Vertical and horizontal Intra-industrial trade between the EU 15 and the 2004 enlargement countries

Inés Mezo*

Abstract

In this paper we analyze the pattern of trade among the EU 15 and the 10 countries (C 10) incorporated in 2004. The methodology used is the CEPII index using COMEXT data disaggregated to 8 digits (more than 10,000 products each year), over the period 1995-2003.

We separated total intra-industrial trade (ITT) into three trade types: inter-industry, intra-industry in horizontally and in vertically differentiated products. We have also studied the specialisation along ranges of quality in the vertical intra-industry trade. The results showed that the increase in ITT between both groups of countries is due to vertical two-way differentiated products. In this type of trade, the C 10 are specialized in low quality goods, but they are increasing their specialization in high quality products.

JEL classification: F14, F15

Keywords: International trade, Intra-industry trade, European Union

* Faculty of Economics, University of A Coruña, E-mail: inesmb@udc.es
Introduction

An essential feature of the integration process is an increase in economic relations and, more specifically, in trade flows between the countries in question, since this integration is essentially brought about by the removal of barriers to trade. Right from the outset, studies of the EEC integration process, initially, Balassa, 1966 and Grubel and Lloyd, 1975, and subsequently, many others, have shown that the reduction or elimination of trade barriers leads to an increase in intra-industrial trade (IIT) as a proportion of total trade. More recent studies have shown that the pace of growth of IIT in the first half of the eighties was lower than during the previous decade (Greenaway and Hine, 1991).

Empirical studies have shown that the growth of IIT in Europe was fundamentally due to an increase in vertically differentiated ITT. In this type of trade the goods exchanged are not perfect substitutes, but are similar types of goods with different levels of quality. Fontagné y Freudenberg (2002) show that the increase of ITT in EU 1980-1999 is due mainly to two-way trade of vertically differentiated products. Other studies that provide similar results are Freudenberg and Müller (1992) for Germany; Hu & Ma (1999) for China; Blanes and Martín (2000) for Spain; Aturupane et al (1999) for eight Eastern European countries and Veeramani (2002) for India.

The adhesion of ten new member countries (C 10)\(^1\) to the EU is of special interest to those who analyse changes in the patterns of trade. The C 10 constitute a group of countries that, prior to their accession, enjoyed only limited trade relations with the EU 15 at the end of the eighties. Both groups of countries eliminated most of

---

\(^1\) Hereafter, we will refer to the 10 countries (Latvia, Lithuania, Estonia, Poland, Czech Rep., Slovakia, Hungary, Slovenia, Malta and Cyprus) that joined the EU in 2004 as the C 10.
the barriers to trade in a short period of time and the EU 15 is now the origin and destination of about three quarters of C 10 international trade.

This paper analyses the patterns of trade between the C 10 and the EU 15. The questions that this research attempts to address are the following: First, has the integration process between the two groups of countries resulted in an increase in ITT as a proportion of total trade?; Second, is the increase in ITT due to levels of two-way trade in vertically differentiated products?; Third, If vertically differentiated ITT is broken down according to levels of quality, what quality ranges do the C 10 countries specialise in and, has there been any observable change in this specialisation after the accession of the C 10 countries?

In an attempt to address these questions this paper is set out in the following way. The next section takes a brief look at vertical ITT models, which constitute the theoretical framework of this analysis. Section 3 examines the methods and data used to measure the two types of ITT. In section 4, the results of empirical analysis are reviewed, while the conclusions are presented in section 5.

---

2 The European Agreements signed between the EU and each of the C 10 can be considered as the first step of the integration process. The main objectives of the Agreements were to favour trade, capital flows and technology. The first of the European Agreements signed with the eight Eastern European countries were the ones with Hungary and Poland (1991). The EU already had similar agreement with Malta (1970) and Cyprus (1972).
2. Theoretical background

The most widely accepted explanation for the patterns of international trade, until the creation of the EEC, was based on the comparative advantage of countries’ factor endowments. This explanation leads to the assumption that there will be a reduction in trade barriers among the given countries which will, in turn, lead to the specialisation of every country according to its factor endowment.

The empirical observation of the effects of the EEC integration process showed that the reduction or elimination of trade barriers actually increased IIT. This was to revolutionise international trade theories.

The search for a theoretical explanation for IIT has been a vibrant area of research over the last few decades. Within this area, one of the most important advances has been the distinction that has been drawn between horizontally and vertically differentiated goods. The former deals with the exchange of goods with different characteristics rather than different levels of quality, and the latter deals with the exchange of similar kinds of goods with different levels of quality. This distinction is revealing since both, the determinants and the consequences of the two different types of IIT, differ.

Initial explanations of ITT (Krugman, 1979, Lancaster 1979, Helpman 1981) focused on large scale economies i.e. monopolistic competition and product differentiation. The models that explain vertical ITT offer various interpretations for the different qualities of goods. Different levels of quality can be explained by corresponding levels of capital endowment (Falvey, 1981 and Falvey and Kierzkowski, 1987); high quality reflects high levels of R & D (Gabszewicz, Thisse, Shaked and Sutton, 1981) or a more highly skilled labour force (Gabszewicz y Turrini, 1997).

The models that explain vertical ITT based on differences in factorial endowment (Falvey, 1981, and Falvey and Kierzkowski, 1987) constitute the theoretical framework of the empirical studies that have developed a methodology for measuring
ITT. This framework is conducive to the idea that the capital-intensive countries export high quality goods and import low quality goods from labour-intensive countries. This is a return to the neoclassical theory based on comparative advantage explained by factor endowment.

3. Empirical methodology and data.

There are two generally accepted empirical methods for disaggregating IIT into intra-industry in horizontally versus vertically differentiated products. The first was developed by Greenaway, Hine and Milner (1994, 1995) and the second, by Fontagné and Freudenberg (1997). Both methods share the assumption that differences in prices reflect differences in quality and that this is a positive relationship. The main difference between these two methods resides in the definition of ITT that each adopts.

The methodology used in this study was that developed by Fontagné and Freudenberg in 1997. This methodology facilitates the measurement of a country bilateral trade by dividing it into three types. These three areas of trade are: inter-industrial trade, intra-industrial trade of horizontally differentiated goods (ITTH) and intra-industrial trade with vertical differentiation (ITTV). The latter, may be further broken down into different ranges of quality. This methodology is carried out over 3 distinct stages.

1. Disaggregation of trade into intra-industrial and inter-industrial trade.

As mentioned above, the main difference between this and other methodologies is the way in which the ITT is calculated. Fontagné and Freudenberg (1997) consider the whole of the flow of trade for a certain product, whether this be inter-industrial or intra-industrial, depending on the degree of overlapping. They fix the level of overlapping that differentiates both types of trade at 10 per cent. Hence, when the value of the minority flow is at least 10 per cent of the majority flow, the total trade in this product is considered to be ITT.
\[ IIT_i = X_i + M_i \]

\[ \frac{\text{Min}(X_i, M_i)}{\text{Max}(X_i, M_i)} \geq 10\% \]

Where \( X_i \) is the total value of export in sector \( i \) and \( M_i \) is the total value of import in sector \( i \).

When this condition is not fulfilled, trade is considered to be inter-industrial. The main advantage of this method therefore, is that every flow, irrespective of the level of disaggregation, is associated with only one type of trade.

2. Disaggregation of ITT into horizontally and vertically differentiated products.

Once the percentage of ITT in total trade is known, it is broken down into horizontal and vertical ITT. The underlying idea is that differences in prices reflect differences in quality. Since the prices are not known, Unit Values (UV) are used as a proxy for price\(^3\).

If the difference between the UV of exports and the UV of imports is small, it is assumed that the quality of the exports and imports is similar and may therefore be defined as horizontal ITT. The threshold value was set at 15 percent, which is the value used in most of the empirical studies.

\[ 0,85 \leq \frac{UVX_i}{UVM_i} \leq 1,15 \]

If the difference between the unit values of exportation and importation is high, it is assumed that the exported goods differ substantially in quality from the goods that are imported and hence trade is deemed to be vertical ITT.

\[^3\] Abd-el-Rahman (1991), and Greenaway, Hine and Milner (1994).
3. Disaggregation of vertical ITT into different ranges of quality.

If, a) the UV of the exports and the UV of the imports is lower than 0.85, then the quality of the exports of the given product is lower than that of the imports. This is considered to be low quality vertical ITT (low ITTV)

If, b) then the quality of the exports is assumed to be superior to that of the imports, and this is considered to be high quality vertical ITT (high-ITTV).

The data used is derived from COMEXT (EUROSTAT), 1995 to 2003. In order to minimise the problem of statistical aggregation, we have used the data at the most available detail (eight-digit numerical codes). The flows of exports and imports are from the perspective of the EU 15, and are reproduced as they appear in the COMEXT statistics.

Table 1. EU 15 trade with C 10 by CN-8 (number of products).

|-------|------|------|------|------|------|------|------|------|------|

4. Empirical results

In this section, we review the trade pattern between the EU 15 and the C10 countries that joined the EU in 2004. Following Fontagné and Freudenberg (1997), three types of total trade are distinguished: one-way trade, vertical ITT and horizontal ITT at a CN-8 digit level. The results are summarised in Table 2. The analysis of these results is carried out by following the stages given in the methodology explained above.
Table 2. Types of Trade between the EU 15 and the C 10.

<table>
<thead>
<tr>
<th>Year</th>
<th>ITTV-Low quality</th>
<th>ITTH</th>
<th>ITTV-High quality</th>
<th>Total ITT</th>
<th>One-way trade</th>
<th>Total trade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>7,82</td>
<td>14,53</td>
<td>38,32</td>
<td>60,67</td>
<td>39,33</td>
<td>100</td>
</tr>
<tr>
<td>1996</td>
<td>7,17</td>
<td>16,55</td>
<td>39,25</td>
<td>62,97</td>
<td>37,03</td>
<td>100</td>
</tr>
<tr>
<td>1997</td>
<td>7,90</td>
<td>15,46</td>
<td>41,52</td>
<td>64,88</td>
<td>35,12</td>
<td>100</td>
</tr>
<tr>
<td>1998</td>
<td>9,96</td>
<td>15,42</td>
<td>41,28</td>
<td>66,66</td>
<td>33,34</td>
<td>100</td>
</tr>
<tr>
<td>1999</td>
<td>12,79</td>
<td>16,04</td>
<td>43,35</td>
<td>72,18</td>
<td>27,82</td>
<td>100</td>
</tr>
<tr>
<td>2000</td>
<td>13,63</td>
<td>20,93</td>
<td>40,33</td>
<td>74,89</td>
<td>25,11</td>
<td>100</td>
</tr>
<tr>
<td>2001</td>
<td>11,82</td>
<td>20,88</td>
<td>42,94</td>
<td>75,64</td>
<td>24,36</td>
<td>100</td>
</tr>
<tr>
<td>2002</td>
<td>14,46</td>
<td>18,57</td>
<td>43,11</td>
<td>76,14</td>
<td>23,86</td>
<td>100</td>
</tr>
<tr>
<td>2003</td>
<td>14,22</td>
<td>18,55</td>
<td>44,29</td>
<td>77,06</td>
<td>22,94</td>
<td>100</td>
</tr>
</tbody>
</table>

1. Disaggregation of trade into intra-industrial and inter-industrial trade.

The results given in Table 2 show the high level of ITT in total trade between the EU 15 and the C 10. ITT increases from 60 per cent of total trade at the beginning of the period to more than 75 per cent in 2003. The level of ITT grew over each year. Of greater interest is the way in which the relative proportion of these different types of trade changes over time. In Table 3 it can be seen that the most intense growth took place during the late nineties. During the current decade, growth in ITT has continued to increase as a percentage of total trade, but not so rapidly.

Table 3. Intra industrial trade and inter industrial trade between the UE 15 and the C 10. (Interannual rate of growth.)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-way trade</td>
<td>3,79</td>
<td>3,03</td>
<td>2,74</td>
<td>8,28</td>
<td>3,75</td>
<td>1,00</td>
<td>0,66</td>
<td>1,21</td>
</tr>
<tr>
<td>One-way trade</td>
<td>-5,85</td>
<td>-5,16</td>
<td>-5,07</td>
<td>-16,56</td>
<td>-9,74</td>
<td>-2,99</td>
<td>-2,05</td>
<td>-3,86</td>
</tr>
</tbody>
</table>

Next, we calculate the share of ITT in 2-digit sector level. Table 4 shows the sectors with the highest levels of ITT. The largest increase in ITT has taken place in Machinery and mechanical devices (84), Machinery and electrical devices (85) and...
Vehicles (87). Together, these three headings contain more than half of total ITT while at the beginning of the period these headings represented 36 per cent of all exchanges.

Table 4. Intra-industrial trade between the EU 15 and the C 10. Main 2-digit level sectors

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>1,74</td>
<td>1,95</td>
<td>1,24</td>
<td>1,07</td>
<td>1,15</td>
<td>2,00</td>
<td>1,76</td>
<td>1,63</td>
<td>1,39</td>
</tr>
<tr>
<td>29</td>
<td>0,79</td>
<td>0,73</td>
<td>0,69</td>
<td>0,56</td>
<td>0,49</td>
<td>0,53</td>
<td>0,59</td>
<td>0,82</td>
<td>0,53</td>
</tr>
<tr>
<td>39</td>
<td>2,94</td>
<td>2,74</td>
<td>3,06</td>
<td>2,81</td>
<td>3,03</td>
<td>3,10</td>
<td>3,09</td>
<td>3,14</td>
<td>3,09</td>
</tr>
<tr>
<td>40</td>
<td>1,00</td>
<td>0,99</td>
<td>1,05</td>
<td>1,18</td>
<td>1,20</td>
<td>1,25</td>
<td>1,38</td>
<td>1,42</td>
<td>1,49</td>
</tr>
<tr>
<td>48</td>
<td>1,39</td>
<td>1,34</td>
<td>1,45</td>
<td>1,35</td>
<td>1,43</td>
<td>1,56</td>
<td>1,63</td>
<td>1,72</td>
<td>1,76</td>
</tr>
<tr>
<td>62</td>
<td>1,94</td>
<td>2,46</td>
<td>2,52</td>
<td>2,41</td>
<td>2,49</td>
<td>1,66</td>
<td>1,67</td>
<td>1,69</td>
<td>1,53</td>
</tr>
<tr>
<td>72</td>
<td>1,86</td>
<td>1,40</td>
<td>1,43</td>
<td>1,46</td>
<td>1,23</td>
<td>1,54</td>
<td>1,35</td>
<td>1,32</td>
<td>1,50</td>
</tr>
<tr>
<td>73</td>
<td>2,79</td>
<td>2,91</td>
<td>2,73</td>
<td>2,69</td>
<td>2,85</td>
<td>2,76</td>
<td>2,78</td>
<td>2,84</td>
<td>2,87</td>
</tr>
<tr>
<td>76</td>
<td>1,16</td>
<td>1,10</td>
<td>1,32</td>
<td>1,24</td>
<td>1,33</td>
<td>1,44</td>
<td>1,40</td>
<td>1,38</td>
<td>1,43</td>
</tr>
<tr>
<td>84</td>
<td>8,84</td>
<td>9,68</td>
<td>11,08</td>
<td>12,56</td>
<td>13,95</td>
<td>14,00</td>
<td>14,69</td>
<td>14,77</td>
<td>15,24</td>
</tr>
<tr>
<td>85</td>
<td>7,74</td>
<td>9,20</td>
<td>10,20</td>
<td>10,63</td>
<td>12,04</td>
<td>13,75</td>
<td>13,32</td>
<td>12,99</td>
<td>13,16</td>
</tr>
<tr>
<td>87</td>
<td>6,41</td>
<td>7,48</td>
<td>8,35</td>
<td>9,91</td>
<td>10,73</td>
<td>11,08</td>
<td>11,17</td>
<td>11,18</td>
<td>12,18</td>
</tr>
<tr>
<td>94</td>
<td>2,51</td>
<td>2,49</td>
<td>2,84</td>
<td>2,57</td>
<td>2,80</td>
<td>2,67</td>
<td>2,77</td>
<td>2,82</td>
<td>2,72</td>
</tr>
<tr>
<td>Others</td>
<td>19,55</td>
<td>18,48</td>
<td>16,92</td>
<td>16,22</td>
<td>17,45</td>
<td>17,54</td>
<td>18,03</td>
<td>18,40</td>
<td>18,18</td>
</tr>
<tr>
<td>ITT</td>
<td>60,67</td>
<td>62,97</td>
<td>64,88</td>
<td>66,66</td>
<td>72,18</td>
<td>74,89</td>
<td>75,64</td>
<td>76,14</td>
<td>77,06</td>
</tr>
</tbody>
</table>

2. Disaggregation of the ITT into horizontal ITT and vertical ITT.

Figure 1 shows the evolution of the relative importance of the three types of trade: ITTV, ITTH and one-way trade. If the evolution of these three types of trade in this period is analysed, it is found that the increase in ITT is due, in main, to the growth of ITT with respect to vertically differentiated goods.

The most important type of trade, in terms of percentage volume, is ITTV, which represents more than half of total trade. Inter-industrial trade was the second most important, followed by ITTH. Of the almost seventeen percentage point increase in ITT that took place over the entire period analysed in the study, thirteen points were due to an increase in ITTV and the remaining four to increased ITTH.
Based on the data obtained, there are two clearly distinguishable stages in the pattern of trade. In the first, which runs up until the end of the nineties, the percentage of vertically differentiated intra-industrial trade grows more rapidly than during the rest of the period analysed, while horizontally differentiated intra-industrial trade remains practically constant. In the second stage, at the beginning of the twenty first century, the share of both types of ITT trade remains is somewhat more stable. Vertically differentiated ITT increases but not as sharply.

3. Disaggregation of vertical ITT according to quality.

Integrated markets are normally associated with high levels of choice and/or a broad range of quality. The disaggregation of ITTV into quality ranges provides a basis for addressing the obvious questions which arise; which ranges are the C 10 countries specialising and, how do these contrast with those of the EU 15? Is there any observable change in this specialisation during this period?
Figure 2. Vertically differentiated intra-industry trade according to ranges of quality.

Imports + exports

![Figure 2](chart.png)

Figure 2 shows that in their IITV with the EU 15, the C 10 specialise in low quality goods. In short, when it comes to the trade in goods that are similar in terms of their characteristics but different in terms of quality, the C10 countries tend to export a higher volume of low quality goods while importing similar goods that are of higher quality. The results obtained in our analysis show that the quality of C 10 exports to the EU 15 has increased. This might be explained, according with the literature, by factors such as a reduction in technological differences between both groups of countries. This is related to FDI and the impact of production fragmentation.

---

4 The data used in order to carry out the calculations is as it appears in COMEXT data. This means that, in figure 2, high quality vertical ITT is deemed as such from the point of view of the EU 15, i.e. the quality of the exports from the EU 15 to the C 10 is higher that the quality of the imports from the C 10 to EU 15.
5. Conclusions

This study has shown how the patterns of trade between the 2004 adhesion countries and the EU 15 have changed as a result of the integration process. The analysis separates trade into three categories: inter-industry trade, and two types of intra-industry trade; horizontally and vertically differentiated products. The methodology used was that implemented by Fontagné and Freudenberg.

The results show that more than 75 per cent of trade flows between the C10 and the EU 15 are in the form of one-way trade. For the whole of the period analysed there was a constant increase in the percentage of ITT as a proportion of total trade. This increase was more intense at the end of the nineteen-nineties, thereafter it continued to grow but at a slower pace.

Analyzing the ITT on a two-digit sector level, we found that the largest increases of ITT were in the following three areas: Machinery and mechanical devices (84), Machinery and electrical devices (85) and Vehicles (87). Together, the three areas represented 36 per cent of total intra-industrial trade in 1995 and more than 50 per cent in 2003.

The increase in ITT during the period was due, fundamentally, to two-way trade of vertically differentiated products. During the period studied, ITT increased by almost seventeen percentage points, from which thirteen were attributable to vertically differentiated ITT and the remaining four to horizontal ITT. A similar trend was clearly observable in the integration process that took place with the Single European market in 1992.

The disaggregation of the VITT into ranges of quality shows that, with respect to the trade in products with similar physical characteristics but of different levels of quality, the C10 are specialized in low quality. One of the most prominent of the results obtained was the way in which this kind of trade has evolved over the period analysed, that is, the level of quality of exports from the C10 to the EU 15 has tended to steadily increase.
References


