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Empirical Explanation of vertical and horizontal  
intra-industry trade in the UK: a comment

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## **1 Introduction**

The pioneering work of Balassa (1967) and Grubel and Lloyd (1975) on the significance and measurement of intra-industry trade (IIT) opened up a substantial literature, both theoretical and empirical.

In recent years, important developments in the literature on intra-industry trade have also stressed that a meaningful distinction - alongside the main division between intra and inter-industry flows - can be drawn between horizontal and vertical components in IIT. This distinction is with regard to the nature of product differentiation. Whereas horizontal differentiation concerns alternative attributes of a particular traded good in a given quality level, vertical differentiation relates to alternative quality levels.

This conceptual specification is important because theoretical models have demonstrated that the forces underlying the two forms of product differentiation within IIT are not the same. Broadly speaking, in the case of vertical IIT (VIIT), the dynamics of product differentiation (by quality) operate according to a Heckscher-Ohlin (HO) logic based on comparative advantages deriving from resource endowments and factor proportions (although there are some non-HO models); in the case of horizontal IIT (HIIT), the typical ingredients of imperfectly competitive market structures play the dominant role.

In spite of these clear indications of the theory, in almost all cases empirical studies investigating the determinants of IIT have not distinguished vertical from horizontal intra-industry trade. Only in recent years have some contributions tried to achieve better empirical assessment by adopting methodological procedures able to separate the vertical and horizontal components of IIT.

Greenaway, Hine and Milner GHM (1995, GHM) and Greenaway, Milner and Elliot (1996, GME) have carried out separate econometric tests for the two components of IIT in the case of the UK, focusing on a range of industry and country determinants of IIT. Overall, the work of Greenaway et al. suggests

that the approach which distinguishes vertical from horizontal IIT is worth pursuing, given that it enables more accurate interpretation of empirical evidence. In particular, their results challenge the idea that the large numbers model of horizontal IIT is the most important explanatory paradigm. However, the evidence reported for the two components of IIT in the case of the UK is not decisive, since it depends closely on the source of data and their level of disaggregation, as well as the methodological criteria adopted.

This paper takes GHM's methodology as its starting point to conduct further investigation of horizontal and vertical IIT in the UK, using 1990 data. It introduces three innovative features compared to the GHM approach. Firstly, unit values are computed using trade data at a very fine level of product disaggregation, 8-digit as compared to the 5-digit level adopted by GHM, in order to obtain a more reliable proxy for prices and consequently for quality differentiation. Secondly, the share of vertical differentiation in IIT is further divided into two components which are separately tested: the part of vertical IIT composed of flows in which the quality of exports appears higher than the quality of imports; and the remaining part consisting of flows in which exports appear to be of lower quality than imports. As shown below, this further distinction yields a more coherent specification of the expected relationship between quality differentiation and vertical intra-industry trade, though there remain unanswered questions about the explanation of intra-industry trade.

Finally, the determinants of UK intra-industry trade are analysed by distinguishing two geographical groupings, advanced and less advanced countries, in order to test the HO explanation of VIIT appropriately.

While our results cast doubt on the robustness of the econometric estimates of Greenaway et al., they show that splitting the two kinds of VIIT gives new results which support the Greenaway et al. proposition that vertical intra-industry trade is to be explained in fundamentally different ways from horizontal intra-industry trade.

The paper is organized as follows. The next section discusses the difference between horizontal and vertical product differentiation, conducting a brief survey of the relevant theoretical

literature on IIT. Section 3 examines results obtained by Greenaway et al. whose work represents the state of the art of the empirical investigation into horizontal and vertical IIT. Section 4 introduces the two types of vertical IIT and presents an econometric test for the industry-specific determinants of the IIT in the UK, giving details on data, definition of variables, statistical specification and results. The final section makes some concluding remarks.

## **2 Horizontal and vertical product differentiation in intra-industry trade**

### *2.1 The Dixit-Stiglitz-Krugman model*

Initially, both theoretical explanations of IIT, such as Dixit and Stiglitz (1977) and Lancaster (1980), and empirical investigations, such as Balassa and Bauwens (1987), focused on what has become known as horizontal intra-industry trade (HIIT) - simultaneous export and import of products of the same type and similar quality. The focus both in the theoretical and the empirical work is on the explanation of IIT through the functioning of imperfectly competitive markets in differentiated products.

By extending Dixit and Stiglitz's (1977) closed economy model to the international context, Krugman (1979) demonstrates that the interaction between economies of scale and horizontal product differentiation may be an independent cause of international trade (in the form of IIT) between countries which do not differ in technology or factor endowments.

The Dixit-Stiglitz-Krugman model has dominated the subsequent literature. The assumptions of Krugman's model are straightforward. On the supply side, industry consists of a large number of firms, each producing a particular variety of the product under conditions of increasing returns. On the demand side, individuals appreciate variety in itself, and any new differentiated good available in the market is bound to enter the consumer's

basket. In autarky, in each country, the range of varieties available to consumers and the exploitation of economies of scale are both constrained by the size of the market. International trade will improve the trade-off between variety and scale economies by creating a larger integrated market in which intra-industry specialization between countries may enable firms to reduce unit costs (although in the simplest version of Krugman's model, all firms are of the same size and there are no scale economy benefits from increases in market size), and in which access to a larger number of varieties increases consumer welfare.

The most obvious candidates for the horizontal IIT described by Krugman's model are countries with similar factor endowments and similar (high) income levels, and in such models there may also be an association between demand structure and income level (Linder, 1961) so that countries similar in income level will tend to have more trade between them.

Un important implication of this framework is that IIT induces less painful adjustment costs in comparison with inter-industry trade: if products losing market share to import competition and products gaining export markets have similar factor intensities (and are produced in the same sectors), resource reallocation between them will be smoother, and wage and price adjustment will be minor. However, as shown later in this work, this kind of result does not obviously carry over to the case of IIT in vertically differentiated products<sup>1</sup>.

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<sup>1</sup>However, the analysis of the difference in adjustment costs between IIT and inter-sectoral trade has been little treated in the formal literature. One of the few attempts to model the proposition that IIT adjustment effects on domestic economy are less severe than inter-industry trade has been provided by Krugman (1981). In Krugman's framework, the supply side is modelled with a national economy consisting of two industries, each employing a specific type of labour (which is non-specific among varieties within an industry). By means of a very simple and compact formulation, Krugman shows the existence of a one-for-one positive relationship between the parameter indicating factor endowment similarity (among countries) and the Grubel-Lloyd IIT index. Subsequently, he analyzes the effect of trade on welfare by using an utility function in which utility depends on real wages and variety. Krugman demonstrates that both factors gain from trade when trading partners are similar in factor endowments and consequently IIT prevails over inter-industry trade.



## 2.2 *Modelling vertical intra-industry trade*

Falvey (1981) and Falvey and Kierzkowski (1985) (henceforth FK) presented a model in which intra-industry trade was driven by vertical product differentiation, and imports and exports of products within the same commodity classification are distinguished by quality differences. This is vertical intra-industry trade (VIIT). By contrast with the models of horizontal IIT, this is a model which is firmly in the Heckscher-Ohlin tradition in which countries have common tastes and technology, and trade arises from differences in factor endowments of countries and factor requirements of goods. Like the standard Heckscher-Ohlin, the FK model can be adapted to include technological differences between countries. The model differs from the standard textbook HOS model in that factor endowment differences explain intra-sectoral rather than inter-sectoral specialisation: it is a Heckscher-Ohlin model of intra-industry trade.

In FK, the supply side of each economy is modelled as two sectors, one producing a single homogeneous good and the other manufacturing different qualities of the same product. Both sectors employ labour, while capital is used only in the sector producing the multi-quality product, with capital intensity positively correlated with the "quality intensity" of the differentiated product. On the demand side, consumers have the same preferences, and the demand for each quality, given relative prices, depends on an individual's income: a higher level of income is associated with demand for a higher quality product. On the reasonable assumption of an uneven distribution of aggregate income among consumers, demand for different qualities of product will emerge in the economy, and the range of qualities demanded will depend on income distribution.

Under these assumptions, the actual pattern of trade - with particular reference to the extent and character of vertical intra-industry trade - depends on the relative influence of the three sources of country differences: factor endowments, technology, and income distribution.

The spectrum of relevant cases presented by FK is very

broad, and in some circumstances the outcomes are indeterminate. However, in the present context, two main results are worth recalling: one deriving from HO assumptions and the other arising from Ricardian hypotheses.

i) Assuming identical technologies but different factor endowments, the pattern of inter-industry trade is clearly determined: the capital-abundant country will be an importer of the homogeneous good and a net exporter of the differentiated product. In this setting, vertical IIT may or may not take place. Moreover, even if IIT occurs, the pattern of IIT in terms of the quality of traded goods is indeterminate. Although the capital-abundant country has a comparative advantage in superior quality production, this advantage may or may not be reflected in its exports. Paradoxically, if differences in factor endowments between the two countries are so pronounced as to determine large differences in their levels of per capita income, the abundant-capital country (the rich country) may concentrate its exports in lower quality products. In fact, a greater distance between the means of the two countries' equally shaped income distributions reduces their area of overlap, and the poor country will demand low quality products only. Obviously, different results are associated with different assumptions about the form of income distributions in the two countries.

ii) Assuming identical factor endowments but different technologies, the pattern of vertical IIT is determinate: the country with superior technology in the homogeneous good sector will tend to export high quality products and to import low quality goods.<sup>2</sup> In this case, with equal per capita income levels between trading partners, (which implies that the country with superior technology in one sector must have inferior technology in the other) consumers in both countries will divide into two groups: a group of high income individuals buying high quality products from the superior technology country, and a group of low income consumers demanding low quality products from the inferior technology country. These results show the way the FK model of