,193	345,951	10,007,735	1,393,764	13	24	-0.653
8215	SPOONS, FORKS, LADL	15,755,948	2,415,222	26,897,635	6,100,114	27	37	-0.503
8301	PADLOCKS AND LOCK	59,189,286	8,669,730	136,887,417	20,894,013	26	26	-0.728
8302	BASE METAL MOUNTIN	74,435,685	7,217,454	146,816,794	20,242,207	18	24	-0.695
8303	ARMOURED OR REINF	1,990,928	7,722,042	5,041,127	14,402,638	41	52	0.373
8304	FILING CABINETS, CAR	1,394,018	1,598,188	1,417,871	2,595,150	93	71	0.953
8305	FITTINGS FOR LOOSE-	6,732,499	647,044	17,436,259	3,123,382	18	30	-0.624
8306	BELLS, GONGS AND T	5,782,288	97,395	29,534,526	1,445,194	3	9	-0.893
8307	FLEXIBLE TUBING OF	6,214,991	1,298,962	10,826,967	2,854,491	35	42	-0.496
8308	CLASPS, FRAMES WIT	21,554,172	2,404,428	31,257,344	8,557,736	20	43	-0.224
8309	STOPPERS, CAPS AND	25,095,803	4,782,752	34,969,857	13,241,702	32	55	-0.077
8310	SIGN-PLATES, NAME-P	2,826,168	470,342	6,635,832	3,319,724	29	67	-0.144
8311	WIRE, RODS, TUBES, P	17,555,664	10,063,855	38,702,717	27,810,966	73	84	-0.087
8401	NUCLEAR REACTORS,	79,754,028	7,456,030	219,665,541	749,054	17	1	-1.000
8402	STEAM OR OTHER VAP	37,221,427	8,220,156	20,700,318	24,995,106	36	91	1.000
8403	CENTRAL HEATING BO	760,629	759,501	1,144,784	8,067,493	100	25	0.900
8404	AUXILLIARY PLANT FO	3,229,319	6,622,028	7,917,587	11,334,144	66	82	0.003
8405	PRODUCER GAS OR W	830,294	597,464	10,611,607	4,645,483	84	61	-0.415
8406	STEAM TURBINES AND	157,108,352	3,288,488	54,496,085	7,489,746	4	24	1.000
8407	SPARK-IGNITION RECI	322,128,567	15,497,939	362,025,019	208,281,305	9	73	0.657
8408	COMPRESSION-IGNITI	133,155,896	29,605,798	254,244,518	80,547,791	36	48	-0.408
8409	PARTS SUITABLE FOR	350,502,202	84,800,838	660,577,531	204,776,743	39	47	-0.442
8410	HYDRAULIC TURBINES,	291,646	507,907	253,780	2,637,254	73	18	1.000
8411	TURBO-JETS, TURBO-P	262,526,021	9,384,433	711,812,716	91,013,958	7	23	-0.692
8412	OTHER ENGINES AND	63,871,935	8,844,796	235,324,993	18,261,597	24	14	-0.896
8413	PUMPS FOR LIQUIDS,	314,599,022	64,095,879	642,530,331	192,140,195	34	46	-0.438
8414	AIR OR VACUUM PUMP	439,148,016	37,401,038	844,956,692	71,788,346	16	16	-0.844
8415	AIR CONDITIONING MA	110,848,564	21,327,772	274,405,916	60,361,417	32	36	-0.615
8416	FURNACE BURNERS F	14,459,645	579,483	58,025,139	5,314,165	8	17	-0.804
8417	INDUSTRIAL OR LABO	21,527,243	7,423,990	666,861,700	43,792,606	51	12	-0.893
8418	REFRIGERATORS, FRE	158,436,480	31,549,956	371,824,056	165,655,450	33	62	-0.228
8419	MACHINERY, PLANT O	409,675,255	29,894,677	670,284,315	111,283,570	14	28	-0.524
8420	CALENDERING OR OTH	16,111,798	5,559,028	16,665,888	5,534,434	51	50	-1.000
8421	CENTRIFUGES, INCLUD	166,335,057	185,304,888	691,912,831	904,186,874	95	87	0.155

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
8422	DISH WASHING MACHI	220,278,803	15,453,218	559,162,052	53,785,740	13	18	-0.797
8423	MASSMETERS (EXCLU	33,526,504	4,682,419	72,860,930	17,878,949	25	39	-0.498
8424	MECHANICAL APPLIAN	96,715,670	14,976,641	279,140,437	93,323,666	27	50	-0.399
8425	PULLEY TACKLE AND	43,026,434	11,229,431	89,385,830	47,573,549	41	69	-0.121
8426	SHIPS' DERRICKS, CRA	38,520,540	15,276,315	163,149,447	104,497,693	57	78	-0.166
8427	FORK-LIFT TRUCKS, O	39,704,821	13,790,547	173,388,621	34,355,712	52	33	-0.733
8428	OTHER LIFTING, HAND	110,525,472	21,948,316	233,614,640	172,869,564	33	85	0.102
8429	SELF-PROPELLED BUL	231,100,047	87,105,952	1,325,896,283	146,667,991	55	20	-0.897
8430	OTHER MOVING, GRAD	191,134,280	21,837,254	253,758,465	55,664,607	21	36	-0.299
8431	PARTS SUITABLE FOR	244,681,810	77,476,896	588,291,285	249,744,431	48	60	-0.332
8432	AGRICULTURAL, HORT	11,099,552	4,508,290	77,584,403	19,522,716	58	40	-0.632
8433	HARVESTING OR THRE	66,341,096	20,436,402	267,893,185	17,360,076	47	12	-1.000
8434	MILKING MACHINES A	8,119,287	891,672	17,134,278	6,300,185	20	54	-0.250
8435	PRESSES, CRUSHERS	12,556,428	1,298,022	49,850,809	4,239,338	19	16	-0.854
8436	OTHER AGRICULTURA	16,452,152	2,629,494	76,095,229	47,611,502	28	77	-0.140
8437	MACHINES FOR CLEAN	24,455,707	2,422,270	47,713,461	20,565,850	18	60	-0.124
8438	MACHINERY, NOT SPE	104,033,847	36,661,577	282,670,728	182,475,334	52	78	-0.101
8439	MACHINERY FOR MAKI	51,213,539	5,239,217	163,028,220	16,273,204	19	18	-0.820
8440	BOOK-BINDING MACHI	25,013,477	453,205	52,207,272	3,803,174	4	14	-0.781
8441	OTHER MACHINERY F	64,566,251	5,221,292	227,278,288	21,795,234	15	18	-0.815
8442	MACHINERY, APPARAT	18,532,263	2,882,719	44,848,630	12,322,946	27	43	-0.472
8443	PRINTING MACHINERY,	463,874,051	12,795,761	1,224,003,030	57,987,957	5	9	-0.888
8444	MACHINES FOR EXTRU	74,319,724	269,789	1,696,848	639,692	1	55	1.000
8445	MACHINES FOR PREPA	83,679,746	5,719,902	170,985,051	22,295,433	13	23	-0.681
8446	WEAVING MACHINES (	40,444,410	4,614,628	88,050,043	8,011,571	20	17	-0.867
8447	KNITTING MACHINES,	41,991,511	6,430,383	133,718,550	7,418,958	27	11	-0.979
8448	AUXILIARY MACHINER	98,793,188	2,876,450	174,278,455	7,093,324	6	8	-0.894
8449	MACHINERY FOR THE	3,561,431	2,244,185	1,959,482	317,862	77	28	-0.092
8450	HOUSEHOLD OR LAUN	97,831,262	2,374,442	223,855,208	8,495,586	5	7	-0.907
8451	MACHINERY (EXCLUDI	72,855,743	5,050,737	197,335,920	11,411,537	13	11	-0.903
8452	SEWING MACHINES (E	158,646,762	5,234,431	206,918,669	19,366,184	6	17	-0.547
8453	MACHINERY FOR PREP	30,387,444	1,641,302	56,150,307	7,163,164	10	23	-0.647
8454	CONVERTERS, LADLES	43,291,817	3,896,373	91,473,857	6,054,790	17	12	-0.914
8455	METAL-ROLLING MILL	95,880,007	2,696,851	808,896,569	43,682,485	5	10	-0.891
8456	MACHINE-TOOLS FOR	17,881,744	216,121	40,163,628	3,513,682	2	16	-0.742
8457	MACHINING CENTRES,	30,634,090	100,479	56,120,456	3,212,575	1	11	-0.782
8458	LATHES FOR REMOVIN	33,567,739	1,705,151	116,480,607	7,788,351	10	13	-0.863
8459	MACHINE-TOOLS (INCL	34,060,719	5,583,991	61,679,902	15,728,605	28	41	-0.463
8460	MACHINE-TOOLS FOR	25,529,562	1,189,136	37,440,506	7,454,408	9	33	-0.311
8461	MACHINE-TOOLS FOR	23,804,413	1,702,728	48,319,314	9,677,610	13	33	-0.509
8462	MACHINE-TOOLS (INCL	102,011,360	7,448,958	131,991,568	28,657,801	14	36	-0.171
8463	OTHER MACHINE-TOO	27,911,698	2,198,834	53,078,785	21,753,264	15	58	-0.126

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
8464	MACHINE-TOOLS FOR	13,367,597	1,961,356	44,467,542	5,888,754	26	23	-0.776
8465	MACHINE-TOOLS (INCL	68,802,749	3,661,788	146,724,124	12,030,001	10	15	-0.806
8466	PARTS AND ACCESSO	69,168,979	8,094,929	191,821,693	33,927,479	21	30	-0.652
8467	TOOLS FOR WORKING	53,925,595	26,641,494	141,406,660	75,735,717	66	70	-0.281
8468	MACHINERY AND APPA	9,019,343	5,663,379	22,764,533	12,708,438	77	72	-0.322
8469	TYPEWRITERS AND W	16,561,966	3,154,986	13,694,531	2,402,897	32	30	0.584
8470	CALCULATING MACHIN	63,018,805	1,259,263	88,702,232	7,174,572	4	15	-0.626
8471	AUTOMATIC DATA PRO	1,358,969,305	48,404,380	3,351,018,689	203,189,335	7	11	-0.856
8472	OTHER OFFICE MACHI	33,102,666	5,707,977	177,830,719	9,847,302	29	10	-0.944
8473	PARTS AND ACCESSO	665,224,265	88,114,137	1,681,229,435	471,881,965	23	44	-0.452
8474	MACHINERY FOR SOR	55,840,567	150,936,983	235,986,569	515,582,860	54	63	0.339
8475	MACHINES FOR ASSE	7,357,501	4,314,559	90,318,251	42,761,066	74	64	-0.367
8476	AUTOMATIC GOODS-V	7,117,336	571,720	40,928,593	9,435,588	15	37	-0.585
8477	MACHINERY FOR WOR	233,774,608	9,976,105	460,409,096	50,608,355	8	20	-0.696
8478	MACHINERY FOR PREP	19,506,707	2,202,772	22,850,492	3,596,547	20	27	-0.412
8479	MACHINES AND MECH	285,127,037	46,376,311	796,075,821	276,756,728	28	52	-0.378
8480	MOULDING BOXES FO	83,325,539	19,263,998	164,268,665	67,275,824	38	58	-0.255
8481	TAPS, COCKS, VALVES	382,424,499	42,943,044	704,496,139	115,210,492	20	28	-0.633
8482	BALL OR ROLLER BEA	309,549,794	36,657,647	554,257,049	129,121,151	21	38	-0.452
8483	TRANSMISSION SHAFT	422,445,967	64,617,941	848,875,663	183,012,117	27	35	-0.565
8484	GASKETS AND SIMILA	62,811,352	3,647,091	151,224,430	10,280,884	11	13	-0.860
8485	MACHINERY PARTS, N	68,122,901	8,292,815	83,326,741	22,508,218	22	43	-0.034
8501	ELECTRICAL MOTORS	163,750,708	20,651,687	339,493,458	54,903,199	22	28	-0.674
8502	ELECTRIC GENERATIN	29,144,196	7,988,177	40,684,164	27,652,891	43	81	0.260
8503	PARTS SUITABLE FOR	57,706,703	8,339,650	116,572,918	31,058,936	25	42	-0.443
8504	ELECTRICAL TRANSFO	179,557,995	26,814,841	433,300,039	165,529,235	26	55	-0.293
8505	ELECTRO-MAGNETS, P	24,338,702	3,400,263	45,957,623	9,174,269	25	33	-0.578
8506	PRIMARY CELLS AND	33,049,831	6,082,622	76,112,862	26,288,628	31	51	-0.361
8507	ELECTRIC ACCUMULA	40,751,602	10,464,092	171,130,291	98,289,706	41	73	-0.195
8508	ELECTRO-MECHANICA	87,369,199	5,009,906	192,090,203	11,333,419	11	11	-0.886
8509	ELECTRO-MECHANICA	49,461,149	3,071,723	113,696,772	16,674,740	12	26	-0.650
8510	SHAVERS AND HAIR CL	13,250,749	507,173	32,663,440	1,308,415	7	8	-0.921
8511	ELECTRICAL IGNITION	107,787,301	24,449,089	209,724,800	45,093,844	37	35	-0.663
8512	ELECTRICAL LIGHTING	71,077,711	3,664,347	98,804,476	10,538,666	10	19	-0.603
8513	PORTABLE ELECTRIC	10,754,472	1,552,324	25,183,011	2,947,159	25	21	-0.824
8514	INDUSTRIAL OR LABO	26,371,961	6,506,560	203,947,204	13,899,116	40	13	-0.920
8515	ELECTRIC (INCLUDING	74,592,757	7,581,573	152,784,924	16,873,258	18	20	-0.788
8516	ELECTRIC INSTANTAN	155,149,353	19,832,271	386,729,551	58,373,669	23	26	-0.715
8517	ELECTRICAL APPARAT	557,853,166	82,719,121	2,661,728,101	269,401,867	26	18	-0.837
8518	MICROPHONES AND ST	78,964,747	3,159,115	348,656,689	12,173,453	8	7	-0.935
8519	TURNTABLES (RECOR	57,288,661	954,217	61,223,833	3,712,393	3	11	-0.176
8520	MAGNETIC TAPE RECO	26,210,609	703,969	26,110,681	3,223,448	5	22	1.000

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
8521	VIDEO RECORDING OR	55,385,287	3,746,040	205,029,455	8,751,300	13	8	-0.935
8522	PARTS AND ACCESSO	15,015,321	747,948	27,012,333	3,229,421	9	21	-0.657
8523	PREPARED UNRECORD	88,412,068	6,948,124	167,766,449	5,850,586	15	7	-1.000
8524	RECORDS, TAPES AND	229,465,368	6,613,872	1,009,755,792	19,040,701	6	4	-0.969
8525	TRANSMISSION APPAR	234,320,575	24,190,891	2,751,181,400	162,986,791	19	11	-0.895
8526	RADAR APPARATUS, R	35,601,079	5,314,151	134,952,413	22,858,722	26	29	-0.700
8527	RECEPTION APPARAT	145,100,381	5,027,235	473,129,037	75,053,079	7	27	-0.648
8528	TELEVISION RECEIVER	57,452,324	5,893,897	335,292,268	56,354,322	19	29	-0.693
8529	PARTS SUITABLE FOR	147,858,479	13,590,862	428,741,593	78,792,972	17	31	-0.623
8530	ELECTRICAL SIGNALLI	8,648,117	6,841,895	8,043,666	20,376,647	88	57	1.000
8531	ELECTRIC SOUND OR	22,359,845	12,015,005	70,883,550	92,143,688	70	87	0.246
8532	ELECTRICAL CAPACIT	58,420,275	1,064,539	93,775,488	6,826,346	4	14	-0.720
8533	ELECTRICAL RESISTO	48,781,606	541,017	58,888,002	1,465,760	2	5	-0.832
8534	PRINTED CIRCUITS	37,783,661	3,045,533	100,016,193	7,803,075	15	14	-0.858
8535	ELECTRICAL APPARAT	94,388,477	8,894,593	181,467,772	46,905,045	17	41	-0.392
8536	ELECTRICAL APPARAT	432,215,596	50,545,898	829,408,979	169,288,755	21	34	-0.540
8537	BOARDS, PANELS (INC	102,606,311	10,907,505	197,120,178	47,829,456	19	39	-0.438
8538	PARTS SUITABLE FOR	116,093,608	23,352,640	180,235,303	50,433,684	33	44	-0.406
8539	ELECTRIC FILAMENT O	93,093,808	10,559,621	245,715,337	16,356,471	20	12	-0.927
8540	THERMIONIC, COLD CA	136,360,102	2,862,927	210,619,070	5,329,170	4	5	-0.936
8541	DIODES, TRANSISTOR	77,009,676	1,661,467	177,476,271	9,550,447	4	10	-0.854
8542	ELECTRONIC INTEGRA	250,787,813	4,285,029	1,073,538,092	38,884,114	3	7	-0.919
8543	ELECTRICAL MACHINE	109,411,441	9,853,216	351,317,002	81,199,519	17	38	-0.544
8544	INSULATED (INCLUDIN	131,798,468	39,274,753	338,616,357	251,122,252	46	85	0.012
8545	CARBON ELECTRODES	13,015,183	4,253,311	30,419,019	15,395,358	49	67	-0.219
8546	ELECTRICAL INSULAT	19,013,758	3,510,382	46,844,004	9,448,611	31	34	-0.648
8547	INSULATING FITTINGS	24,537,466	2,045,985	61,896,978	14,834,471	15	39	-0.490
8548	ELECTRICAL PARTS O	3,123,883	14,717,904	916,965	3,223,401	35	44	-0.678
8601	RAIL LOCOMOTIVES P	1,369,963	0	11,894,379	368,216,510	0	6	0.944
8602	THER RAIL LOCOMOTI	6,717,506	15,266,646	446,382	2,453,921	61	31	-0.343
8603	SELF-PROPELLED RAI	0	57,747	0	13,793	0	0	-1.000
8604	RAILWAY OR TRAMWA	453,265	334,408	0	173,127	85	0	0.475
8605	RAILWAY OR TRAMWA	0	6,000,000	13,458	260,806,810	0	0	1.000
8606	RAILWAY OR TRAMWA	517,134	1,746,599	415,875	1,933,405	46	35	1.000
8607	PARTS OF RAILWAY O	11,546,023	49,725,768	34,883,177	73,979,813	38	64	0.019
8608	RAILWAY OR TRAMWA	142,139	2,303,498	2,353,628	18,828,190	12	22	0.764
8609	CONTAINERS (INCLUDI	5,528,387	352,866,555	53,997,645	1,002,739,862	3	10	0.861
8701	TRACTORS (EXCLUDIN	209,373,853	24,730,210	737,874,767	87,831,867	21	21	-0.787
8702	PUBLIC-TRANSPORT T	100,285,311	16,543,098	57,587,998	80,353,500	28	83	1.000
8703	MOTOR CARS AND OT	1,861,968,391	456,991,929	2,004,736,945	1,149,317,447	39	73	0.658
8704	MOTOR VEHICLES FOR	991,532,948	181,099,479	330,182,770	761,758,506	31	60	1.000
8705	SPECIAL PURPOSE MO	50,242,657	9,110,147	151,206,470	38,239,076	31	40	-0.552

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
8706	CHASSIS FITTED WITH	22,678,688	10,359,141	61,321,598	24,172,040	63	57	-0.473
8707	BODIES (INCLUDING C	36,305,211	4,903,684	28,307,034	12,988,526	24	63	1.000
8708	PARTS AND ACCESSO	1,867,399,282	749,989,817	1,483,424,650	1,453,959,145	57	99	1.000
8709	WORK TRUCKS, SELF-	2,670,278	3,197,457	10,939,018	7,523,286	91	81	-0.313
8710	TANKS AND OTHER AR	0	0	35,778,889	115,906,345	ERR	47	0.528
8711	MOTORCYCLES (INCL	40,881,720	6,962,220	167,197,129	17,812,202	29	19	-0.842
8712	BICYCLES AND OTHER	10,462,448	814,732	16,730,504	16,004,661	14	98	0.416
8713	INVALID CARRIAGES,	2,391,477	32,530	6,533,774	211,255	3	6	-0.917
8714	PARTS AND ACCESSO	55,583,241	5,434,369	125,544,496	6,700,489	18	10	-0.964
8715	BABY CARRIAGES AND	3,968,951	48,525	11,308,588	603,732	2	10	-0.859
8716	TRAILERS AND SEMI-T	22,291,383	34,623,204	61,977,905	106,682,457	78	73	0.290
8801	BALLOONS AND DIRIGI	869,261	1,034,074	3,548,141	655,635	91	31	-1.000
8802	OTHER AIRCRAFT (FO	1,048,477,494	56,333,567	1,874,324,156	732,420,491	10	56	-0.100
8803	PARTS OF GOODS OF	99,536,605	71,547,496	548,326,836	218,671,495	84	57	-0.506
8804	PARACHUTES (INCLUDI	37,806,345	2,964,877	2,499,329	8,303,492	15	46	1.000
8805	AIRCRAFT LAUNCHING	108,096,589	19,331	1,164,181	10,170,225	0	21	1.000
8901	CRUISE SHIPS, EXCUR	3,736,184	220,684,776	7,007,720	21,877,419	3	49	-1.000
8902	FISHING VESSELS; FA	71,998,557	10,735	73,640,909	523,308	0	1	-0.524
8903	YACHTS AND OTHER V	7,823,736	42,306,623	44,125,685	138,943,128	31	48	0.454
8904	TUGS AND PUSHER CR	0	970	32,743,286	1,190,761	0	7	-0.930
8905	LIGHT-VESSELS, FIRE-	16,050,258	54,524	3,284,189	16,238,674	1	34	1.000
8906	OTHER VESSELS, INCL	1,869,027	16,038	828,598	2,319,503	2	53	1.000
8907	OTHER FLOATING STR	4,257,294	775,994	9,770,233	1,596,675	31	28	-0.741
8908	VESSELS AND OTHER	21,520	600,000	48,705	75,622	7	78	-1.000
9001	OPTICAL FIBRES AND	49,270,940	972,245	115,301,323	13,664,875	4	21	-0.678
9002	LENSES, PRISMS, MIR	9,476,553	3,145,075	30,155,994	5,623,851	50	31	-0.786
9003	FRAMES AND MOUNTI	57,616,171	336,628	107,275,092	1,923,445	1	4	-0.938
9004	SPECTACLES, GOGGL	8,427,215	2,710,506	34,384,757	4,625,244	49	24	-0.863
9005	BINOCULARS, MONOC	5,277,558	668,497	15,428,832	2,433,978	22	27	-0.704
9006	PHOTOGRAPHIC (EXCL	43,571,233	6,613,333	82,099,361	11,256,027	26	24	-0.785
9007	CINEMATOGRAPHIC C	6,645,746	1,020,888	15,793,207	6,458,226	27	58	-0.254
9008	IMAGE PROJECTORS (	13,864,202	743,370	20,814,051	855,033	10	8	-0.968
9009	PHOTO-COPYING APPA	193,793,580	7,709,573	560,656,145	25,733,971	8	9	-0.906
9010	APPARATUS AND EQUI	29,313,868	2,107,690	56,807,531	5,350,325	13	17	-0.789
9011	COMPOUND OPTICAL	7,530,602	207,968	9,294,139	545,020	5	11	-0.679
9012	MICROSCOPES (EXCL	5,155,054	858,517	12,817,507	159,694,627	29	15	0.908
9013	LIQUID CRYSTAL DEVI	14,065,932	1,631,070	45,208,353	13,439,637	21	46	-0.450
9014	DIRECTION FINDING C	46,887,819	2,616,515	139,162,949	29,360,196	11	35	-0.551
9015	SURVEYING (INCLUDIN	32,464,793	6,077,673	93,024,307	26,426,581	32	44	-0.497
9016	BALANCES OF A SENSI	4,558,080	190,630	7,444,690	210,541	8	6	-0.986
9017	DRAWING, MARKING-O	56,564,691	3,156,205	92,372,019	5,236,717	11	11	-0.890
9018	INSTRUMENTS AND AP	355,620,185	45,411,743	819,077,795	112,438,168	23	24	-0.747

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
9019	MECHANO-THERAPY A	24,815,777	1,408,969	44,571,464	2,298,091	11	10	-0.914
9020	OTHER BREATHING AP	27,953,946	1,570,788	45,843,152	7,022,661	11	27	-0.533
9021	ORTHOPAEDIC APPLIA	83,115,029	4,848,399	243,585,948	9,238,084	11	7	-0.947
9022	APPARATUS BASED O	130,959,117	5,445,800	182,293,964	29,468,303	8	28	-0.362
9023	INSTRUMENTS, APPAR	16,113,137	6,648,842	39,343,664	17,144,639	58	61	-0.378
9024	MACHINES AND APPLI	18,418,500	1,556,721	32,646,940	2,553,263	16	15	-0.869
9025	HYDROMETERS AND SI	15,427,337	2,300,912	32,952,800	1,666,204	26	10	-1.000
9026	INSTRUMENTS AND AP	125,564,736	8,860,827	238,857,584	28,090,491	13	21	-0.710
9027	INSTRUMENTS AND AP	130,012,017	7,371,576	323,177,996	24,142,008	11	14	-0.840
9028	GAS, LIQUID OR ELECT	52,413,280	3,205,170	81,846,916	33,196,177	12	58	0.009
9029	REVOLUTION COUNTE	27,908,394	846,344	46,887,159	9,478,795	6	34	-0.375
9030	OSCILLOSCOPES, SPE	85,307,320	6,012,310	256,211,179	29,121,466	13	20	-0.762
9031	MEASURING OR CHEC	210,122,299	20,344,945	289,265,597	50,375,714	18	30	-0.450
9032	AUTOMATIC REGULATI	197,531,104	11,048,757	454,901,774	63,896,922	11	25	-0.659
9033	PARTS AND ACCESSO	23,705,267	1,722,971	32,356,331	5,686,627	14	30	-0.372
9101	WRIST-WATCHES, POC	10,334,656	559,348	21,684,024	5,819,462	10	42	-0.367
9102	WRIST-WATCHES, POC	64,310,676	615,507	145,111,364	3,646,710	2	5	-0.928
9103	CLOCKS WITH WATCH	2,842,052	81,042	2,415,160	209,637	6	16	1.000
9104	INSTRUMENT PANEL C	2,039,606	2,240	2,049,497	500,595	0	39	0.961
9105	OTHER CLOCKS	16,007,738	331,150	13,499,704	1,073,260	4	15	1.000
9106	TIME OF DAY RECORDI	5,800,498	818,909	8,264,320	2,918,131	25	52	-0.080
9107	TIME SWITCHES WITH	12,045,423	132,960	15,999,514	116,146	2	1	-1.000
9108	WATCH MOVEMENTS,	286,860	42,695	814,543	247,704	26	47	-0.440
9109	LOCK MOVEMENTS, C	986,968	3,904	1,791,419	457,520	1	41	-0.279
9110	COMPLETE WATCH OR	402,402	2,531	482,804	6,638	1	3	-0.903
9111	WATCH CASES AND PA	85,585	11,012	427,502	28,534	23	13	-0.903
9112	CLOCK CASES AND CA	100,028	1,518	238,975	93,424	3	56	-0.204
9113	WATCH STRAPS, WAT	3,675,127	55,028	6,204,645	126,591	3	4	-0.945
9114	OTHER CLOCK OR WA	2,779,853	12,526	5,778,176	94,559	1	3	-0.947
9201	PIANOS, INCLUDING AU	2,317,170	186,579	919,698	420,234	15	63	1.000
9202	OTHER STRING MUSIC	2,104,791	152,898	3,980,354	507,696	14	23	-0.682
9203	KEYBOARD PIPE ORGA	95,458	209,929	360,190	376,514	63	98	-0.228
9204	ACCORDIONS AND SIM	429,865	23,000	329,603	1,463,059	10	37	1.000
9205	OTHER WIND MUSICAL	1,887,840	65,959	3,728,860	194,377	7	10	-0.870
9206	PERCUSSION MUSICAL	1,657,312	244,528	3,972,889	255,505	26	12	-0.991
9207	MUSICAL INSTRUMENT	17,403,219	933,189	16,374,130	2,365,568	10	25	1.000
9208	MUSICAL BOXES, FAIR	849,335	57,069	1,298,561	1,066,860	13	90	0.384
9209	PARTS (FOR EXAMPLE,	4,256,238	112,790	5,976,902	30,179,747	5	33	0.892
9401	SEATS (EXCLUDING TH	55,083,212	8,684,115	201,406,892	1,405,990,448	27	25	0.810
9402	MEDICAL, SURGICAL,	14,545,109	1,707,595	20,025,492	6,397,436	21	48	-0.078
9403	OTHER FURNITURE AN	53,130,965	181,592,122	159,252,521	524,283,240	45	47	0.527
9404	MATTRESS SUPPORTS	3,912,229	13,761,792	36,253,841	89,066,114	44	58	0.399

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
9405	LAMPS AND LIGHTING	60,549,475	22,266,185	141,884,154	47,977,595	54	51	-0.520
9406	PREFABRICATED BUIL	2,124,645	25,302,325	11,076,803	48,961,568	15	37	0.451
9501	WHEELED TOYS DESIG	3,342,831	378,999	6,522,462	80,547	20	2	-1.000
9502	DOLLS REPRESENTIN	17,371,384	69,942	42,651,938	1,033,160	1	5	-0.927
9503	OTHER TOYS; REDUCE	94,167,128	1,373,050	284,088,876	11,585,610	3	8	-0.898
9504	ARTICLES FOR FUNFAI	46,724,320	2,093,012	158,887,063	32,242,794	9	34	-0.576
9505	FESTIVE, CARNIVAL O	5,665,633	1,518,586	19,931,893	2,976,221	42	26	-0.815
9506	ARTICLES AND EQUIP	77,912,685	17,997,646	299,461,723	26,138,681	38	16	-0.929
9507	FISHING RODS, FISH-H	17,378,242	2,470,158	49,477,118	8,358,433	25	29	-0.690
9508	ROUNDABOUTS, SWIN	374,201	9,730	405,582	97,179	5	39	0.472
9601	WORKED IVORY, BONE	362,539	788,777	725,371	2,701,840	63	42	0.681
9602	WORKED VEGETABLE	9,643,188	552,448	17,551,247	668,139	11	7	-0.971
9603	BROOMS, BRUSHES (IN	21,118,910	4,150,556	60,746,836	29,177,830	33	65	-0.226
9604	HAND SIEVES AND HAN	504,469	118,925	806,765	313,360	38	56	-0.217
9605	TRAVEL SETS FOR PE	929,460	39,454	1,814,490	423,152	8	38	-0.395
9606	BUTTONS, PRESS-FAS	19,828,008	652,011	33,453,195	4,395,884	6	23	-0.569
9607	SLIDE FASTENERS AN	5,503,035	2,100,333	17,417,321	7,136,938	55	58	-0.406
9608	BALL POINT PENS; FEL	53,735,671	2,358,055	104,580,516	21,586,197	8	34	-0.451
9609	PENCILS (EXCLUDING	11,166,001	3,236,294	31,655,870	1,856,695	45	11	-1.000
9610	SLATES AND BOARDS,	1,754,165	109,610	1,554,219	799,442	12	68	1.000
9611	DATE, SEALING OR NU	6,567,182	164,472	15,791,757	1,077,762	5	13	-0.820
9612	TYPEWRITER OR SIMIL	26,862,764	2,073,521	50,919,600	2,072,938	14	8	-1.000
9613	CIGARETTE LIGHTERS	12,193,801	306,895	22,640,313	308,777	5	3	-1.000
9614	SMOKING PIPES (INCL	1,343,134	4,163	1,621,109	79,347	1	9	-0.574
9615	COMBS, HAIR-SLIDES	5,879,394	201,940	13,049,695	1,550,790	7	21	-0.683
9616	SCENT SPRAYS AND SI	1,734,284	157,179	10,370,298	1,072,086	17	19	-0.808
9617	VACUUM FLASKS AND	3,038,006	45,183	12,344,305	513,930	3	8	-0.904
9618	TAILORS' DUMMIES AN	1,079,577	3,562,096	2,227,803	1,770,446	47	89	-1.000
	TOTALS (Million rand)	**38,379**	**12,501**	**86,481**	**36,924**			

Table A1 South African 4-digit IIT and MIIT, 1992 and 1997

HS NO.	DESCRIPTION	1992 IMPORTS (R)	EXPORTS (R)	1997 IMPORTS (R)	EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
1	LIVE ANIMALS.	21,675,225	13,803,819	48,225,110	58,803,645	78	90	0.258
2	MEAT & EDIBLE MEAT	217,739,292	212,008,735	715,381,358	212,760,656	99	46	-0.997
3	FISH AND CRUSTACEA	78,743,755	446,310,269	186,942,019	881,281,372	30	35	0.602
4	DAIRY PRODUCE; BIRD	70,572,612	69,615,389	310,734,779	222,258,915	99	83	-0.223
5	PRODUCTS OF ANIMAL	49,732,478	19,776,061	198,806,906	46,253,442	57	38	-0.698
6	LIVE TREES AND OTHE	9,257,338	74,591,806	28,610,518	164,176,930	22	30	0.645
7	EDIBLE VEGETABLES A	164,917,282	79,034,397	198,127,283	903,497,095	65	36	0.923
8	EDIBLE FRUIT AND NUT	51,443,704	1,604,883,069	146,379,590	2,743,165,340	6	10	0.846
9	COFFEE, TEA, MATE AN	146,014,158	36,066,339	394,918,358	138,806,427	40	52	-0.416
10	CEREALS	1,794,635,403	277,434,378	1,576,211,677	1,295,064,087	27	90	1.000
11	PRODUCTS OF THE MIL	126,839,861	136,396,504	207,270,416	275,086,157	96	86	0.266
12	OIL SEEDS AND OLEAGI	196,792,084	66,035,401	196,272,430	240,856,480	50	90	1.000
13	LAC; GUMS, RESINS AN	71,922,305	9,347,962	89,123,531	22,193,964	23	40	-0.145
14	VEGETABLE PLAITING	10,436,791	477,390	38,471,404	2,952,108	9	14	-0.838
15	ANIMAL OR VEGETABL	461,058,474	150,802,555	1,193,341,031	254,400,083	49	35	-0.752
16	PREPARATIONS OF ME	70,099,303	62,744,872	218,919,483	76,875,808	94	52	-0.827
17	SUGARS AND SUGAR C	61,912,193	359,978,536	138,367,378	1,383,436,242	29	18	0.861
18	COCOA AND COCOA PR	56,720,004	22,441,832	178,916,843	163,751,299	57	96	0.073
19	PREPARATIONS OF CE	24,633,518	36,140,093	109,360,064	91,169,714	81	91	-0.212
20	PREPARATIONS OF VE	30,954,998	723,699,864	163,131,263	1,238,045,185	8	23	0.591
21	MISCELLANEOUS EDIB	80,852,865	54,505,165	243,698,565	185,175,173	81	86	-0.110
22	BEVERAGES, SPIRITS A	254,032,812	387,038,002	744,372,484	1,613,892,487	79	63	0.429
23	RESIDUES AND WASTE	281,429,153	109,913,772	977,278,705	62,749,443	56	12	-1.000
24	TOBACCO AND MANUF	277,859,049	94,460,659	277,426,051	361,538,803	51	87	1.000
25	SALT, SULPHUR, EART	245,018,097	592,167,275	488,288,858	788,489,126	59	76	-0.107
26	ORES, SLAG AND ASH.	56,013,508	2,308,250,263	86,658,876	4,606,944,502	5	4	0.974
27	MINERAL FUELS, OILS	250,153,991	4,177,337,680	16,234,396,033	11,658,542,049	11	84	-0.362
28	INORGANIC CHEMICAL	659,589,601	1,805,908,561	2,395,252,490	4,222,370,767	54	72	0.164
29	ORGANIC CHEMICALS.	1,789,863,754	338,668,034	3,629,712,159	1,403,735,609	32	56	-0.267
30	PHARMACEUTICAL PR	858,727,785	98,643,628	2,483,154,893	316,569,669	21	23	-0.763
31	FERTILIZERS.	141,158,348	215,826,717	312,973,352	670,747,219	79	64	0.452
32	TANNING OR DYEING E	428,005,245	172,581,614	969,510,936	386,047,417	57	57	-0.435
33	ESSENTIAL OILS AND R	217,584,017	87,538,841	595,438,264	376,698,594	57	77	-0.133
34	SOAP, ORGANIC SURFA	158,958,324	76,834,521	353,248,788	255,970,252	65	84	-0.041
35	ALBUMINOIDAL SUBST	130,929,397	28,030,858	333,207,300	52,008,911	35	27	-0.788
36	EXPLOSIVES; PYROTEC	19,619,257	67,310,444	75,898,489	146,196,612	45	68	0.167
37	PHOTOGRAPHIC OR CI	292,164,100	14,884,802	466,363,215	52,971,166	10	20	-0.641
38	MISCELLANEOUS CHE	1,018,296,739	319,154,552	2,282,548,209	1,186,608,776	48	68	-0.186
39	PLASTICS AND ARTICL	1,503,791,361	590,509,633	3,686,339,055	1,211,021,167	56	49	-0.557
40	RUBBER AND ARTICLE	767,050,697	149,612,513	1,703,614,296	707,055,347	33	59	-0.254
41	RAW HIDES AND SKINS	161,804,375	389,872,415	535,298,871	1,124,774,637	59	64	0.326
42	ARTICLES OF LEATHER	98,506,265	24,138,134	277,973,225	120,561,962	39	61	-0.301
43	FURSKINS AND ARTIFIC	284,582	3,888,324	1,286,573	6,115,688	14	35	0.379
44	WOOD AND ARTICLES	366,207,400	380,997,536	868,082,551	1,088,831,472	98	89	0.170
45	CORK AND ARTICLES O	40,647,221	961,285	96,767,377	901,349	5	2	-1.000
46	MANUFACTURES OF ST	5,391,178	285,176	14,973,905	1,651,839	10	20	-0.750
47	PULP OF WOOD OR OF	41,668,031	979,497,196	118,060,949	1,869,210,399	8	12	0.842
48	PAPER AND PAPERBOA	1,005,300,786	771,102,797	2,077,485,614	1,532,602,546	87	85	-0.169
49	PRINTED BOOKS, NEWS	490,917,956	30,495,813	812,715,881	140,273,803	12	29	-0.491
50	SILK.	3,858,598	96,070	20,605,260	524,374	5	5	-0.950
51	WOOL, FINE OR COARS	45,759,121	806,217,246	131,604,641	987,778,911	11	24	0.358
52	COTTON.	335,337,410	111,178,782	695,469,075	210,702,461	50	47	-0.567
53	OTHER VEGETABLE TE	39,718,134	666,090	138,460,823	1,475,226	3	2	-0.984

HS NO.	DESCRIPTION	1992 IMPORTS (R)	1992 EXPORTS (R)	1997 IMPORTS (R)	1997 EXPORTS (R)	1992 GLiD (%)	1997 GLiD (%)	1992/97 A2i
54	MAN-MADE FILAMENTS	403,861,567	138,263,284	745,088,268	354,227,785	51	64	-0.225
55	MAN-MADE STAPLE FIB	663,046,634	61,105,939	837,601,018	279,879,047	17	50	0.112
56	WADDING, FELT AND N	65,571,183	19,027,039	142,913,250	40,574,210	45	44	-0.564
57	CARPETS AND OTHER	47,833,405	39,174,844	98,862,105	97,249,132	90	99	0.065
58	SPECIAL WOVEN FABRI	67,387,168	22,049,374	233,269,635	69,806,746	49	46	-0.553
59	IMPREGNATED, COATE	185,267,395	20,296,447	383,565,344	48,859,240	20	23	-0.748
60	KNITTED OR CROCHET	100,715,801	38,730,355	271,603,592	61,940,883	56	37	-0.761
61	ARTICLES OF APPAREL	163,759,316	132,114,480	342,468,553	365,672,473	89	97	0.133
62	ARTICLES OF APPAREL	211,067,851	342,513,173	428,063,453	465,308,605	76	96	-0.277
63	OTHER MADE UP TEXTI	134,947,555	40,054,406	292,258,398	227,192,817	46	87	0.087
64	FOOTWEAR, GAITERS	277,134,416	43,391,941	924,803,960	101,426,306	27	20	-0.836
65	HEADGEAR AND PARTS	15,793,008	5,818,279	70,581,456	17,203,533	54	39	-0.656
66	UMBRELLAS, SUN UMB	9,649,579	3,073,089	21,842,391	18,334,609	48	91	0.112
67	PREPARED FEATHERS	5,186,576	1,031,098	20,671,601	12,136,210	33	74	-0.165
68	ARTICLES OF STONE, P	104,805,398	153,582,986	292,273,239	432,412,156	81	81	0.196
69	CERAMIC PRODUCTS.	342,284,432	58,744,969	832,305,402	116,619,692	29	25	-0.789
70	GLASS AND GLASSWA	268,670,987	151,095,735	574,388,720	272,277,309	72	64	-0.432
71	NATURAL OR CULTURE	344,525,332	7,159,398,554	2,102,852,937	46,698,566,936	9	9	0.915
72	IRON AND STEEL.	573,168,975	5,967,736,057	1,215,458,973	12,249,976,234	18	18	0.814
73	ARTICLES OF IRON OR	939,634,430	686,249,720	1,696,848,418	1,769,309,845	84	98	0.177
74	COPPER AND ARTICLE	113,111,253	1,293,320,949	215,808,190	1,418,312,991	16	26	0.098
75	NICKEL AND ARTICLES	22,817,048	646,054,704	237,350,655	648,784,823	7	54	-0.975
76	ALUMINIUM AND ARTIC	211,652,653	487,079,739	561,099,901	3,998,131,598	61	25	0.819
78	LEAD AND ARTICLES T	2,846,969	11,161,415	71,080,143	12,938,397	41	31	-0.949
79	ZINC AND ARTICLES TH	19,428,198	22,287,900	44,225,193	136,806,117	93	49	0.644
80	TIN AND ARTICLES THE	27,700,632	4,669,061	72,397,455	11,631,689	29	28	-0.730
81	OTHER BASE METALS;	44,678,428	196,059,387	126,524,374	498,113,682	37	41	0.574
82	TOOLS, IMPLEMENTS,	436,317,320	152,242,779	845,306,048	400,328,800	52	64	-0.245
83	MISCELLANEOUS ARTI	222,771,502	44,972,192	459,526,711	118,487,203	34	41	-0.526
84	NUCLEAR REACTORS,	10,603,642,875	1,583,598,545	25,758,468,262	6,110,149,321	26	38	-0.540
85	ELECTRICAL MACHINE	4,632,491,548	525,758,960	15,526,654,006	2,199,784,475	20	25	-0.734
86	RAILWAY OR TRAMWA	26,274,417	428,301,221	104,004,544	1,729,145,431	12	11	0.887
87	VECHILES (EXCLUDING	5,278,035,839	1,504,840,542	5,290,652,535	3,880,064,534	44	85	0.989
88	AIRCRAFT, SPACECRA	1,294,786,294	131,899,345	2,429,862,643	970,221,338	18	57	-0.150
89	SHIPS, BOATS AND FLO	105,756,576	264,449,660	171,449,325	182,765,090	57	97	-1.000
90	OPTICAL, PHOTOGRAP	2,109,471,482	169,371,457	4,601,860,520	738,655,907	15	28	-0.628
91	CLOCKS AND WATCHE	121,697,472	2,670,370	224,761,647	15,338,911	4	13	-0.781
92	MUSICAL INSTRUMENT	31,001,228	1,985,941	36,941,187	36,829,560	12	100	0.709
94	FURNITURE; BEDDING,	189,345,635	253,314,134	569,899,703	2,122,676,401	86	42	0.662
95	TOYS, GAMES AND SPO	262,936,424	25,911,123	861,426,655	82,512,625	18	17	-0.827
96	MISCELLANEOUS MAN	183,243,588	20,621,912	399,270,710	77,505,553	20	33	-0.583
97	WORKS OF ART, COLLE	28,492,455	18,404,867	84,387,420	50,300,574	78	75	-0.273
	Totals (Million rand)	**46,675**	**42,463**	**120,686**	**136,904**			

Table A2 South African 2-digit IIT and MIIT, 1992 and 1997

BIBLIOGRAPHY

Amiti, M. 1998. Inter-industry trade in manufactures: Does country size matter? *Journal of international economics* 44:231-55.

Andreosso-O'Callaghan, B & Noonan, CA. 1996. European intra-industry trade: emerging industrial specialisation in central and eastern Europe. *Journal of world trade* 30(6):138-68.

Aquino, A. 1978. Intra-industry trade and intra-industry specialisation as concurrent sources of international trade in manufactures. *Weltwirtschaftliches Archiv* 114(2):275-96.

Aquino, A. 1981. The measurement of intra-industry trade when overall trade is imbalanced. *Weltwirtschaftliches Archiv* 117(4):763-66.

Balassa, B. 1966. Tariff reductions and trade in manufactures among the industrial countries. *American economic review* 56:466-73.

Balassa, B. 1979. *Intra-industry trade and the integration of developing countries in the world economy.* World Bank staff working paper 312. Washington: World bank.

Balassa, B. 1986a. Intra-industry trade among exporters of manufactured goods. In Greenaway, D & Tharakan, PKM (eds) *Imperfect competition and international trade: the policy aspects of intra-industry trade.* Brighton: Wheatsheaf Press.

Balassa, B. 1986b. Intra-industry specialisation: a cross-country analysis. *European economic review* 30(1):27-42.

Balassa, B. 1986c. The determinants of intra-industry specialisation in United States trade. *Oxford economic papers* 38(2):220-233.

Balassa, B & Bauwens, L. 1987. Intra-industry specialisation in a multi-country and multi-industry framework. *Economic journal* 97:927-39.

Baumann, R. 1992. An appraisal of recent intra-industry trade for Latin America. *Cepal review* 48:82-94.

Barker, T. 1977. International trade and economic growth: an alternative to the neo-classical approach. *Cambridge journal of economics* 1:153-72.

Becuwe, S & Mathieu, C. 1992. The determinants of intra-industry trade: the case of the automobile industry. *Weltwirtschaftliches Archiv* 128(1):34-51.

Bensel, T & Elmslie, BT. 1992. Rethinking international trade theory: a methodological appraisal. *Weltwirtschaftliches Archiv* 128(2):249-65.

Bergstrand, JH. 1983. Measurement and determinants of intra-industry international trade. In Tharakan, PKM (ed) *Intra-industry trade: empirical and methodological aspects.* Amsterdam: North-Holland.

Bernhofen, DM. 1998. Intra-industry trade and strategic interaction: theory and evidence. *Journal of international economics* 45:77-96.

Bhattacharyya, R. 1994. India's intra-industry trade: an empirical analysis. *Indian economic journal* 42(2):54-74.

Brander, JA. 1981. Intra-industry trade in identical commodities. *Journal of international economics* 11:1-14.

Brander, JA & Krugman, P. 1983. A reciprocal dumping model of international trade. *Journal of international economics* 12:313-21.

Brülhart, M. 1994. Marginal intra-industry trade: measurement and relevance for the pattern of industrial adjustment. *Weltwirtschaftliches Archiv* 130(3):600-13.

Caves, RE. 1981. Intra-industry trade and market structure in the industrial countries. *Oxford economic papers* 33(2):202-23.

Chow, P, Kellman, M & Shachmurove, Y. 1994. East Asian NIC manufactured intra-industry trade 1965-1990. *Journal of Asian economics* 5(3):335-48.

Christodoulou, M. 1992. Intra-industry trade in agrofood sectors: the case of the EEC meat market. *Applied economics* 24(8):875-84.

Clark, DP. 1993. Recent evidence on determinants of intra-industry trade. *Weltwirtschaftliches Archiv* 129(2):332-44.

Cooper, D, Greenaway, D & Rayner, AJ. 1993. Intra-industry trade and limited producer horizons: an empirical investigation. *Weltwirtschaftliches Archiv* 129(2):345-66.

Culem, C & Lundberg, L. 1986. The product pattern of intra-industry trade: stability among countries and over time. *Weltwirtschaftliches Archiv* 122(1):113-30.

Davis, D. 1995. Intra-industry trade: a Heckscher-Ohlin-Ricardo approach. *Journal of international economics* 39:201-26.

Dixit, AK & Stiglitz, J. 1977. Monopolistic competition and optimum product variety. *American economic review* 67:297-308.

Donnenfeld, S. 1986. Intra-industry trade and imperfect information about product quality. *European economic review* 30(2):401-17.

Drabek, Z & Greenaway, D. 1984. Economic integration and intra-industry trade: the EEC and CMEA compared. *Kyklos* 37(3):444-69.

Eaton, J and Kierzkowski, H. 1984. Oligopolistic competition, product variety and international trade. In Kierzkowski, H (ed) *Monopolistic competition and international trade.* Oxford: Clarendon Press.

Ethier, WJ. 1982. National and international returns to scale in the modern theory of international trade. *American economic review* 72:389-405.

Falvey, RE. 1981. Commercial policy and intra-industry trade. *Journal of international economics* 11:495-511.

Falvey, RE and Kierzkowski, H. 1987. Product quality, intra-industry trade and (im)perfect competition. In Kierzkowski, H (ed) *Protection and competition in international trade.* New York: Basil Blackwell.

Farrell, MJ. 1991. Industry characteristics and scale economies as sources of intra-industry trade. *Journal of economic studies* 18(4):36-58.

Finger, JM. 1975. Trade overlap and intra-industry trade. *Economic inquiry* 13:581-89.

Finger, JM & De Rosa, DA. 1979. Trade overlap, comparative advantage and protection. In Giersch, H (ed) *On the economics of intra-industry trade.* Tübingen: JCB Mohr.

Francois, JF & Kaplan, S. 1996. Aggregate demand shifts, income distribution and the Linder hypothesis. *Review of economics and statistics* 78(2):244-50.

Globerman, S & Dean, JW. 1990. Recent trends in intra-industry trade and their implications for future trade liberalisation. *Weltwirtschaftliches Archiv* 126(1):25-49.

Globerman, S & Dean, JW. 1992. A puzzle about intra-industry trade: a reply. *Weltwirtschaftliches Archiv* 128(4):747-48.

Gonzalez, JG & Velez, A. 1995. Intra-industry trade between the United States and the major Latin American countries: measurement and implications for free trade in the Americas. *International trade journal* 9(4):519-36.

Gray, HP. 1988. Intra-industry trade: an "untidy" phenomenon. *Weltwirtschaftliches Archiv* 124(2):211-29.

Greenaway, D. 1982. Identifying the gains from pure intra-industry exchange. *Journal of economic studies* 9:40-56.

Greenaway, D & Hine, RC. 1991. Intra-industry specialisation, trade expansion and adjustment in the European economic space. *Journal of Common Market studies* 29(6):603-22.

Greenaway, D, Hine, R & Milner, C. 1994. Country-specific factors and the pattern of horizontal and vertical intra-industry trade in the UK. *Weltwirtschaftliches Archiv* 130(1):77-100.

Greenaway, D, Hine, R & Milner, C. 1995. Vertical and horizontal intra-industry trade: a cross industry analysis for the UK. *Economic journal* 105(433):1505-18.

Greenaway, D & Milner, C. 1981. Trade imbalance effects in the measurement of intra-industry trade. *Weltwirtschaftliches Archiv* 117(4):756-62.

Greenaway, D & Milner, C. 1983. On the measurement of intra-industry trade. *Economic journal* 93:900-08.

Greenaway, D & Milner, C. 1984. A cross section analysis of intra-industry trade in the UK. *European economic review* 25:319-44.

Greenaway, D & Milner, C. 1986. *The economics of intra-industry trade.* Oxford: Basil Blackwell.

Greenaway, D & Milner, C. 1987. Intra-industry trade: current perspectives and unresolved issues. *Weltwirtschaftliches Archiv* 123(1):39-57.

Grubel, HG & Lloyd, PG. 1975. *Intra-industry trade.* London: Macmillan.

Gunasekera, HDBH. 1989. The relationship between the variation in protection within manufacturing industries and intra-industry trade in Korea: a preliminary analysis. *The developing economies* 27(1):83-93.

Haberler, G. 1936. *The theory of international trade with its applications to commercial policy.* London: W Hodge & Co.

Hamilton, C & Kniest, P. 1991. Trade liberalisation, structural adjustment and intra-industry trade: a note. *Weltwirtschaftliches Archiv* 127(2):356-67.

Hansson, P. 1991. Determinants of intra-industry specialisation in Swedish foreign trade. *Scandinavian journal of economics* 93(3):391-405.

Havrylyshyn, O & Civan, E. 1985. Intra-industry trade among developing countries. *Journal of development economics* 18(2-3):253-71.

Havrylyshyn, O & Kunzel, P. 1997. *Intra-industry trade of Arab countries: an indicator of potential competitiveness.* World Bank working paper WP/97/47. Washington: World Bank.

Heckscher, E. 1949. The effects of foreign trade on the distribution of income. In Ellis, H and Metzler, L (eds) *Readings in the theory of international trade.* Philadelphia: Blakiston.

Helleiner, G. 1973. Manufactured exports from less-developed countries and multinational firms. *Economic journal* 83:21-47.

Helpman, E. 1981. International trade in the presence of product differentiation, economies of scale and monopolistic competition: a Chamberlin-Heckscher-Ohlin approach. *Journal of international economics* 11:305-40.

Helpman, E & Krugman, PR. 1985. *Market structure and foreign trade.* Brighton: Wheatsheaf.

Hirschberg, JG, Sheldon, IM & Dayton, JR. 1994. An analysis of bilateral intra-industry trade in the food processing sector. *Applied economics* 26(2):159-67.

Hoekman, B & Djankov, S. 1996. *Intra-industry trade, foreign direct investment, and the reorientation of eastern European exports.* World Bank policy research working paper 1652. Washington: World Bank.

Hughes, KS. 1993. Intra-industry trade in the 1980s: a panel study. *Weltwirtschaftliches Archiv* 129(3):561-72.

Hwang, H. 1984. Intra-industry trade and oligopoly: a conjectural variations approach. *Canadian journal of economics* 17(1):126-38.

Jordan, T. 1993. Intra-industry trade - an in-depth study of Swedish liquid pump trade. *Weltwirtschaftliches Archiv* 129(4):752-76.

Karrenbrock, JD. 1990. The internationalisation of the beer brewing industry. *Federal Reserve Bank of St. Louis review* 72(6):3-19.

Khalifah, NA. 1995. Intra-industry trade in a developing economy: the case of Malaysia. *Asian economies* 24:35-66.

Khalifah, NA. 1996. AFTA and intra-industry trade. *Asian economic bulletin* 12(3):351-68.

Kol, J. 1988. *The measurement of intra-industry trade.* Erasmus University: Rotterdam.

Krugman, PR. 1979. Increasing returns, monopolistic competition, and international trade. *Journal of international economics* 9:469-79.

Krugman, PR. 1980. Scale economies, product differentiation, and the pattern of trade. *American economic review* 70(5):950-59.

Krugman, PR. 1981. Intra-industry specialisation and the gains from trade. *Journal of political economy* 89(5):959-73.

Krugman, PR. 1982. Trade in differentiated products and the political economy of trade liberalisation. In Bhagwati, JN (ed) *Import competition and response.* Chicago: National Bureau of Economic Research.

Krugman, PR. 1991. Increasing returns and economic geography. *Journal of political economy* 99:483-99.

Lakatos, I. 1970. Falsification and the methodology of scientific research programmes. In Lakatos, I & Musgrave, A (eds) *Criticism and the growth of knowledge.* Cambridge: Cambridge University Press.

Lancaster, KJ. 1979. *Variety, equity, and efficiency: product variety in an industrial society.* New York: Columbia University Press.

Lancaster, KJ. 1980. Intra-industry trade under perfect monopolistic competition. *Journal of international economics* 10:151-75.

Lee, H-H & Lee, Y-Y. 1993. Intra-industry trade in manufactures: the case of Korea. *Weltwirtschaftliches Archiv* 129(1):159-71.

Leontief, WW. 1953. Domestic production and foreign trade: the American capital position re-examined. In Bhagwati, JN (ed) 1969 *International trade: selected readings.* Harmondsworth: Penguin.

Linder, SB. 1961. *An essay on trade and transformation.* New York: John Wiley & Sons.

Little, JS. 1996. US regional trade with Canada during the transition to free trade. *New England economic review* 86(1):3-21.

Loertscher, R & Wolter, F. 1980. Determinants of intra-industry trade: among countries and across industries. *Weltwirtschaftliches Archiv* 116:280-93.

Lundberg, L. 1982. Intra-industry trade: the case of Sweden. *Weltwirtschaftliches Archiv* 118(2):302-16.

Lundberg, L. 1988. The role of comparative costs for determining inter- and intra-industry trade with developing countries. *European economic review* 32:1699-1710.

Lundberg, L. 1992. Economic integration, inter- and intra-industry trade: the case of Sweden and the EC. *Scandinavian journal of economics* 94(3):393-408.

Manrique, GG. 1987. Intra-industry trade between developed and developing countries: the United States and the NICs. *Journal of developing areas* 21:481-94.

Mardas, D. 1992. Intra-Industry trade in manufactured products between the European Economic Community and the eastern European countries. *Journal of world trade* 26(5):5-23.

Menon, J. 1994. Trade liberalisation, closer economic relations and intra-industry specialisation. *Australian economic review* 106(2):31-42.

Menon, J. 1996. The dynamics of intra-industry trade in ASEAN. *Asian economic journal* 10(1):105-15.

Menon, J & Dixon, PB. 1996a. Regional trade agreements and intra-industry trade. *Journal of economic integration* 11(1):1-20.

Menon, J & Dixon, PB. 1996b. How important is intra-industry trade in trade growth? *Open economies review* 7:161-75.

Michaely, M. 1962. Multilateral balancing in international trade. *American economic review* 52:685-702.

Milner, C. 1988. Weighting considerations in the measurement and modelling of intra-industry trade. *Applied economics* 20:295-301.

Motta, M. 1994. International trade and investments in a vertically differentiated industry. *International journal of industrial organisation* 12(2):179-96.

Niroomand, F. 1988. Inter- versus intra-industry trade: a note on US trends, 1963-1980. *Weltwirtschaftliches Archiv* 124(2):337-40.

Nolle, DE. 1990. The determinants of intra-industry trade for developing economies. *Rivista internazionale di scienze economiche e commerciali* 37:409-423.

Norman, G and Dunning, JH. 1984. Intra-industry foreign direct investment: its rationale and effects. *Weltwirtschaftliches Archiv* 120:522-40.

Ohlin, B. 1933. *Interregional and international trade.* Cambridge, Massachusetts: Harvard University Press.

Pagoulatos, E and Sorenson, R. 1975. Two-way international trade: an econometric analysis. *Weltwirtschaftliches Archiv* 111(3):454-65.

Parr, RG. 1994. Intra-industry trade and the prospect of trade liberalisation in South Africa. *South African journal of economics* 62(4):393-405.

Pomfret, R. 1979. Intra-industry trade in intra-regional and international trade. In Giersch, H (ed) *On the economics of intra-industry trade.* Tübingen: JCB Mohr.

Posner, MV. 1961. International trade and technical change. *Oxford economic papers* 13:323-41.

Pryor, FL. 1992. A puzzle about intra-industry trade: a comment. *Weltwirtschaftliches Archiv* 128(4):742-46.

Ricardo, D. 1817 [1963]. *The principles of political economy and taxation.* Homewood, Illinois: Irwin.

Rodgers, JR. 1988. Intra-industry trade, aggregation and the HOS model. *Journal of economic studies* 15(5):5-23.

Samuelson, PA. 1948. International trade and the equalisation of factor prices. *Economic journal* 58:163-84.

Samuelson, PA. 1949. International factor-price equalisation once again. *Economic journal* 59:181-97.

Schuler, MK. 1995. On intra-industry trade in intermediates. *Economia internazionale* 48(1):67-84.

Shaked, A and Sutton, J. 1984. Natural oligopolies and international trade. In Kierzkowski, H (ed) *Monopolistic competition and international trade.* Oxford: Oxford University Press.

Simson, RA. 1987. *Intra-industry trade in South Africa.* MCom dissertation, University of Natal, Durban.

Siriwardana, AM. 1990. Intra-industry trade: a note on new evidence from Australia, 1968-1982. *Weltwirtschaftliches Archiv* 126(1):165-72.

Smith, A. 1776 [1961]. *The wealth of nations, Vol 1.* Cannan, E (ed) London: Methuen.

Somma, E. 1994. Intra-industry trade in the European computers industry. *Weltwirtschaftliches Archiv* 130(4):784-99.

Södersten, B. 1980. *International economics,* 2nd ed. London: Macmillan.

South African Reserve Bank. 1998. *Quarterly bulletin,* no. 210 (December 1998). Pretoria: South African Reserve Bank.

Stolper, WF & Samuelson, PA. 1941. Protection and real wages. *Review of economic studies* 9:58-73.

Tharakan, PKM. 1984. Intra-industry trade between the industrial countries and the developing world. *European economic review* 26(1-2):213-27.

Tharakan, PKM & Kerstens, B. 1995. Does north-south horizontal intra-industry trade really exist? An analysis of the toy industry. *Weltwirtschaftliches Archiv* 131(1):86-105.

Toh, K. 1982. A cross-section analysis of intra-industry trade in the US manufacturing industries. *Weltwirtschaftliches Archiv* 118(2):281-300.

Torstensson, J. 1996. Determinants of intra-industry trade: a sensitivity analysis. *Oxford bulletin of economics and statistics* 58(3):507-24.

Uri, ND & Beach, ED. 1996. The significance of quality differences for the United States and Canada wheat trade. *Applied economics* 28(8):985-97.

Venables, AJ. 1984. Multiple equilibria in the theory of international trade with monopolistic competitive industries. *Journal of international economics* 16:103-21.

Verdoorn, PJ. 1960. The intra-block trade of Benelux. In Robinson, EAG (ed) *Economic consequences of the size of nations.* London: Macmillan.

Vernon, R. 1966. International investment and international trade in the product cycle. *Quarterly journal of economics* 80:190-207.

Vernon, R. 1979. The product cycle hypothesis in a new international environment. *Oxford bulletin of economics and statistics* 41(4):255-68.

Vona, S. 1990. Intra-industry trade: a statistical artefact or a real phenomenon? *Banca-Nazionale-del-Lavoro quarterly review* 0(175):383-412.

Vona, S. 1991. On the measurement of intra-industry trade: some further thoughts. *Weltwirtschaftliches Archiv* 127(4):678-700.

Winters, LA. 1991. *International economics,* 4th ed. Hammersmith, London: Harper Collins.

Wood, A. 1994. Give Heckscher and Ohlin a chance! *Weltwirtschaftliches Archiv* 130(1):20-49.

World Bank. 1997. *World development report 1997.* New York: Cambridge University Press.

Yavas, BF & Vardiabasis, D. 1994. Intra-industry trade in the Pacific rim: estimates and trends. *International journal of management* 11(1):591-98.