INTRA-INDUSTRY TRADE IN THE PORTUGUESE ECONOMY: PRODUCTS AND PARTNERS*

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1. INTRODUCTION

Intra-industry trade can be defined as the existence of simultaneous exports and imports within industries.[1] These simultaneous trade flows can be either associated with a specialization along quality ranges (intra-industry trade in vertically differentiated products) or associated with a specialization in varieties (intra-industry trade in similar, horizontally differentiated products).

This article analyses the evolution of Portuguese intra-industry trade over the 1995-2004 period, on a bilateral basis and with a very detailed product breakdown. The article adopts the methodology proposed by Fontagné and Freudenberg (1997), which allows elementary trade flows to be broken down into three categories according to similarity in unit values and trade overlap: inter-industry trade (insignificant overlap between exports and imports); horizontal intra-industry trade (significant overlap and limited differences in unit values); vertical intra-industry trade (significant overlap and large differences in unit values). The traditional Grubel-Lloyd index is also computed and the results of both methods for the Portuguese economy are compared.

The article is organized as follows. Section 2 discusses the methodologies for the measurement of intra-industry trade and describes the database. Section 3 examines the evolution of intra-industry trade in Portugal over the 1995-2004 period along the product and geographical dimensions. Section 4 presents some concluding remarks.

2. MEASURING INTRA-INDUSTRY TRADE: METHODOLOGY AND DATA

The standard definition of intra-industry trade (IIT) refers to the simultaneous import and export of differentiated products within the same industry. Nevertheless, a more detailed definition must take into consideration that products can be differentiated horizontally (different varieties) and vertically (different qualities). Horizontal intra-industry trade (HIIT) includes trade in similar products with differentiated varieties, for instance France and Germany bilateral trade in cars of similar class, cylinder capacity and price range. In vertical intra-industry trade (VIIT), products are distinguished by quality and price, in-

* The views expressed in the article are those of the authors, and not necessarily those of the Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the authors.

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(1) See Greenaway and Milner (1987), Greenaway and Torstensson (1997) and Greenaway and Milner (2003) for a review of the literature on intra-industry trade.

cluding for example exports from Italy to China of high-quality high-price shirts and, in the opposite direction, the import of low-quality low-price shirts.

The theoretical literature has established the determinants of the two types of IIT. As regards HIIT, goods are distinct due to certain attributes, but they are basically the same in terms of quality, cost and technology employed in their production. HIIT between countries with similar endowments is basically driven by consumers' preferences for diversified consumption bundles and by the existence of monopolistic competition with economies of scale in the production of each variety of the good (see, for instance, Dixit and Stiglitz (1977), Krugman (1979, 1980), Lancaster (1980) and Helpman (1981)). VIIT has been modelled in different ways in the theoretical trade literature, but this type of product differentiation usually takes place under perfect competition. Differences in factor endowments, technology and income distribution may explain VIIT using Heckscher-Ohlin-Ricardo type models, as in the works of Falvey (1981), Flam and Helpman (1987), Falvey and Kierzkowski (1987) and Stokey (1991). The results of these models can be interpreted as a "quality ladder" approach, as more advanced countries export higher-quality versions while lower-income countries export the lower-quality ones.

It is also important to establish the link between the international fragmentation of production and IIT. International fragmentation of production, *i.e.*, the cross-border dispersion of components' production/assembly within vertically integrated production processes, with countries specializing in particular stages of the production sequence, has become a new paradigm in the international organization of the production in recent decades.[2] These activities explain part of the increase in world trade, as more intermediate goods circulate between countries, and have consequences on the nature and measurement of IIT. In empirical terms, trade resulting from the international fragmentation of production can be classified either as inter-industry trade or as IIT. At a highly disaggregated product breakdown level, different intermediate and final goods are usually classified in distinct product categories and their trade flows are considered inter-industry trade. However, at a more aggregate level, intermediate and final goods tend be classified in the same category. In this case, the simultaneous exports and imports within the same category that correspond to different production stages (typically the result of international fragmentation) are classified as IIT.[3]

The classical measure of IIT was proposed by Grubel and Lloyd (1975). This measure, now known as the Grubel-Lloyd (GL) index, is simple to calculate and intuitively appealing. The GL approach is based on the intensity of trade overlap for each product. In fact, for each bilateral trade flow in a specific product, Grubel and Lloyd (1975) define the level of IIT as the difference between total trade and the trade imbalance. In order to facilitate the comparisons between industries and countries, IIT is presented as a percentage of total trade, that is:

(2) Important contributions to the theory of international fragmentation of production include the works of Arndt (1997), Venables (1999), Jones and Kierzkowski (1990, 2005), Deardorff (2001, 2005), Kohler (2004) and Grossman and Rossi-Hansberg (2006).

(3) See Jones *et al.* (2002) and Ando (2006) for a discussion on the link between international fragmentation and IIT.

$$GL_{ij} = \frac{(X_{ij} + M_{ij}) - |X_{ij} - M_{ij}|}{X_{ij} + M_{ij}} = 1 - \frac{|X_{ij} - M_{ij}|}{X_{ij} + M_{ij}} \quad (1)$$

where X_{ij} are exports of product i to country j in period t and M_{ij} are imports of product i from country j in period t. If a country only imports or exports within the same sector and trading partner, *i.e.*, either $X_{ij} = 0$ or $M_{ij} = 0$, there is no IIT and the expression reduces to zero. Similarly, if the bilateral export value is exactly equal to the bilateral import value, *i.e.*, $X_{ij} = M_{ij}$, the whole expression reduces to one. Therefore, the GL index varies between 0 (all trade is inter-industry) and 1 (all trade is intra-industry).

The expression for the whole economy is:

$$GL = \frac{\sum_{ij}(X_{ij} + M_{ij}) - \sum_{ij}|X_{ij} - M_{ij}|}{\sum_{ij}(X_{ij} + M_{ij})} \quad (2)$$

which is equivalent to a weighted average of the GL_{ij}, with weights given by the share of total trade of product i with partner j in total trade.

A large number of empirical studies divide total IIT flows into HIIT and VIIT. Starting from the assumption that differences in quality are reflected in differences in prices, information on unit values is used to empirically disentangle HIIT and VIIT. This approach has become popular after the works of Greenaway *et al*. (1994, 1995) who adapt the GL index to measure the intensity of VIIT and HIIT in the UK using information on the unit values of exports and imports.[4] If the difference in unit values is below a given threshold, goods are considered of the same quality, otherwise they are considered to be vertically differentiated, that is:

$$\frac{1}{1+\alpha} \leq \frac{UVX_{ij}}{UVM_{ij}} \leq 1+\alpha \quad (3)$$

If the unit value of exports of product i to partner j, UVX_{ij}, and the unit value of imports of product i from partner j, UVM_{ij}, do not differ by more than α per cent, then equation 3 holds and trade of product i with partner j is considered to be differentiated horizontally. If the export and import unit values differ by more than α per cent, trade of product i with partner j is considered to be differentiated vertically.[5] In this case, two situations can occur. Either the unit value of exports is relatively high in comparison with the unit value of imports, that is $\frac{UVX_{ij}}{UVM_{ij}} > 1+\alpha$, or the unit value of exports is relatively low compared with the unit value of imports, that is $\frac{UVX_{ij}}{UVM_{ij}} < \frac{1}{1+\alpha}$. The first case is usually denominated as superior VIIT or high-quality VIIT and relates to situations where exports are of higher quality than imports. It

(4) Empirical studies using the GL index with bilateral data and disentangling HIIT and VIIT include the works of Hu and Ma (1999), Durkin and Krygier (2000), Blanes and Martín (2000), Martín-Montaner and Ríos (2002) and Byun and Lee (2005).

(5) Originally Greenaway *et al*. (1994, 1995) defined the range of relative unit prices of exported and imported goods as $1-\alpha \leq \frac{UVX_{ij}}{UVM_{ij}} \leq 1+\alpha$. However, as discussed in Fontagné and Freudenberg (1997), the two sides of this condition are not compatible.

can also include trade resulting from international fragmentation within the same product category, with exports involving final goods and imports involving intermediate products. In turn, the second case is usually designated as inferior VIIT or low-quality VIIT and comprises situations where imports are of higher quality than exports. Again, international fragmentation can generate trade classified as inferior VIIT, if imports involve final goods and exports concern intermediates classified in the same product category. As discussed in Ando (2006), the international fragmentation of production can also result in HIIT, if the local value added to the imported parts and components is small, leading to minor unit-price differentials between imports and exports. In addition, the existence of transfer pricing within multinational firms can, to some extent, influence the relative trade prices of intermediate and final products involved in international fragmentation activities.

The choice of the dispersion factor α is crucial, but it has an arbitrary nature (see Davis and Weinstein (2001) for a discussion). Most of the literature has used $\alpha = 0.15$ or $\alpha = 0.25$, being that the higher the dispersion factor, the narrower the range of VIIT. Some authors have argued that a dispersion factor $\alpha = 0.15$ could be considered two low, given the differences in import and export values resulting solely from the distinct reporting of transport and freight costs. In fact, import values are reported CIF (cost, insurance and freight) and exports are reported FOB (free on board), which can account for a significant difference between the two flows. However, this issue does not apply in our case, as the BACI database that is used in this work provides reconciled bilateral trade flows on a FOB-FOB basis. Therefore, in this article we use $\alpha = 0.15$.[6]

An alternative approach to measure IIT was proposed by Fontagné and Freudenberg (1997) and Fontagné et al. (1998), based upon the work of Abd-el Rahman (1991), which we will denominate Fontagné-Freudenberg (FF) method. By using information on unit values at a very detailed level, this methodology breaks down total bilateral trade flows into three types of trade: one-way trade (*i.e.*, inter-industry trade), two-way trade in horizontally differentiated goods (*i.e.*, HIIT), and two-way trade in vertically differentiated goods (*i.e.*,VIIT). Trade at the elementary level is classified either as inter-industry or as IIT, according to condition 4:

$$\frac{Min\left(X_{ij}, M_{ij}\right)}{Max\left(X_{ij}, M_{ij}\right)} < 0.1 \qquad (4)$$

if the value of the minority flow (for example, imports) represents less than 10 per cent of the majority flow (exports in this case), then condition 4 holds and both bilateral flows are considered as inter-industry trade. Otherwise, total trade of product i with partner j is classified as IIT and will be broken down into VIIT or HIIT using the range of relative unit values defined in condition 3. As a result, in this method each elementary trade flow is totally associated with a unique trade type, which contrasts with the relation between IIT and balanced trade contained in the GL approach. For the overall economy, a measure of these three-types of trade is obtained by summing the figures at the most elementary level.[7] In

(6) As a robustness check, we have performed all the computations with $\alpha = 0.25$. These results are available from the authors upon request. The results obtained with the two dispersion factors are qualitatively similar, though, as expected, with a difference in levels.

(7) See Fontagné and Freudenberg (2002), Fontagné *et al.* (2006), Ecochard *et al.* (2006), Fukao *et al.* (2003) and Ando (2006) for applications of this method.

order to facilitate the analysis of the results, the different types of trade are shown as a percentage of total trade.

As previously described, IIT exists if a country simultaneously imports and exports similar goods. However, similarity is identified empirically by the goods being classified in the same sector or product category, according to standard industrial classifications. Consequently, the measurement of IIT has been subject to several controversies and criticisms in the literature (see Lloyd (2002)). One of the most relevant empirical shortcomings is that the measurement of IIT crucially depends on the level of product and country breakdown considered. In fact, the analysis can be applied at different product/geographical breakdown levels giving rise to the so-called aggregation problem (see, for instance, Gullstrand (2002)). In sectoral terms, an insufficient disaggregation in the trade classifications leads to a higher measure of IIT: the lesser the detail of the classification used, the more products are classified in the same sector (the issue of "categorical aggregation"). Similarly, the geographical bias arises from an insufficient disaggregation of partner countries. As discussed in Fontagné and Freudenberg (1997), empirical research on IIT should be done on a strict bilateral basis and using a very detailed product breakdown to minimize this problem. Still, caution must be used when comparing and interpreting IIT indices.

The international trade data used in this article comes from the BACI - CEPII database, which provides reconciled bilateral values (in US dollars), quantities and unit values at the 6-digit of the 1992 Harmonized System (HS) classification, including over 5000 products and 200 trading partners in each year. In this database, the detailed import and export values are fully comparable in a FOB-FOB basis since CIF costs were estimated and removed from CIF import values.[8] The sample period starts in 1995 and ends in 2004. We computed the IIT indexes at the HS 6-digit level in bilateral terms and then aggregated data at the industry level to allow sectoral analysis, using the 2-digits of the International Standard Industrial Classification (ISIC), rev.3. In addition, we used the CEPII classification by transformation level based on the Broad Economic Categories of the United Nations, which includes five different stages of production: primary goods, processed goods, parts and components, investment goods and consumption goods.

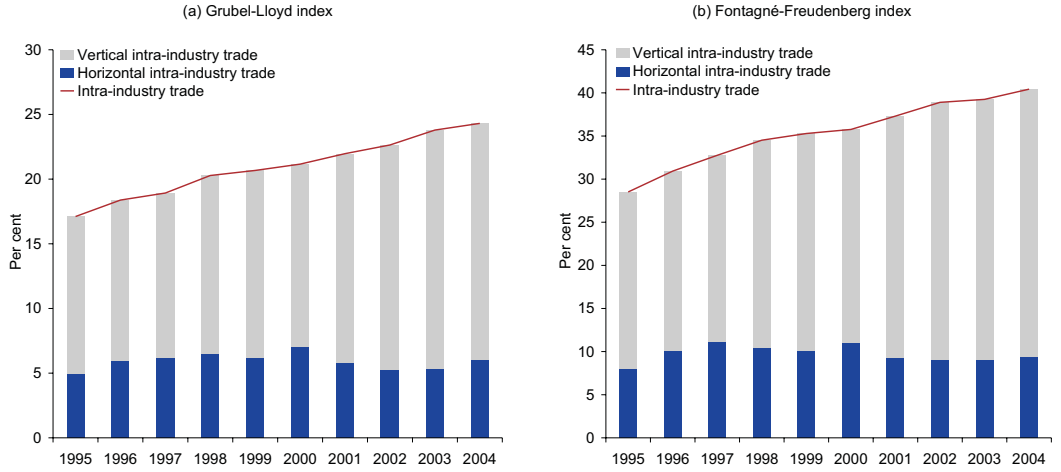
3. INTRA-INDUSTRY TRADE IN THE PORTUGUESE ECONOMY

Table 1 and Chart 1 display the evolution of the share of IIT in total Portuguese trade flows from 1995 to 2004 using the methodologies described in Section 2 with a dispersion factor of 15 per cent to disentangle VIIT and HIIT. The results of both methodologies have clear differences in levels, but the evolution over time is similar. The main type of trade in Portuguese economy is still inter-industry trade, but IIT rose steadily over this decade. From 1995 to 2004, there was an increase of the share of IIT in Portuguese international trade, from 28.5 to 40.4 per cent according to the FF approach and from 17.1 to 24.3 per cent according to the GL index. The results indicate that a significant and growing share of

(8) See Gaulier and Zignago (2008) for a detailed description of this database.

Chart 1

EVOLUTION OF INTRA-INDUSTRY TRADE IN PORTUGAL
As a percentage of total trade



Sources: BACI - CEPII database and authors' calculations.

Table 1

EVOLUTION OF TRADE TYPES IN PORTUGAL
As a percentage of total trade

Grubel-Lloyd index

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	1995-99	2000-04
Inter-industry trade	82.9	81.6	81.1	79.7	79.3	78.8	78.0	77.4	76.2	75.7	80.9	77.1
Intra-industry trade	17.1	18.4	18.9	20.3	20.7	21.2	22.0	22.6	23.8	24.3	19.1	22.9
Horizontal	4.9	6.0	6.2	6.5	6.1	7.0	5.8	5.3	5.3	6.0	6.0	5.9
Vertical	12.2	12.4	12.7	13.8	14.5	14.1	16.1	17.4	18.5	18.3	13.2	17.0
Superior	4.6	5.1	5.0	5.2	6.4	5.6	6.8	6.7	6.6	6.4	5.3	6.4
Inferior	7.7	7.3	7.7	8.6	8.2	8.5	9.4	10.7	11.9	11.8	7.9	10.6

Fontagné-Freudenberg index

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	1995-99	2000-04
Inter-industry trade	71.5	69.1	67.2	65.5	64.7	64.2	62.7	61.1	60.8	59.6	67.5	61.5
Intra-industry trade	28.5	30.9	32.8	34.5	35.3	35.8	37.3	38.9	39.2	40.4	32.5	38.5
Horizontal	8.1	10.2	11.1	10.5	10.1	11.0	9.3	9.0	9.1	9.4	10.0	9.5
Vertical	20.5	20.8	21.7	24.1	25.2	24.7	28.0	29.9	30.2	31.0	22.5	29.0
Superior	7.9	8.3	8.4	8.8	11.1	10.9	12.5	12.0	11.2	11.3	9.0	11.5
Inferior	12.6	12.5	13.2	15.2	14.1	13.8	15.6	17.9	19.0	19.7	13.6	17.5

Sources: BACI - CEPII database and authors' calculations.

Portuguese IIT corresponds to vertically differentiated products, while the share of HIIT has remained remarkably stable over this period.[9] In addition, VIIT in Portugal is mainly of products with export prices lower than import prices, accounting for 60.2 per cent of total VIIT in the 2000-04 period using the FF methodology (62.3 per cent with the GL index). This fact is in line with the "quality ladder" results of VIIT models that indicate that less advanced economies tend to export lower-price qualities of a given product. The increase in the share of VIIT in total Portuguese trade is more evident since 2000 and results mainly from the growth of inferior VIIT.

Fontagné and Freudenberg (2002) examine the evolution of IIT in the EU and conclude that this type of trade is particularly relevant for intra-EU trade, and this is true for each individual country. However, there are important differences among Member-States concerning the relative importance of IIT in 1999. In intra-EU trade, IIT is most pronounced for France, Germany, Belgium and the UK. In contrast, trade is mainly inter-industry for small periphery countries, like Greece, Finland and Portugal. They also find that there was an increase of the share of IIT in intra-EU trade between 1980 and 1999 in all member countries with the exception of Greece and Ireland. For most EU countries, the observed increase in IIT is almost entirely due to VIIT, which is in line with the results that we found for Portugal.

The next two subsections analyse in more detail the evolution of IIT in the Portuguese economy over the 1995-2004 decade, identifying the individual industries and trading partners where this type of trade is more relevant. The detailed analysis is done using the FF methodology. We choose this method because the value of each bilateral trade flow is totally classified in one of the three trade categories.

3.1. Product breakdown

This subsection examines the evolution of Portuguese IIT in the different industries, using two distinct classifications: an industrial classification and a broader classification by economic categories. Using the 2-digits of the ISIC rev.3, there are four industries were IIT appears to be especially relevant, in the sense that their share in total IIT is more than 1 percentage point higher than their share in total Portuguese trade over the whole period (Table 2). These industries are "motor vehicles" (ISIC 34), where the highest difference is found, "wearing apparel, dressing and dyeing of fur" (ISIC 18), "rubber and plastics products" (ISIC 25) and, to a lesser extent, "fabricated metal products" (ISIC 28). In the first three sectors, the proportion of IIT in total sectoral trade is above 60 per cent in the 2000-04 period, compared with an index of 38.5 per cent for the whole economy, and increased over time. In all of these industries, VIIT is more significant than HIIT in the most recent period and grew strongly since 2000. The recent increase of the share of VIIT in total sectoral trade is especially marked in "motor vehicles". VIIT in these four sectors comprises mostly products with export prices lower than import prices. In the 2000-04 period, HIIT is more significant than VIIT in "basic metals" (ISIC 27) and in "other transport equipment" (ISIC 35) and it increased over the 1995-2004 decade.

(9) Aturupane *et al.* (1999) examined trade between the European Union (EU) and eight Central and Eastern European economies in the first half of the nineties and also found that VIIT dominates HIIT in all countries.

Table 2 (to be continued)

PORTUGUESE SECTORAL TRADE BY TYPES OF TRADE
Shares as a percentage

ISIC rev.3		1995-1999							
		Shares in:		Share in total sectoral trade					
		Total trade	Total IIT	Inter-industry	Intra-industry				
					Total	Horizontal	Vertical		
							Total	Superior	Inferior
01	Agriculture, hunting and related service activities	3.4	1.2	88.3	11.7	3.5	8.2	4.3	3.9
02	Forestry, logging and related service activities	0.6	0.5	72.4	27.6	7.9	19.8	4.0	15.7
05	Fishing, aquaculture and service activities incidental to fishing	0.3	0.5	52.7	47.3	3.0	44.3	34.3	9.9
10	Mining of coal and lignite; extraction of peat	0.3	0.0	99.9	0.1	0.0	0.0	0.0	0.0
11	Extraction of crude petroleum and natural gas	2.5	0.0	100.0	0.0	0.0	0.0	0.0	0.0
12	Mining of uranium and thorium ores	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
13	Mining of metal ores	0.3	0.0	99.8	0.2	0.0	0.2	0.1	0.0
14	Other mining and quarrying	0.3	0.2	77.1	22.9	13.8	9.2	5.2	4.0
15	Manufacture of food products and beverages	7.6	4.5	80.7	19.3	7.6	11.7	5.7	6.1
16	Manufacture of tobacco products	0.1	0.0	83.8	16.2	0.6	15.6	8.3	7.4
17	Manufacture of textiles	8.3	7.8	69.1	30.9	6.3	24.6	7.9	16.7
18	Manufacture of wearing apparel; dressing and dyeing of fur	5.0	7.1	53.7	46.3	8.1	38.2	10.8	27.4
19	Tanning and dressing of leather; manufacture of luggage, handbags and footwear	4.5	2.5	82.0	18.0	3.3	14.7	7.5	7.2
20	Manufacture of wood and cork; manufacture of articles of straw and plaiting	2.3	1.4	80.2	19.8	4.4	15.4	3.2	12.2
21	Manufacture of paper and paper products	3.2	2.2	78.3	21.7	6.1	15.6	6.0	9.6
22	Publishing, printing and reproduction of recorded media	0.7	0.8	63.7	36.3	4.5	31.8	9.3	22.5
23	Manufacture of coke, refined petroleum products and nuclear fuel	1.8	2.2	60.7	39.3	6.7	32.6	13.9	18.7
24	Manufacture of chemicals and chemical products	8.3	6.3	75.3	24.7	6.3	18.4	7.5	10.9
25	Manufacture of rubber and plastics products	2.8	4.9	43.5	56.5	13.4	43.1	10.2	32.9
26	Manufacture of other non-metallic mineral products	2.5	2.1	72.2	27.8	5.1	22.7	6.3	16.4
27	Manufacture of basic metals	3.8	2.8	75.6	24.4	15.2	9.2	3.7	5.5
28	Manufacture of fabricated metal products, except machinery and equipment	2.5	3.5	53.5	46.5	7.5	38.9	15.8	23.1
29	Manufacture of machinery and equipment n.e.c.	7.3	6.8	69.9	30.1	4.4	25.8	9.5	16.3
30	Manufacture of office, accounting and computing machinery	1.7	1.1	79.2	20.8	4.3	16.6	6.5	10.1
31	Manufacture of electrical machinery and apparatus n.e.c.	5.0	5.7	63.0	37.0	5.7	31.3	14.4	16.8
32	Manufacture of radio, television and communication equipment and apparatus	4.9	4.2	71.8	28.2	2.7	25.5	15.5	10.0
33	Manufacture of medical, precision and optical instruments, watches and clocks	1.7	1.8	65.4	34.6	6.1	28.5	13.6	14.8
34	Manufacture of motor vehicles, trailers and semi-trailers	14.0	25.3	41.1	58.9	33.0	25.9	10.1	15.8
35	Manufacture of other transport equipment	2.0	1.4	77.3	22.7	4.5	18.2	8.3	10.0
36	Manufacture of furniture; manufacturing n.e.c.	2.1	2.8	56.0	44.0	10.5	33.5	19.6	14.0
37	Recycling	0.0	0.0	91.4	8.6	0.0	8.6	8.5	0.1
40	Electricity, gas, steam and hot water supply	0.1	0.1	32.2	67.8	67.8	0.0	0.0	0.0
74	Other business activities	0.0	0.0	78.7	21.3	0.7	20.6	12.6	8.0
92	Recreational, cultural and sporting activities	0.0	0.0	67.5	32.5	31.0	1.4	0.9	0.5
93	Other service activities	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Total		100.0	100.0	67.5	32.5	10.0	22.5	9.0	13.6

Table 2 (continued)

PORTUGUESE SECTORAL TRADE BY TYPES OF TRADE

Shares as a percentage

ISIC rev.3		2000-2004							
		Shares in:		Share in total sectoral trade					
		Total trade	Total IIT	Inter-industry	Intra-industry				
					Total	Horizontal	Vertical		
							Total	Superior	Inferior
01	Agriculture, hunting and related service activities	2.9	1.6	78.6	21.4	8.7	12.7	5.9	6.8
02	Forestry, logging and related service activities	0.4	0.5	57.8	42.2	8.5	33.7	2.2	31.6
05	Fishing, aquaculture and service activities incidental to fishing	0.4	0.6	43.5	56.5	1.5	55.0	43.7	11.3
10	Mining of coal and lignite; extraction of peat	0.3	0.0	99.2	0.8	0.0	0.8	0.3	0.4
11	Extraction of crude petroleum and natural gas	4.1	0.0	100.0	0.0	0.0	0.0	0.0	0.0
12	Mining of uranium and thorium ores	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
13	Mining of metal ores	0.2	0.0	100.0	0.0	0.0	0.0	0.0	0.0
14	Other mining and quarrying	0.3	0.2	76.6	23.4	3.5	19.9	3.0	16.9
15	Manufacture of food products and beverages	7.4	4.6	75.9	24.1	7.1	17.0	7.4	9.6
16	Manufacture of tobacco products	0.2	0.3	47.5	52.5	10.5	42.0	30.7	11.2
17	Manufacture of textiles	6.8	6.9	61.0	39.0	8.5	30.4	11.6	18.8
18	Manufacture of wearing apparel; dressing and dyeing of fur	3.6	5.7	39.4	60.6	14.9	45.6	15.6	30.0
19	Tanning and dressing of leather; manufacture of luggage, handbags and footwear	3.4	2.1	76.4	23.6	5.1	18.5	8.7	9.9
20	Manufacture of wood and cork; manufacture of articles of straw and plaiting	2.3	1.6	73.3	26.7	7.0	19.6	6.2	13.4
21	Manufacture of paper and paper products	3.2	2.1	75.1	24.9	10.2	14.7	4.8	9.9
22	Publishing, printing and reproduction of recorded media	0.6	0.4	75.1	24.9	2.3	22.5	7.3	15.2
23	Manufacture of coke, refined petroleum products and nuclear fuel	2.2	2.1	62.7	37.3	12.0	25.2	13.8	11.5
24	Manufacture of chemicals and chemical products	9.0	7.6	67.6	32.4	9.3	23.0	9.1	13.9
25	Manufacture of rubber and plastics products	3.1	5.3	35.2	64.8	9.6	55.2	16.1	39.1
26	Manufacture of other non-metallic mineral products	2.3	2.2	63.9	36.1	7.7	28.4	5.0	23.4
27	Manufacture of basic metals	4.6	3.5	70.6	29.4	16.7	12.7	4.1	8.6
28	Manufacture of fabricated metal products, except machinery and equipment	2.6	3.6	47.1	52.9	6.9	46.0	16.3	29.7
29	Manufacture of machinery and equipment n.e.c.	7.1	6.2	66.3	33.7	4.8	28.8	11.2	17.7
30	Manufacture of office, accounting and computing machinery	2.3	2.7	55.7	44.3	2.9	41.3	27.2	14.1
31	Manufacture of electrical machinery and apparatus n.e.c.	4.2	4.6	57.7	42.3	6.0	36.3	15.8	20.5
32	Manufacture of radio, television and communication equipment and apparatus	6.3	6.1	63.0	37.0	3.3	33.7	9.1	24.6
33	Manufacture of medical, precision and optical instruments, watches and clocks	1.8	1.7	63.7	36.3	6.1	30.1	12.5	17.7
34	Manufacture of motor vehicles, trailers and semi-trailers	13.8	21.8	39.0	61.0	16.9	44.1	18.5	25.5
35	Manufacture of other transport equipment	2.1	2.7	48.7	51.3	28.9	22.5	8.2	14.2
36	Manufacture of furniture; manufacturing n.e.c.	2.3	3.0	49.0	51.0	10.0	41.1	26.5	14.6
37	Recycling	0.0	0.0	85.8	14.2	0.4	13.8	12.1	1.7
40	Electricity, gas, steam and hot water supply	0.2	0.5	0.3	99.7	99.7	0.0	0.0	0.0
74	Other business activities	0.0	0.0	66.0	34.0	0.0	34.0	25.3	8.7
92	Recreational, cultural and sporting activities	0.0	0.0	70.0	30.0	28.6	1.4	0.7	0.7
93	Other service activities	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Total		100.0	100.0	61.5	38.5	9.5	29.0	11.5	17.5

Sources: BACI - CEPII database and authors' calculations.

Table 3

PORTUGUESE TRADE BY MAIN STAGES OF PRODUCTION AND TYPES OF TRADE
As a percentage of total trade of each stage

	1995-1999					
	Inter-industry	Intra-industry				
		Total	Horizontal	Vertical		
				Total	Superior	Inferior
Primary goods	90.9	9.1	3.3	5.9	2.5	3.4
Processed goods	71.4	28.6	7.7	20.9	8.0	12.9
Parts and components	51.5	48.5	10.1	38.4	16.2	22.2
Investment goods	73.2	26.8	7.7	19.1	8.8	10.3
Consumption goods	63.1	36.9	13.9	23.0	8.7	14.3
Total	67.5	32.5	10.0	22.5	9.0	13.6

	2000-2004					
	Inter-industry	Intra-industry				
		Total	Horizontal	Vertical		
				Total	Superior	Inferior
Primary goods	88.2	11.8	4.7	7.2	2.3	4.9
Processed goods	66.4	33.6	10.5	23.1	8.9	14.2
Parts and components	41.2	58.8	6.7	52.2	17.5	34.6
Investment goods	65.1	34.9	11.8	23.0	11.3	11.8
Consumption goods	58.0	42.0	10.0	32.0	13.6	18.4
Total	61.5	38.5	9.5	29.0	11.5	17.5

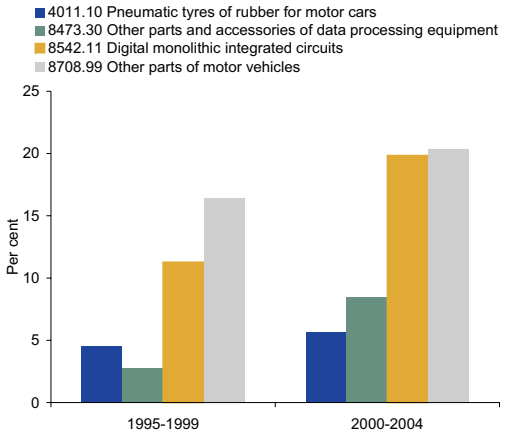
Sources: BACI - CEPII database and authors' calculations.

We also use the CEPII classification by transformation level based on the Broad Economic Categories of the United Nations to examine the groups of products where IIT is more relevant (Table 3). As expected, trade in primary goods is overwhelmingly dominated by inter-industry trade over the 1995-2004 period, corresponding to around 90 per cent of total. On the contrary, the highest share of IIT in Portugal is found in parts and components, representing 58.8 of total trade in these products in the 2000-04 period. A significant proportion of Portuguese trade in consumption goods is also IIT (42.0 per cent in the more recent period). IIT represent also more than 30 per cent of trade in intermediate processed goods and in investment goods. In all stages of production, Portuguese IIT is higher in vertically than in horizontally differentiated products and there was an increase of VIIT in all categories over this decade. These facts are especially striking in parts and components, where VIIT accounts for 52.2 percent of total trade and grew strongly in the last five-years considered. In all stages of production considered, Portuguese VIIT is mainly of products with export prices lower than import prices, as would

Chart 2

MAIN PRODUCTS IN PORTUGUESE VERTICAL INTRA-INDUSTRY TRADE IN PARTS AND COMPONENTS

As a share of total Portuguese VIIT in parts and components



Sources: BACI - CEPII database and authors´ calculations.
Note: The names of the items were taken directly, with some abbreviation, from the 6-digit 1992 Harmonized System (HS) classification.

be expected since VIIT in Portugal is mostly carried out with higher-income European countries (see subsection 3.2 below).

The strong increase of Portuguese VIIT in parts and components points to the existence of back-and-forth transactions associated with the international fragmentation of production. The link between international fragmentation and IIT can be better established empirically if trade flows are examined at the product level. Chart 2 displays the main items of VIIT in parts and components in the Portuguese economy using the 1992 HS classification at the 6-digit breakdown level. Portuguese VIIT in parts and components appears relatively concentrated in a few items, with the four main products representing together more than 50 per cent of total in the 2000-04 period and showing an increase over the decade. Two items of parts and components stand out for their high significance in terms of VIIT. The share of "other parts of motor vehicles" (HS 8708.99) in total Portuguese VIIT in parts and components increased from 16.5 per cent in the 1995-99 period to 20.3 per cent in the 2000-04 period. Similarly, "digital monolithic integrated circuits" (HS 8542.11) represents also a high and increasing share of VIIT in parts and components (11.3 per cent in 1995-99 and 19.8 per cent of total in 2000-04). The two other main products are also related with the industries of parts and components for motor vehicles and for data processing machines: "pneumatic tyres of rubber for motor cars" (HS 4011.10) and "other parts and accessories of data processing equipment" (HS 8473.30). The relevance of these intermediate products simultaneously on imports and exports signals the integration of Portugal in the international production networks of these industries.

3.2. Geographical breakdown

Following what was done in the previous subsection, we now turn to the geographical analysis of the different types of trade over the 1995-2004 period. Table 4 includes a geographical breakdown of Portuguese international trade, including the 14 partners with a share above 1 percent in the 2000-04 period, as well as an EU aggregate comprising the 15 initial Member-States (EU15). The results indicate that IIT in Portugal is mostly done with other EU15 countries. In fact, EU15 represents 76 per cent of total Portuguese trade in the 2000-04 period, but it accounts for 93.8 per cent of Portuguese IIT. In addition, the share of IIT in Portuguese bilateral trade with EU15 partners increased from 40 per cent in the 1995-99 period to 47.5 per cent in the 2000-04 period. The increase in IIT over this decade is also evident in the majority of the Portuguese 14 main trading partners, with Belgium, Austria, Brazil and Japan being the only countries where there was a decline.

The highest bilateral indices of IIT in the 2000-04 period occur in the two major trading partners of Portugal (Spain and Germany) and result mainly from IIT in vertically differentiated products. The results for Spain are especially striking, as total IIT and VIIT account for 63.2 per cent and 45.2 per cent of bilateral trade in the period 2000-04, respectively. On the contrary, in all non-EU15 partners considered the share of IIT in total bilateral trade is below 25 per cent. The lowest shares of IIT in bilateral trade in the 2000-04 period appear in Portuguese trade with Japan and Brazil (IIT shares of 4.2 and 7.4 per cent, respectively). In the 2000-04 period, VIIT is more important than HIIT in Portuguese bilateral trade with these 14 countries, with the exception of Norway. In addition, the share of VIIT in total bilateral trade over the 1995-2004 decade increased in all countries selected, except Austria and Brazil. The strongest increase in the VIIT bilateral share over this period occurred in Portuguese trade with Germany, from 27.2 per cent in 1995-99 to 42.4 per cent of total bilateral trade in 2000-04. Finally, Portuguese VIIT with these trading partners is mainly of products with export prices lower than import prices. The two exceptions in the 2000-04 period are the Netherlands and Switzerland, where superior VIIT has a higher share in total bilateral trade than inferior VIIT.

Table 4

PORTUGUESE BILATERAL TRADE WITH MAIN TRADING PARTNERS BY TYPES OF TRADE

Shares as a percentage

	1995-1999								2000-2004							
	Shares in:		Share in total bilateral trade						Shares in:		Share in total bilateral trade					
	Total trade	Total IIT	Inter-industry	Intra-industry					Total trade	Total IIT	Inter-industry	Intra-industry				
				Total	Horizontal	Vertical						Total	Horizontal	Vertical		
						Total	Superior	Inferior						Total	Superior	Inferior
Spain	20.1	34.5	44.0	56.0	17.6	38.4	13.2	25.3	24.7	40.5	36.8	63.2	18.0	45.2	17.5	27.7
France	11.9	14.7	59.8	40.2	10.3	29.9	13.5	16.4	10.8	13.7	51.0	49.0	11.1	37.9	17.1	20.8
Italy	6.5	6.1	69.5	30.5	8.6	21.9	8.4	13.6	5.8	5.2	64.9	35.1	6.1	28.9	13.6	15.3
United Kingdom	8.8	9.1	66.1	33.9	13.0	20.9	7.2	13.7	6.9	6.8	62.1	37.9	11.9	26.0	12.5	13.5
Germany	16.8	22.3	56.8	43.2	16.0	27.2	11.8	15.4	14.8	19.7	48.9	51.1	8.7	42.4	13.2	29.2
Belgium	3.5	3.4	68.1	31.9	10.5	21.4	7.2	14.2	4.2	3.1	71.4	28.6	5.5	23.1	8.5	14.5
Austria	1.0	0.6	79.4	20.6	2.8	17.8	10.6	7.3	1.0	0.5	80.2	19.8	6.5	13.3	6.2	7.0
Netherlands	4.7	3.3	77.3	22.7	4.3	18.3	9.9	8.4	4.2	3.1	71.6	28.4	6.2	22.2	12.2	10.0
Sweden	1.6	0.6	87.9	12.1	1.4	10.6	2.9	7.7	1.2	0.5	84.8	15.2	1.0	14.2	5.8	8.4
EU15	77.7	95.5	60.0	40.0	12.6	27.4	10.8	16.6	76.0	93.8	52.5	47.5	11.5	36.1	14.3	21.8
Switzerland	1.4	0.6	85.5	14.5	1.9	12.6	6.9	5.7	1.0	0.5	79.4	20.6	2.2	18.4	11.9	6.5
Norway	1.1	0.1	97.4	2.6	0.3	2.3	0.7	1.7	1.2	0.8	76.2	23.8	14.4	9.3	2.5	6.8
USA	3.8	1.6	86.7	13.3	1.3	11.9	4.5	7.4	4.1	2.2	79.2	20.8	6.6	14.2	3.1	11.1
Brazil	1.2	0.3	91.4	8.6	0.8	7.9	4.0	3.9	1.1	0.2	92.6	7.4	0.9	6.5	3.2	3.3
Japan	1.8	0.3	95.2	4.8	1.5	3.3	1.7	1.6	1.3	0.1	95.8	4.2	0.3	3.8	1.9	2.0
Total	100.0	100.0	67.5	32.5	10.0	22.5	9.0	13.6	100.0	100.0	61.5	38.5	9.5	29.0	11.5	17.5

Sources: BACI - CEPII database and authors' calculations.

4. CONCLUSIONS

This article measures and characterizes the intra-industry trade (IIT) in the Portuguese economy, disentangling horizontal intra-industry trade (HIIT) and vertical intra-industry trade (VIIT). Assuming that differences in unit values correspond to differences in the quality of products, HIIT relates with trade of similar products and VIIT captures trade of products that differ in quality. The Grubel-Lloyd and the Fontagné-Freudenberg indicators are the main measures of IIT suggested in the empirical trade literature. Both indicators are computed for the 1995-2004 period, on a bilateral basis and with a very detailed product breakdown. Nevertheless, in the detailed analysis only the results of the latter indicator are presented.

Inter-industry trade is still the dominant type of trade in the Portuguese economy, but our results point to a substantial increase of IIT, in particular since 2000. IIT in Portugal, measured with the Fontagné-Freudenberg method, accounts for around 40 per cent of total trade in 2004 (28.5 per cent in 1995). As observed in other EU countries, this increase mostly resulted from the growth of trade in vertically differentiated goods. VIIT in Portugal is mainly of products with export prices lower than import prices, representing around 60 per cent of the total. This fact is in line with the "quality ladder" results of VIIT models that indicate that less advanced economies tend to export lower-price qualities of a given product. Portuguese VIIT is mostly done with higher-income European countries, with Spain and Germany showing the highest proportions of this type of trade.

Additional conclusions arise when products are grouped according to their transformation level. Portuguese trade in primary goods is dominated by inter-industry trade, corresponding to around 90 per cent of total. On the contrary, the highest share of IIT in Portugal is found in parts and components, representing 58.8 per cent of total trade in these products in the 2000-04 period. This fact points to the existence of some intra-industry transactions associated with the international fragmentation of production, namely in parts and components for automobiles and for automatic data processing machines. At the industry level, significant and increasing shares of IIT, mostly vertical, are found in the industries of rubber and plastic products, motor vehicles, wearing apparel and metal products.

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