DYNAMIC DETERMINANTS OF INTERNATIONAL TRADE PATTERNS: THE CASE OF EUROPEAN FOOD PRODUCTS, BEVERAGES AND TOBACCO INDUSTRY

Teresa Fernández-Núñez[*] and Miguel A. Márquez[**]

Abstract:

This paper introduces the empirical dynamic model proposed by Fernández-Núñez and Márquez (2010) for examining changes and the determinants in the international trade patterns on food products, beverages and tobacco industry. Using data for 12 European countries over the 1985-2007 period, firstly we analyze how the observed changes in all components of total trade are explained by factor endowments, technology, market size and consumer tastes and preferences. Secondly, we investigate whether the endogenous evolution of the different components of total trade may also affect changes in the international trade patterns. The econometric analysis reveals that technology, market size and the presence of interactions among different types of trade are the main dynamic determinants of international trade on European food products industry. The results also suggest some important economic political recommendations to encourage this manufacture and to influence on its trade pattern.

Keywords: *international trade pattern, dynamic model, interaction, food products, beverages and tobacco industry, European Union*

JEL Classification: F10, F14, F15

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1. Introduction

International trade patterns change over time[1]. Such dynamic aspects of trade have been emphasized by theoretical models of trade and growth (Krugman, 1987; Lucas, 1988; Grossman and Helpman, 1991; Redding, 2002; Bond and al., 2003). However, very few empirical studies have examined the dynamic processes of trade patterns (Proudman and Redding, 2000; Redding, 2002; Tingval, 2004; Bastos y Cabral, 2007; Altzinger and Damiman, 2009; Fernández-Núñez y Márquez, 2010)[2].

This paper, starting from the empirical model proposed by Fernández-Núñez and Márquez (2010), explores the dynamic determinants of international trade pattern on Food products, Beverages and Tobacco industry[3] [FBT] in the EU-12[4] over the 1985-2007 period. This model allows not only to integrate all components of total trade, but also to test the existence of relevant interactions among the diffentent types of trade considered.

The aim of this study is first of all to identify the main forces behind changes in international trade pattern over time in the EU12 FBT. According to the different theories to explain patterns of trade (comparative advantage and increasing returns to scale), we investigate how changes in cross-countries endowments –physical, human and technological capital- in per capita income and in the market size influence on the international trade pattern. The second aim of the paper is to capture how the development of one kind of trade co-evolves with other kinds of trade. In other words, we intend to detect the presence of interactions among the different types of trade. We hypothesize that the interactions could be generated by cross-trade type externalities (Venables, 2001, Krugman and Obstfeld, 2003). Its importance derives from the effects that could result in the trade pattern.

This paper is organized as follows. After this introduction, Section 2 briefly reviews the theoretical underpinnings of international trade. In Section 3 the main changes in the trade pattern of FBT industry for the different countries in the EU12 are described. Then, Section 4 contains the econometric specification, including a description of the explanatory variables and of the data. After that, in Section 5 we introduce the econometric results. Finally, Section 6, concludes.

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[1] Total international trade in a country can be decomposed in different trade types according to overlap in trade and to its similarity in quality: inter-industry trade (InterT), horizontal intra-industry trade (HIIT), low quality vertical intra-industry trade (LQVIIT) and high quality vertical intra-industry trade (HQVIIT). A country's international trade pattern is characterized by the weight of these different trade types in total trade at a point in time. We consider that changes in the international trade pattern mean changes in the weight of the different trade types in total trade.

[2] Proudman and Redding (2000) study the differences in international trade dynamics among the G-5 economies; Redding (2000) analyzes the dynamic of international specialization on 20 industries and 7 OECD countries; Tingvall (2004) examines the drivers of changes in countries specialization on 22 industries in 10 European countries; Bustos and Cabral (2007) study changes in international trade patterns in 20 OECD countries and they introduce new dynamic measures for examining these shifts; Alzinger and Damijan (2009), emphasize the role of productivity differences in the pattern of trade between 21 EU countries; Fernández and Márquez (2010) analyze the dynamic of international trade pattern of the Spanish manufacture of food products, beverages and tobacco in intra-EU exchanges from 1985 to 2007.

[3] Manufacture of Food products, Beverages and Tobacco" belongs to NACE subsection DA. This sector covers NACE Division DA15 and DA16.

[4] The EU-12 countries are: Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, and United Kingdom. Data for Belgium and Luxembourg are aggregated because statistics initially considered their values together.

2. International trade patterns: Theoretical framework

It is widely recognized that the distinction between inter-industry trade and intra-industry trade is required in order to reach an adequate knowledge of international trade pattern in a country.

According to the most conventional theory in international trade, proposed by Herckscher and Ohlin, inter-industry trade is explained by the presence of comparative advantages between countries. These advantages occur due to differences in relative factor endowments across countries and relative intensities with which factors are used in the production of each good traded. Therefore, it is expected among countries with dissimilar factor endowments.

Furthermore, "New trade theory" offers two alternative models to support intra-industry trade. On one hand, models based on monopolistic competition (Helpman and Krugman 1985), which explain intra-industry trade in horizontally differentiated products (the varieties exchanged are of similar characteristics and qualities). These models incorporate, as an essential element of their argument, the presence of enterprises that combine both strategies of product differentiation and increasing returns to scale (they are related to market size). This type of trade is expected among countries with similar factor endowments and per capita income.

On the other hand, they are models of vertically differentiated trade (the varieties exchanged are of different qualities). The differences in the levels of product quality may derive from the distinct intensity of capital or technology used in the production of the different varieties (Falvey and Kierzkowski, 1987; Flam and Helpman 1987). These models again introduce the concept of comparative advantage in the explanation of trade intra-industry. Therefore, the varieties of higher (lower) quality are produced in countries more (less) abundant in physical and human capital, and more (less) technologically advanced. In short, the existence of vertical intra-industry trade will require different factor endowments and income levels between countries. However, in this sense, some researchers point out these differences cannot be very wide, otherwise there will be no overlap between the varieties demanded in one country and those produced in another (e.g. Martin and Orts 2002; Cabral et al. 2008; Jensen and Lüthje 2009; Milgram and Moro 2010).

Even though trade in horizontally differentiated products is mainly explained by increasing returns to scale, as we before mentioned, in most of cases, this trade also leads to cost differences across countries. (Acharya, 2008; Liapis, 2011)[5]. This is because many of the most companies with competitive advantages are locate in well endowed countries, strengthening to their general comparative advantage. Consequently, explanations in country's international trade performance should primarily focus attention on comparative advantage.

It is well-known that even today factor endowments are important sources of comparative advantage. Then, the particular country's endowment structure should influence on trade pattern at a point in time. However, theoretical models of growth and trade underline that international trade patterns evolve over the time (see, e.g., Grossman and Helpman, 1991 or Redding, 2002) This would mean that comparative advantage is not a static concept; it could evolve with the passage of time for a host of reasons (mainly by the country's economic development –Balassa, 1979). In this sense, in order to reach a better knowledge

[5] The presence of enterprises that combine both product differentiation and increasing returns to scales is the most important condition that can lead to horizontal intra-industry trade (Liapis, 2011).

about the trade dynamics it will be necessary to understand how the countries' advantages are changing over time. These changes could be explained by the role of knowledge spillovers and technology transfer (e.g. Grossman and Helpman, 1991) or the role of factor accumulation (see Redding, 2002) in trade. Thus, on one hand access to foreign technology and knowledge can foster domestic innovation; and on the other hand, trade in tangible goods can promote the exchange of intangible acquaintance (Kiriyama, 2012).

Following Fernández-Núñez and Márquez (2010), the possible interplays among different types of trade (or different characteristics of goods traded) are another of the framework conditions that could also facilitate the trade pattern changes. They consider that these interconnections could be generated by cross-trade type externalities. Input-output relationships and inter-industry linkages could be the propagation mechanisms for these externalities (Capello, 2009). They set out two channels through which these relationships and linkages could contribute to these spillovers. The first channel is referred to the effects generated by technology diffusion through imports and foreign direct investments [FDI] (e.g. Venables, 2001, Jensen, 2002; Saggi, 2002; Javorcik, 2004; Keller, 2004; Klugler, 2006; Harding and Javorcik, 2009, Kiriyama, 2012)[6]. The second one links skills and the mobility of workers with trade patterns (Slaughter, 1999; Venables 2001; Cabral et al., 2006; Winchester et al., 2006)[7].Thus, the movement of worker can also be related to innovation.

Benefits of technology diffusion will be influenced not only by such channels of propagation but also by the capacity to assimilate and apply new information (Blomström and Wang, 1992; Rivera and Oliva, 2008; Kiriyama, 2012). The absorptive capacity depends not only on skill levels or R&D capacities, but also on economic policy actions that exceed trade policy issues.

In short, the usual appeals to comparative advantage explaining trade patterns could be complemented by the interactions between the types of trade reflecting the aforementioned channels. Therefore, it would be very interesting to detect the possible existence of interactions that happens among the different components of trade.

3. The international trade pattern of Food products, Beverages and Tobacco industry in EU12 Member States.

Our analysis focuses on the changes that have occurred in the intra-EU exchanges of FBT industry in EU12 Member States, between 1985 and 2007. In the descriptive analysis, we made use of data for the flows in value terms (thousands of euro) and ton terms of both total exports and imports towards EU12. Our trade data come from the Comext Eurostat Database, which provides disaggregated trade data at the six digit levels of the NIMEXE Nomenclature up to 1987, and after that year, at the eight digits levels of the Combined Nomenclature.

[6] Imports and FDI are two important channels of international technology diffusion. Imports allow domestic firms access to more sophisticated intermediate and capital goods that are domestically unavailable. FDI may also promote knowledge spillovers to local producers.

[7] According to traditional models of international trade, trade will led to movements of factors of production among industries due to the alteration in relative prices. Thus, the international trade could shift the demand for skill/unskill labour across industries but also, could alter the skill composition of labour demand within each industry.

To separate empirically the international trade into its four components, we followed the standard methodology in the literature. Firstly, to distinguish between inter and intra-industry trade we used the index proposed by Grubel and Lloyd adjusted for categorical aggregation[8]. Secondly, in order to disentangle the different types of intra-industry (horizontal and vertical), we follow the methodological approach firstly proposed by Abd-el Rahman (1991) and also used by Greenaway et al. (1994), based on the ratio between the unit value of exports and the unit value of imports.[9]

A few stylized facts emerge from the application of this methodology to the EU12 trade of FBT. First, for the EU average, inter-industry trade is the largest component of total trade. This feature can be observed in all the European countries (Figure 1)[10]. In 2007, only two countries, Germany and Belgium-Luxembourg, were characterized by a high share of IIT in their trade with other Member States. This result makes clear that there are large differences in the commercial structure of the FBT industry in the different countries of the UE12. It also indicates that trade pattern in FBT industry depends on the particular endowment structure of every economy. Thus, that means that comparative advantage remains an important determinant of trade pattern in this sector[11]. At the same time, the minor protagonist of intra-industry flows may derive from the own characteristics of this industry: it is an activity of low demand and technological content, with a high degree of standardization of products and little exposure to foreign competition. (Fernández-Núñez and Márquez, 2010). In addition, most of production is for domestic consumption (Liapis, 2011).

Second, following the entry into force of the Single European Act, every Member State of the European Union, increased its intra-industry exchanges more than its inter-industry flows (table 1) [12]. This result also occurred in the EU average (IIT increased from 26,40% of the intra-EU trade in 1985 to 44,95% in 2007). However, the intensity of these changes was more important in the three countries of later incorporation into the EU12 (Greece, Spain and Portugal). The gains of IIT, on the one hand, point out a closer commercial structure among the European countries. But, on the other hand, they also mean

[8] To remedy the problem of sectoral aggregation posed by the Grubel and Lloyd index, firstly, these indices are calculated at the product level. Later, they are grouped according to its respective volume of trade in the total of the FBT industry trade. They are calculated from aggregate flows between any Member State and its fellow EU12. In this way, the results obtained can be overestimated because of geographical aggregation. Nonetheless, this choice of measuring intra-industry trade using aggregate flows has been used in other works (see Díaz, 2002).

[9] This methodology uses relative unit value per ton of exports over imports as proxy for prices, assuming that differences in prices reflect differences in quality of products exchanged. Trade is considered to be horizontal intra-industry when the relative unit value of exports over imports (UVM) is within a range of ±15%. Intra-industry trade is considered to be vertical when the relative unit value of exports over imports is outside this range. When the relative unit value index of a product is over (below) 1.15 (0.85), vertical intra-industry is considered to be high quality (low quality).

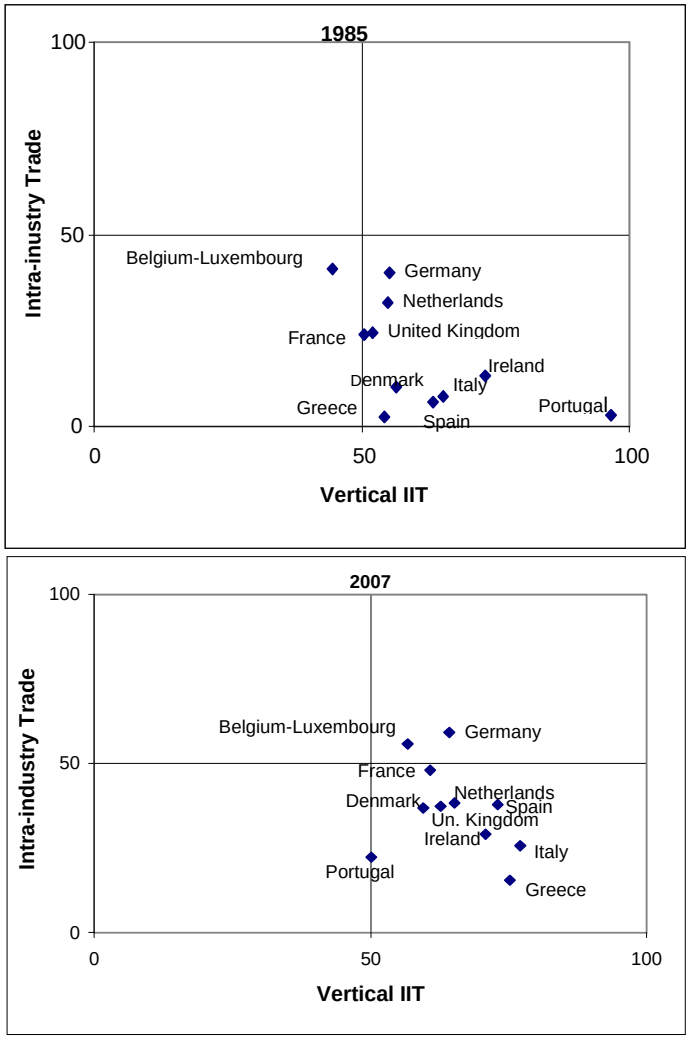
[10] This feature is shown in the vertical dimension of Figure 1. If a country is in the lower quadrants, inter-industry is dominant (IIT < 50 per cent of total trade).

[11] Although the trade pattern of FBT industry still depends on the comparative advantages, not all the EU12 countries have comparative advantages in this industry. In addition, the countries vary their comparative advantage in food products subsectors. For example, only two countries, Netherlands and Italy, have revealed comparative advantage in exports of pasta, or only three economies, France, Italy and Spain, have comparative advantage in exports of wine (as measured by the Balassa's index).

[12]These results were also obtained in previous studies. For example, see Balassa and Bauwens, (1988); Greenaway and Hine (1991); Neven and Röller (1991); European Commission, (1997); Brülhart and Hine (1999) and Díaz (2002), among others authors.

that competitiveness of FBT is more and more related to product differentiation strategies than to the concept of comparative advantages. Nevertheless, since the mid-nineties, after the implementation of European Single Market, the relative share of intra-industry and inter-.industry flows in total trade has remained almost stable in all of the EU12 countries. Only four countries, Greece, Ireland, Germany and Denmark, were characterized by a high increase in their share of IIT with other Member States (table 1).

Figure 1. Trade types in Intra-EU Flows of FBT by Country
1985 and 2007



Note: IIT as percentage of intra-EU trade.
Vertical IIT as percentage of IIT
Source: Author's elaboration on Eurostat Comext Database

Third, VIIT is the more dominant type of IIT within European trade in all Member States (Table 2). This feature is also shown in the horizontal dimension of Figure 1. All countries are in the bottom right quadrants (VIIT > 50 per cent of IIT). So, as we may observe, whether intra-EU trade is mainly inter-industry trade, IIT is more important for vertically differentiated products than for horizontally differentiation[13]. Moreover, since 1985, progress in the IIT has been widely due to the increase in this

[13] Although IIT is mainly of vertical nature in all countries, there are important differences by sectors at the country level. Thus, for example IIT is mainly of a horizontal nature in animal food in Germany, whereas in the case of Spain, is majority of vertically differentiation.

type of trade –VIIT-. These gains have largely relied on trade of high quality products[14]. The average European share of high-quality VIIT has a greater growth than that of low-quality in 1985-2007 period. In spite of this, the results suggest a clear specialization in relative low-quality exports in Spain, Ireland, Denmark and Germany (LQVIIT > 50% of VIIT). The other countries included in EU12 are specialized into relative high-quality exports in intra-EU flows. Consequently, the majority of Member States show the same intra-EU commercial specialization by product quality over the period considered. Only two countries, Greece and Italy, have shifted from a specialization in low-quality varieties in VIIT in intra EU-flows to other in high-quality[15].

Table 1.Dynamics of Intra-industry trade in intra-EU exchanges of FBT by Country 1985- 2007(*)

	1985	1995	2007
Greece	2,31	8,90	15,66
Spain	5,53	36,81	38,03
Portugal	2,69	20,87	22,31
Italy	7,61	23,11	25,97
Ireland	13,39	22,09	29,04
Belgium-Luxembourg	40,88	52,45	56,06
Germany	39,95	46,72	59,14
Denmark	10,12	25,09	36,80
France	23,99	46,37	48,11
Netherlands	31,96	37,45	38,46
United Kingdom	24,34	38,93	37,62
EU12	26,40	39,06	44,95

(*) IIT as percentage of intra-EU trade
Source Author's elaboration on Eurostat Comext Database

Table 2.Composition of FBT trade within the EU by country, (1985-2007)
(Data as percentage of intra-EU trade)

Countries	2007			Variation 1985-2007		
	Inter-industry	Intra-industry		Inter-Industry	Intra-industry	
		Horizontal	Vertical		Horizontal	Vertical
Greece	84,34	3,86	11,8	-13,35	2,80	10,54
Spain	61,97	10,28	27,75	-32,50	8,24	24,26
Portugal	77,69	11,09	11,22	-19,61	11,00	8,62
Italy	74,03	5,97	20,00	-18,36	3,32	15,04
Ireland	70,96	8,49	20,55	-15,65	4,87	10,78
Belg-Lux.	43,94	24,26	31,81	-15,19	1,58	13,61
Germany	40,86	21,12	38,02	-19,18	3,17	16.02
Denmark	63,20	14,86	21.85	-26,68	10,46	16,22
France	51,89	18,91	29,2	-24,12	6,99	17,14
Netherlands	61,54	13,43	25,03	-6,49	-1,02	7,52
Un.Kingdom	62,38	14,00	23,62	-13,28	2,33	10,95
EU12	55,05	36,45	8,50	-18,54	12,06	6,48

Note: The variation measures the percentage increase in trade from the initial to the final year of the period analyzed.
Source: Author's elaboration on Eurostat Comext Database

[14] In this sense, there are also some differences by sectors at country level.

[15] These results are similar to those obtained by Díaz (2001). However, it is noteworthy that Member States like Portugal, Italy or Greece, with lower relative level of income and factor endowment exports seem to be mostly of a higher quality than imports. The opposite behavior is contemplated in a country like Germany, well endowed and with higher relative level of income. These findings are against theoretical predictions. Otherwise, in the rest of European countries the empirical evidence supports VIIT models.

Table 3.VIIT within European countries by ranges of quality in FBT industry (1985-2007)

Countries	% of Intra-EU trade				% of VIIT		Variation 1985-2007	
	1985		2007		HQVIIT			
	HQVIIT	LQVIIT	HQVIIT	LQVIIT	1985	2007	HQVIIT	LQVIIT
Greece	0,26	0,99	6,52	5,28	20,54	55,27	6,26	4,28
Spain	1,62	1,88	11,05	16,70	46,25	39,83	9,44	14,82
Portugal	2,19	0,41	6,46	4,76	84,35	57,59	4,27	4,35
Italy	2,20	2,76	14,22	5,78	44,29	71,09	12,02	3,02
Ireland	4,65	5,12	8,85	11,70	47,69	43,06	4,20	6,58
Belg-Lux.	9,32	8,87	16,04	15,77	51,23	50,42	6,72	6,89
Germany	8,99	13,02	18,45	19,57	20,84	48,54	9,47	6,55
Denmark	2,09	3,64	10,30	11,55	36,45	47,34	8,30	7,92
France	9,14	2,93	22,27	6,93	75,76	76,26	13,13	4,01
Netherlands	13,03	4,48	18,67	6,36	74,42	74,61	5,64	1,88
Un.Kingdom	8,83	3,84	14,74	8,88	69,67	62,39	5,91	5,04
EU12	0,50	1,52	5,62	2,88	24,75	66,11	5,12	1,36

Note: The variation measures the percentage increase in VIIT by ranges of quality from the initial to the final year of the period analyzed.

Source: Author's elaboration on Eurostat Comext Database

4. Dynamic determinants of international trade pattern in the European FBT industry

4.1. Econometric specification

The aim of this section is to explain the observed changes in the intra-EU trade of FBT industry of every EU12 Member State. For this purpose, we start by introducing an empirical model proposed by Fernández-Núñez and Márquez (2010). This model permits not only to analyze the determinants of international trade from different theories (comparative advantage and increasing returns to scale), but also to test the existence of relevant interactions among the different types of trade considered.

The final theoretical specification we use is as follows:

$$\log H_{ijt} = \gamma_{ij}^{n} + \alpha_{1ij}^{n} \log TK_{jt} + \alpha_{2ij}^{n} \log HK_{jt} + \alpha_{3ij}^{n} \log PK_{jt} +$$

$$+ \sum_{k=1}^{n-1} a_{ijk}^{n} \log H_{kj(t-1)} + a_{ijE}^{n} \log E_{jt} + a_{GDPj}^{n} \log GDPpc_{jt} + e_{ijt}^{n} \qquad (1)$$

In this system of log-linear equations, the dependent variable H_{ijt} expresses the proportion of each i component (*InterT, HIIT, HQVIIT y LQVIIT*) in intra-EU trade of FBT relative to a reference trade component or a numeraire trade component (designated as *n* –in this case is *InterT*) in each *j* Member State in the *t* year .TKj, HKj y PKj, denote the levels of technological per worker, physical per worker and human capital in each Member State relative to the EU average. The three all variables are considered as supply side variables. Their coefficients ($\alpha_{1i}^{n}, \alpha_{2i}^{n}$, α_{3i}^{n}) measure the effect of a unit change in the corresponding variable, relative to a unit change in the numeraire category.

The signs and significances of the parameters a_{ikj}^{n} provide empirical evidence for complementary (in case of a positive coefficient) or competitive (in case o a negative coefficient) relationship between the different types of trade. The interpretation of the parameters a_{iij}^{n} is different. They are associated with the degree of persistence of the trade in the *i*-th component.

E_j denotes the intra-EU total exchanges of FBT for each Member States. Its inclusion in this function is derived from statistical properties (Fernández Núñez and Márquez, 2010). According to theories of international trade, total trade may also be contemplated as a proxy of market size (returns to scale). If the

parameter a_{iEj}^{n} is negative (positive), the relative share of the *i*-th trade component falls (rises) as intra-EU total trade grows.

Finally, as demand side variable, $GDPpc_j$ reflects the difference in per capita income between a *j* country and EU-12 average. Traditionally, this variable has been used as an indicator of differences in factor endowments. However, following the Linder hypothesis (1961), it could also be taken as a proxy of differences in consumer tastes and preferences (e.g. Martin and Orts, 2002).

4.2. Explanatory variables and data

In this section, we contemplate the following explanatory variables: factor endowments and market size as supply side variables, and per capita income as demand side. In addition, we take into account the interactions between the different types of trade considered.

4.2.1. Factor endowments

Differences in factor endowments between countries are the main source of comparative advantage. This is the theoretical support in the traditional model of international trade (Model of Herckscher-Ohlin), but also in Vertical IIT models. The empirical model proposed by Fernández-Núñez and Márquez (2010), follows this theoretical foundation too by accounting that countries' relative endowments directly impact on their patterns of trade. According to Hummels and Levinsohn (1995), we employ direct measures of factor endowments, corresponding to the three different types of factor of production: physical per worker, technological per worker and human capital.

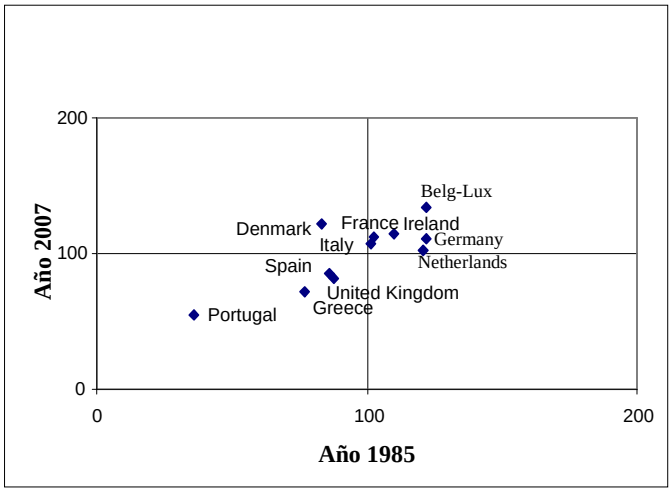
Physical and technological capital stocks are expressed in constant 2000 euros. They are calculated with the perpetual inventory method. Physical capital is measured using real Gross Fixed Capital Formation flows from STAN database (OECD), but also supplemented by information from AMECO database (DG-ECFIM) to complete the series from 1985 to 2007. Technological capital is calculated using Gross Domestic expenditures on R&D from STAN database[16] (see Leamer, 1984; Coe and Helpman, 1995; Díaz, 2002; Fernández-Nuñez and Márquez, 2010). Once made up both series, values were divided by the employment level for the stock of physical capital per worker, or technological. To construct a measure of human capital endowment we used as a proxy the portion of the population 25 to 64 years of age which has completed at least upper secondary education (see, e.g., Díaz, 2002; Jensen and Lüthje, 2009, Fernández-Núñez and Márquez, 2010). To get this series, it is used data from OECD, but also complemented by data from Eurostat. The three variables are built in order to compare the differences between every Member State and the EU12 average.

In figures 2, 3 and 4 indices for each measure of factor endowment and country are displayed. We can observe there are significant differences in factor endowments in European economies. In the last two decades, we also find that cross-country differences have decreased in physical capital and above all in human capital. However, the differences in technological capital have remained very large, indicating the high potential of R&D in sustaining comparative advantage (see table 4). In other words, technological capital stock per worker may be a very important factor driving the intra-European trade pattern in FBT. The structure observed is not very surprising: there are two groups of countries in the EU12. The first

[16] The depreciation rate used was 10% in the case of physical capital and 5% in the case of technological capital.

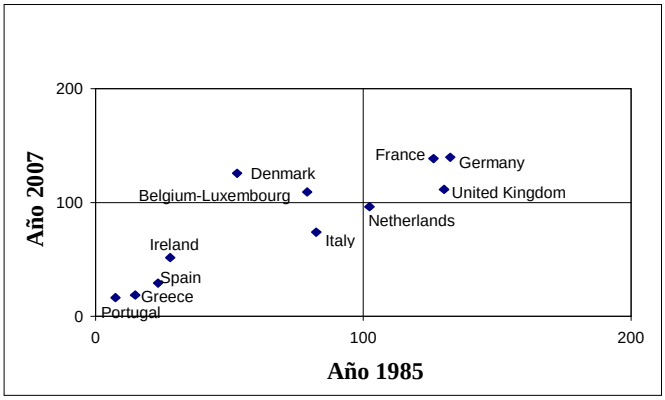
one, formed by economies which are located in the bottom left quadrant, is characterized by its poor endowments. It includes the South European economies –Greece, Italy, Portugal and Spain- and Ireland. Consequently, these economies are in a clear position of disadvantage relative to the EU12 average. The second group is composed of the remaining countries, which are better endowed and are in a position of comparative advantage. According to theories of international trade, these differences across countries lead one to hypothesize that it is most likely a trade pattern dominated by inter-industry exchanges than intra-industry. These theoretical expectations are corroborated in the trade pattern of FBT in the EU12 (see section 3). Besides, one may forecast intra-industry trade to be mainly based on products of different qualities with just small differences in factor endowments. In particular, following VIIT models, it may be expected that countries with higher (lower) income and relative factor endowment experience a greater specialization in relative high (low) quality exports. In short, the expected sign for all three explanatory variables related to the productive factor will be negative on LQVIIT and positive on HQIIT. At the same time, it may be positive on HIIT[17].

Figure 2: Physical Capital per Worker Endowment by Country relative to the EU12 average1985-2007 (EU12 =100, percentage in constant 2000 Euros)



Source: OECD, DG-ECFIN, Eurostat and author's elaboration

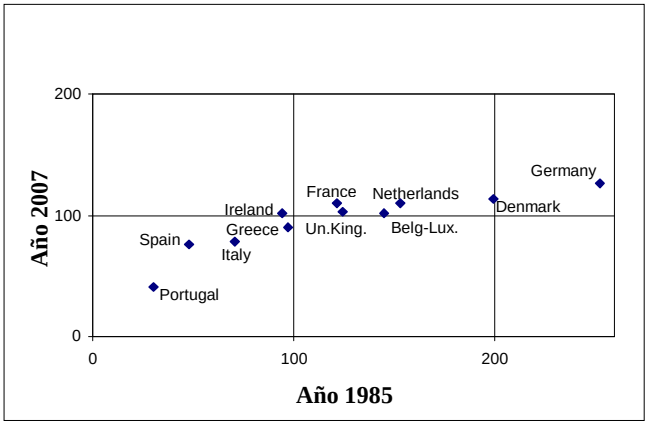
Figure 3. Technological Capital per Worker Endowment by Country relative to the EU12 average, 1985-2007 (EU12 =100, percentage in constant 2000 Euros)



Source: Eurostat and author's elaboration

[17] Following the argument line of Liapis (2011) we assume that the expected sing for HIIT is positive because, as a country improves its factor endowments it will be more likely to attract businesses that combine strategies of horizontal product differentiation and economies of scale (favoring the competitive advantages between companies).

Figure 4: Human Capital Endowment by Country relative to the EU12 average
1985-2007 (EU12= 100)



Source: OECD, Eurostat and author's elaboration

Table 4. Convergence of the endowment structure and the per capita income across all countries
(Coefficients of variation)

	1985	2007
Physical capital stock per worker	0,27	0,24
Technological capital stock per worker	0,68	0,57
Human capital	0,54	0,25
GDP pc	0,33	0,30

Note: Coefficients of variation are standard deviations from the mean divided by respective means
Source: Author's elaboration

4.2.2. Market size

As we mentioned above, the inclusion of total intra-EU trade as explanatory variable is based on theoretical results derived from statistical properties (Fernández-Núñez and Márquez, 2010). However, taking account the work of Helpman (1981) and the Linder's theory of overlapping demands[18], total trade may be considered as a proxy of market size (see Milgram and Moro, 2010). Thereby, this variable may be used to test the effect of a country's economic size (returns to scale) on the intra-industry trade in horizontal differentiated products. In this sense, it is assumed that if total trade increases it will also enhance economic size. Consequently the expected sing for market size may be positive on HIIT and negative on VIIT (HQVIIT or LQVIIT).

4.2.3. Per capita income

Differences in per capita income between each Member State and the EU average are included as demand side variable[19]. In accordance with the Linder hypothesis (1961), this variable could be contemplated as a proxy for differences in consumer tastes and preferences (e.g. Martin and Orts, 2002)[20]. Differences in per capita income will have a direct impact on the demand pattern (Gullstrand 2002): higher (lower) income consumers will demand high (low) quality varieties. Thus, trading partner countries with similar per capita income levels will be also similar in the composition of demand and

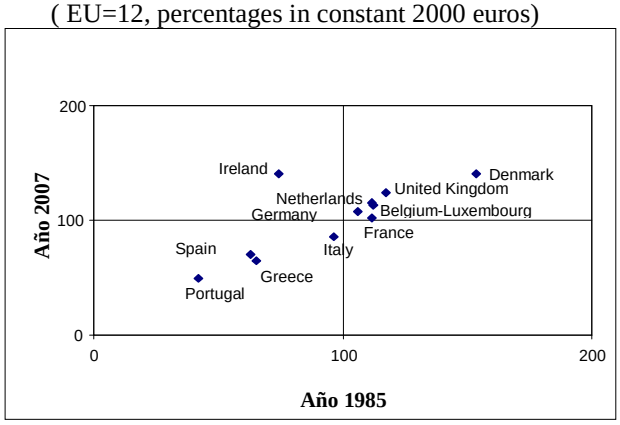
[18] In line with the hypothesis of Linder, external markets can be considered as an expansion of the home markets.

[19] GDP pc data derived from Eurostat. They are expressed in constant prices of the year 2000 euros.

[20] Traditionally GDPpc has commonly been used as a proxy for relative endowment differences (Helpman and Krugman, 1985; Helpman, 1987; and Greenaway et al., 1994).

trade. Differences in per capita income among each Member State and the EU12 average are displayed in figure 5.

Figure 5: Per capita income by Country relative to the EU12 average,1985-2007
(EU=12, percentages in constant 2000 euros)



Source: OECD, Eurostat and author's elaboration

Overall, these results show the wide differences across countries in terms of per capita income. These divergences have not diminished over time (see table 4). Countries characterized with poorer relative factor endowment, also have a level of per capita below the average of the EU12. According to the theoretical foundations, one may expect a positive influence of per capita income on HIIT y HQVIIT and negative on LQVIIT.

4.2.4. Interactions among trade types

Finally, the interactions among different types of trade are considered. The goal is to capture the influence of the development of one kind of trade type on the development of other kind of trade. In order to get it, the lag value of the weight of each trade type in total trade relative to the weight of inter-industry trade in total trade is introduced.[21]. A positive sign for this variable indicates a complementary relationship between the two trade types considered (between a given trade type and another component considered as dependent variable). That is, an increase of the relative share of a given trade type in one year "*t*", would foster the development of the other trade type include as dependent variable. A negative sign implies a competitive relationship.

5. Empirical results

This section presents the estimation results of the econometric specification (1) contained in section 4.1. First of all, the results individually disaggregated by countries are shown. Secondly, we offer the average estimates for all countries in the UE12.

5.1. Indidual analysis (by countries)

The method of estimating the parameters of the systems of equations was the Seemengly Unrelated Regression (SUR) estimation technique (Zellner, 1962). This technique allows to take into account the

[21] In this paper we consider inter-industry trade as numeraire component because it is the majority trade type in intra-EU trade of FBT.

possible correlation between the errors of the different equations for each countries. It also enables you to perform a conjoint significance analysis for each of the model's variables.

Table 5. Intra-EU trade pattern of FBT by country in the EU12, 1985-2007.
Estimation results: SUR estimation techique

Variables		Countries with comparative disadvantages					Countries with comparative advantages					
Dep	Expl.	Gr	Sp	Por	It	Ir	B-L	Ger	Den	Fr	Neth.	UK
HIIT (log $((w_1/w_4)_{(-1)})$)	**E**	-1,034	**-1,005***	0,536	0,897	**-1,258****	0,2911	**1,193***	**2,098****	1,102	0,572	0,515
		(0,97)	(0,53)	(1,77)	(1,25)	(0,62)	(0,35)	(0,64)	(0,66)	(0,73)	(0,59)	(1,63)
	PK	5,310	**-14,454****	-12,54	-0,320	-1,398	0,2069	**2,815****	**8,597***	0,943	-2,34	-2,332
		(8,93)	(4,90)	(7,83)	(9,72)	(1,20)	(2,19)	(1,29)	(4,77)	(1,98)	(5,80)	(5,60)
	TK	**16,035****	**10,040****	5,261	-0,600	**4,510***	-1,599	-6,113	**-4,588****	2,721	1,211	2,741
		(5,96)	(2,16)	(5,99)	(6,35)	(2,36)	(1,44)	(4,13)	(2,13)	(3,34)	(6,88)	(11,19)
	HK	4,360	0,087	-0,744	-0,373	**2,528****	-0,421	**-1,274****	0,844	-1,295	0,467	0,488
		(4,04)	(0,91)	(1,28)	(1,05)	(0,99)	(0,48)	(0,54)	(1,09)	(1,16)	(0,71)	(1,19)
	GDPpc	-9,290	4,373	11,776	7,347	-2,737	2,7025	-14,95	1,291	12,570	-10,67	-2,136
		(10,09)	(7,59)	(7,61)	(5,46)	(1,40)	(3,61)	(8,50)	(2,88)	(8,19)	(3.06)	(5,87)
	HIIT	-0,079	-0,021	0,198	0,183	-0,002	0,2331	-0,054	0,135	0,460	0,236	0,345
		(0,23)	(0,19)	(0,27)	(0,23)	(0,13)	(0,19)	(0,18)	(0,17)	(0,17)	(0,22)	(0,40)
	HQVIIT	0,148	0,130	0,114	0,517	1,042	0,0133	0,194	0,443	-0,286	0,091	-0,173
		(0,279)	(0,21)	(0,36)	(0,37)	(0,29)	(0,14)	(0,19)	(0,20)	(0,26)	(0,22)	(0,21)
	LQVIIT	0,309	0,195	0,480	-0,354	0,484	0,3819	-0,723	0,008	0,023	-0,21	0,515
		(0,45)	(0,23)	(0,0,32)	(0,30)	(0,14)	(0,13)	(0,21)	(0,18)	(0,17)	(0,17)	(1,63)
	R^2	0,43	0,86	0,81	0,67	0,87	0,70	0,81	0,83	0,78	0,53	0,37
HQVIIT (log $((w_2/w_4)_{(-1)})$)	**E**	-0,120	-0,134	0,529	0,216	**-1,962****	-0,602	**1,878****	**1,299****	**1,616****	-0,013	1,766
		(1,04)	(0,44)	(0,67)	(0,78)	(0,47)	(0,61)	(0,70)	(0,48)	(0,58)	(0,57)	(1,36)
	PK	-12,52	-8,168	2,388	5,637	-4,617	-1,518	-2,067	-8,891	-0,203	-3,928	-3,439
		(9,58)	(4,13)	(2,96)	(6,16)	(0,92)	(3,72)	(1,41)	(3,52)	(1,59)	(5,58)	(4,70)
	TK	11,838	3,16	-2,067	-2,044	8,278	4,028	-0,491	3,352	4,414	3,750	8,850
		(6,39)	(1,81)	(0,36)	(4,02)	(1,80)	(2,45)	(4,52)	(1,57)	(2,67)	(6,61)	(9,38)
	HK	-1,265	1,710	-1,266	-0,390	1,295	-0,777	1,280	0,863	0,847	0,133	-1,436
		(4,34)	(0,77)	(0,48)	(0,66)	(0,76)	(0,83)	(0,59)	(0,80)	(0,92)	(0,68)	(1,00)
	GDPpc	7,075	-5,748	-9,865	-4,477	-3,218	5,129	-4,249	-8,381	6,356	0,546	8,676
		(10,83)	(6,39)	(2,88)	(3,46)	(1,06)	(6,15)	(9,30)	(2,12)	(6,55)	(2,95)	(4,92)
	HIIT	-0,300	-0,167	0,172	0,286	-0,094	0,810	0,301	0,134	-0,026	-0,214	-0,134
		(0,25)	(0,16)	(0,10)	(0,15)	(0,10)	(0,32)	(0,20)	(0,12)	(0,14)	(0,21)	(0,22)
	HQVIIT	0,138	-0,168	0,112	-0,158	0,488	-0,147	-0,118	-0,234	-0,165	-0,194	-0,417
		(0,30)	(0,17)	(0,13)	(0,23)	(0,22)	(0,24)	(0,20)	(0,14)	(0,20)	(0,21)	(0,34)
	LQVIIT	-0,050	0,4755	0,573	0,607	0,062	0,032	-0,199	0,217	-0,026	0,203	-0,193
		(0,48)	(0,19)	(0,12)	(0,19)	(0,11)	(0,23)	(0,23)	(0,13)	(0,14)	(0,16)	(0,18)
	R^2	0,75	0,82	0,85	0,95	0,89	0,75	0,86	0,89	0,86	0,45	0,67
LQVIIT (log $((w_3/w_4)_{(-1)})$)	**E**	**-1,162****	**-0,960****	0,622	1,178	-0,170	0,610	**1,196***	-0,965	0,746	1,177	-0,745
		(0,38)	(0,28)	(1,05)	(0,76)	(1,07)	(0,49)	(0,60)	(0,63)	(1,06)	(0,71)	(1,96)
	PK	-8,525	-4,084	5,52	7,740	0,488	0,584	2,878	-10,50	-5,612	12,029	-2,56
		(3,56)	(2,59)	(4,64)	(5,90)	(2,08)	(3,00)	(1,21)	(4,61)	(2,88)	(6,91)	(6,73)
	TK	7,910	6,213	-3,465	-4,087	1,276	-0,342	-3,823	6,668	6,115	-13,648	-2,89
		(2,37)	(1,14)	(3,55)	(3,86)	(4,08)	(1,97)	(3,89)	(2,06)	(4,85)	(8,19)	(13,43)
	HK	-1,269	-0,0267	0,841	0,231	-0,037	-0,042	0,522	1,801	-0,862	-1,806	-2,13
		(1,65)	(0,95)	(0,7)	(0,64)	(1,72)	(0,66)	(0,51)	(1,05)	(1,68)	(0,84)	(1,43)
	GDPpc	5,689	11,00	-4,292	7,674	-0,280	-3,992	-3,976	-2,090	-5,069	0,942	5,36
		(4,02)	(4,02)	(4,51)	(3,31)	(2,41)	(4,95)	(8,01)	(2,78)	(11,87)	(3,65)	(7,04)
	HIIT	0,034	0,312	0,084	0,090	0,362	0,056	0,288	-0,059	0,007	0,329	0,048
		(0,09)	(0,10)	(0,16)	(0,14)	(0,23)	(0,26)	(0,17)	(0,16)	(0,25)	(0,27)	(0,32)
	HQVIIT	0,138	-0,091	-0,532	-0,115	0,308	0,002	-0,070	0,345	-0,271	-0,484	-0,030
		(0,11)	(0,11)	(0,12)	(0,22)	(0,50)	(0,19)	(0,18)	(0,19)	(0,37)	(0,26)	(0,48)
	LQVIIT	-0,050	0,151	0,532	0,251	0,079	-0,355	0,378	0,366	0,059	0,361	0,385
		(0,17)	(0,12)	(0,19)	(0,18)	(0,25)	(0,18)	(0,20)	(0,18)	(0,25)	(0,20)	(0,25)
	R^2	0,68	0,94	0,83	0,88	0,70	0,59	0,89	0,88	0,82	0,48	0,71

NOTE: Estimated standard errors are given in parentheses; significance levels are represented as (*) 10%, (**) 5% y (***) 1%.

Source: Author's elaboration

The results of the estimation are given in Table 5. In general terms, the estimated equations fit well statistically. For each equation, it is possible to find various significant variables[22].

The results reveal a great heterogeneity by country. However, there are some similarities between groups of countries according to its relative factor endowments and its level of per capita income (comparative advantage/disadvantage).

Firstly, on one hand, increases in intra-EU trade of FBT (market size) in countries with comparative advantages have significant and positive influence on intra-industry trade .On the other hand, in countries poorly endowed, influence would be significant and negative on this type of exchanges. These results may imply that while in countries with comparative advantages, an advance in trade is still more related to product differentiation strategies, in countries with disadvantages is more dependent on the concept of comparative advantage.

Secondly, improvements in technological and human capital in economies with lower relative productive factors would foster the presence of enterprises that combine both product differentiation and increasing returns to scales, while advances in physical capital would generate the opposite effect. In countries with a favorable comparative position, improvements in factor endowments would lead to a contrary impact on the HIIT (advances in physical capital would be positive and in human and technological capital would be negative).

Thirdly, on the one hand, the presence of significant interactions of the relative share of HQVIIT with the relative share of LQVIIT is more usual in disadvantaged countries. The positive values of the elasticities indicate a complementary relationship between these two types of trade. This means that an increase of the importance of LQVIIT in a given year in countries like Spain, Portugal or Italy in one year, would be followed by an increase in the following year of the relative proportion of HQVIIT in these economies *ceteris paribu*s. Consequently, it would imply a rise in the quality of the products of these economies against their imported products. These interactions may be derived from the positive role played by Foreign Direct Investments (Capello, 2009). In this sense, Harding and Javorcik (2007) point out the FDI could be associated with more and higher quality trade transactions by the local firms. On the other hand, in advantaged countries persistence in the effects of LQVIIT is observed.

In the rest of the equations of the system, the response offered by each country is different. There is no clear systematic by country according to its factor endowment and per capita income.[23].

Finally, in order to know what the main forces are behind the changes in the trade pattern in every country in the EU12, a conjoint significance analysis of each of the variables of the model was done. The order of statistical significant of the explanatory variables is reported in Table 6. These results again reveal the great heterogeneity by country. There are no differences by economies according to their comparative position. However, from the global review we deduce that the technological capital, the market size and the presence of interactions tend to be the most significant determinants of the main changes in the trade pattern of European FBT.

[22] The elasticities of the different regressor may be interpreted relative to the elasticity corresponding to the numeraire group..

[23] These results are similar to those obtained in previous studies. See, for example, Blanes and Martín (2002), Martín and Orts (2002), Abraham and Van Hove (2007), among others.

Table 6. Order of statistical significance of the explanatory variables in the international trade pattern of European FBT (Wald statistic)

Variables		Disadvantaged countries					Advantaged countries					
		Gr	Sp	Por	It	Ir	B-L	Ger	Den	Fr	Neth	UK
E		2***	2***	8	5	3***	4	2***	1***	1***	3	4
PK		3***	5***	6	6	1***	8	1***	4***	6	6	5
TK		1***	1***	7	7	2***	2**	5	2***	2***	7	7
HK		7	6*	3**	8	6***	6	4**	7	7	5	1**
GDPpc		5	4***	2***	1***	4***	5	7	3***	4**	1***	2*
Interac	HIIT	4	3***	5	3	7***	3	6	8	3***	2*	8
	HQVIIT	6	8	4*	4	5***	7	8	5**	5*	8	6
	LQVIIT	8	7	1***	2***	8***	1***	3***	6	8	4	3

NOTE: Significance levels are represented as (*) 10%, (**) 5% and (***) 1%
242 observations (11 countries and 22 years)
Source: Author's elaboration)

5.2. Analysis of average estimates for all countries in the EU12

In order to obtain the average influences for all countries the model with panel data was estimated. Fixed effects by country and time were incorporated. The results of estimation are displayed in Table 7.

In general terms, on the one hand, it is observed that these average estimates are withholding the different answers for each country. On the other hand, the empirical model is most appropriate to explain vertical intra-industry than horizontal intra-industry: there are five explanatory variables significant at the significance levels of 1% or 5% in HQVIIT or LQVIIT, whereas only there are three in HIIT. These findings point out that in the FBT, factor endowment, differences in per capita income and market size offer more significant effects in VIIT than in HIIT.

Table 7. International trade pattern of FBT
Regression Results: Panel data (EU12, 1985-2007)

Explanatory Variables	Dependent Variables		
	HIIT	HQVIIT	LQVIIT
γ	-0.0007 (3,827)	8.4572 (3.785)	5.8750 (2.483)
Log (E)	-0.0359 (0,876)	-0.5473 (0.221)**	-0.4045 (0.147)***
Log (PK)	1.3968 (0.029)**	-1.3950 (0.863)	-0.4123 (0.463)
Log(TK)	0.2162 (0.531)	0.8274 (0.369)**	0.8506 (0.309)***
Log (HK)	0.3645 (0.280)	0.6198 (0.232)***	0.2855 (0.227)
Log (GDPpc)	0.2801 (0..404)	-1,0368 (0.405)**	-0.4808 (0.329)
HIIT $(\text{Log}\ (w_1/w_4)_{(-1)})$	0.2490 (0.135)*	0.0788 (0.077)	0.1489 (0.0450)***
HQVIIT $(\text{Log}\ (w_2/w_4)_{(-1)})$	0.0919 (0.482)	0.4546 (0.068)***	-0.0905 (0.036)**
LQVIIT $(\text{Log}\ (w_3/w_4)_{(-1)})$	0.1724 (0.040)**	0.0724 (0.083)	0.4454 (0.055)***
R^2	0.91	0,90	0.92

NOTE: Estimated standard errors are given in parentheses; significance levels are represented as (*) 10%, (**) 5% y (***) 1%.
OLS estimation with fixed effects by country and time.
Source: Author's elaboration

Thus, we can see that a relative greater technological and human capital in FBT explain the specialization in high quality products within the EU. The importance of physical capital endowment seems to be linked to the exports of similar quality products. So this type of capital would foster the presence of competitive advantages among enterprises[24] .

We also detected the presence of relevant and meaningful interactions among the different components of trade. These results give support to the hypothesis that interactions between trade types in a country generate externalities on the development of others. Individually, for example, in the case of the LQVIIT equation, the values of the elasticities are significant and also indicative of a complementary relationship from HIIT[25], to this category and a competitive relationship from HQVIIT[26]. There are also significant interactions of the relative share of LQVIIT with the relative share of HQVIIT. The elasticity of 0.1724 suggests a complementary relationship between these two types of trade. Its positive sing implies that an increase of the importance of LQVIIT in on year would promote an improvement of HIIT the following year.

Finally, persistence of the trade is observed in each trade type. This finding indicates that the relative share of each component in a given year, determines the proportion reached the following year. Thus, efforts to improve a type of trade have its persistence over time.

6. Final remarks

In this paper we have explained the observed changes in the intra-EU trade of Food products, Beverages and Tobacco of every EU12 Member State over the 1985-2007 period. For this purpose, we start by introducing the empirical model proposed by Fernández-Núñez and Márquez (2010). This model allows not only to analyze how factor endowments, consumer tastes and market size affect the composition of countries' trade, but also to test if the evolution endogenous of the different components of total trade may impact on the trade pattern.

The inter-industry trade is still the largest component of total trade in EU12. By contrast, since 1985, every Member State of the European Union, has increased its intra-industry exchanges more than its inter-industry flows with a predominance of vertically differentiated products. These changes point out that commercial structure of FBT is more and more related to product differentiation strategies. However, the comparative advantage (based on differences in technological, physical and human capital endowments between countries) remains an important determinant on intra EU trade pattern, even though these advantages may change over time.

According to the findings of our econometric analysis a great heterogeneity and the lack of a clear systematic by country is observed. Despite this, differences in technological capital endowment, market size and the presence of interactions or externalities among the different components of trade are the main dynamic determinants of European trade within FBT industry.

[24] Our results confirm those of Díaz, 2002; Faustino and Leitão, 2007; Milgram and Moro, 2010.

[25] The positive value of the elasticity (0.1489) means that an increase of the relative share of HIIT in one year would be followed by an increase in the following year of the relative share of LQVIIT, ceteris paribus.

[26] The negative value of the elasticity (-0.0905) means that an increase of the relative share of HQIIT in one year would be followed by a decrease in the following year of the relative share of LQVIIT, ceteris paribus.

Likewise, advances in technological and human capital play a key role in the high quality exports of FBT. In this sense, an important policy implication of this paper is that the best approach to encourage FBT and to influence its trade pattern is to invest in technology and human capital and promote the development and implementation of new technologies. However, the extent to which a country can foster its innovation and technology depends not only on skill levels of workforce or R&D capacities, but also on a wide range of government actions. Thus, it would be necessary to develop policies actions that include R&D spending and building infrastructure, besides industrial strategies that promote and favour the emergence of economies of scale and above all that foster the presence of exporters or affiliates of multinationals.

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