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International Trade Patterns over the Last Four Decades: How does Portugal Compare with other Cohesion Countries?*

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Abstract

This paper compares the international trade pattern of Portugal with the other three EU15 Cohesion countries - Spain, Greece and Ireland - over the last forty years. The paper adopts a fact-finding approach, investigating the degree of openness of these economies and making extensive use of the standard Balassa (1965) index to assess the technological content of these countries' manufacturing trade. In order to infer on international trade specialization and on the persistence of trade patterns, the paper provides empirical evidence on the shape of the cross-sector distribution of 120 manufacturing exports and examines the intra-distribution dynamics. The Balassa index is also computed using import data, which allows for an assessment on the similitude of relative import structures and a crude identification of major vertical specialization activities. The paper concludes that there was a significant increase in the degree of openness of all economies, particularly in Ireland. Over the last four decades, Portugal shows a tendency to reduce its overall extent of export specialization, but significant differences with the world average still remain. The same behaviour is found in Greece and, more strongly, in Spain, which is the least specialized country. Conversely, Ireland shows the strongest export specialization and there is evidence of an increase in the last twenty years. The overall degree of specialization is higher on the export than on the import side, as the four countries analyzed show an import structure very close to the world average in the 2000-04 period. In the Portuguese case, we also find evidence that the degree of persistence of export patterns is higher than that of imports, in particular over longer horizons.

Keywords: International Trade, Export Specialization, Import, Balassa Index, Distribution Dynamics.

JEL Codes: C14, F14, O50

*The authors thank Christian Beardah for making his MATLAB toolbox for density estimation publicly available, António Antunes for additional MATLAB code and Jorge Correia da Cunha for his comments. The usual disclaimer applies. Address: Banco de Portugal, Research Department, R. Francisco Ribeiro 2, 1150-165 Lisboa - Portugal. E-mails: jamador@bportugal.pt, scabral@bportugal.pt and jfrmaria@bportugal.pt.

1 Introduction

Over the last four decades, trade openness has increased and international trade patterns have evolved significantly. Several papers have studied changes in specialization patterns.[1] From an individual country's perspective it is interesting to identify the modifications in the trade pattern because they may provide insights on the underlying structural changes in the economy, namely in its structure of production. In addition, the magnitude and the pace of such changes is an indirect indicator of the flexibility of the economy in allocating resources between sectors. Therefore, these elements are relevant to understand the growth performance of the economy. This type of analysis can be enhanced by taking a set of countries as a benchmark, thereby investigating their relative behaviours. In this paper, we are particularly interested in understanding how does Portugal compare with the other initial EU Cohesion Fund beneficiaries, i.e. the relative sectoral specialization of Portuguese exports and imports and its dynamics since 1967, against those of Greece, Spain and Ireland.[2] To our knowledge, no thorough empirical work is available for Portugal, especially comparing with the other Cohesion countries and over such a long period of time.

This paper starts by assessing the degree of trade openness in the four countries considered and particularly in the Portuguese case. It is typically acknowledged that Portugal became a more open economy since the sixties but it is rarely added that this trend was not stronger than in Spain or Greece, namely when the degree of openness is measured at constant prices. Comparing with Ireland, where the degree of openness has increased almost exponentially, it becomes clear that the resemblances are very limited, even in the sixties. Moreover, empirical work on the evolution of international trade patterns typically focus on exports and somewhat disregards the import side. Although relative export structures are sometimes sufficient to reveal comparative advantages, imports hold specific information on patterns of consumption that should not be overlooked. In fact, the availability and the consumption of a higher number of varieties of each good leads to a higher diversification of imports. In addition, global information flows and increased cultural interchange tend to approximate consumption patterns in different countries, leading to similar relative import structures. Furthermore, vertical specialization activities, i.e. the import of intermediate goods to be used in the production of other goods that are latter exported, have become increasingly important, explaining why certain products are imported so intensively (see Hummels et al. (2001)).

[1] See De Benedictis et al. (2006) for a synopsis of the recent empirical literature on specialization dynamics.

[2] The Cohesion Fund, which started in 1994, is a structural instrument that helps European Union (EU) Member States to reduce economic and social disparities and to stabilize their economies. Eligible Member States of the Union are those whose gross national product (GNP) per capita is below 90% of the EU-average. Four Member States, Spain, Greece, Portugal and Ireland, were eligible under the Cohesion Fund until the end of 2003. The European Commission's mid-term review of 2003 deemed Ireland (GNP average of 101%) as ineligible under the Cohesion Fund as of 1 January 2004.

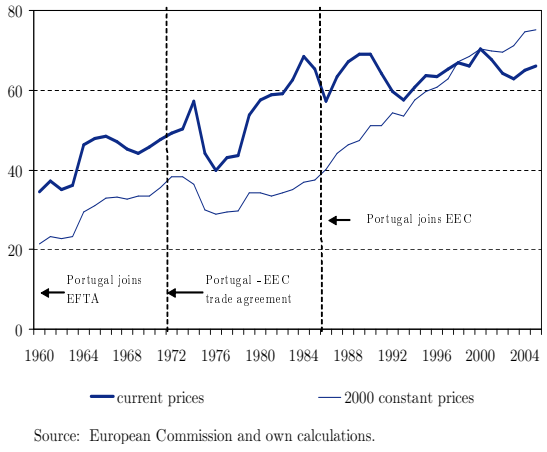
The paper is organized as follows. In the next section we examine the degree of openness in the selected countries since 1960, with special emphasis on the Portuguese case. Section 3 briefly describes the methodology and the database used to analyse the evolution of trade patterns. Section 4 is devoted to the export side. The section starts by examining the export structure of Portugal over the last forty years, using the shares of each sector in total exports. The analysis is then developed using the Balassa (1965) index. This indicator, which aims to capture revealed comparative advantages, has been extensively employed in the empirical trade literature and it remains the most commonly used.[3] A special focus is placed on the behaviour of the indices grouped by technological content (high technology, medium-high technology, medium-low technology and low-technology) and on how country differences are explained by the contributions of the different subsectors. This section ends with a distributional analysis of export specialization across industries. This will involve two different, although closely related, issues: (i) the external shape of the distribution over time (i.e. changes in the overall degree of export specialization, including the analysis as whether there is an increasing specialization in a limited number of industries or whether the degree of specialization tends to remain unchanged and uniformly distributed across industries); and (ii) intra-distribution dynamics (i.e. overall assessment of persistence/mobility of initial patterns of export specialization, focusing on movements of individual industries). In Section 5 we turn to the import side and examine how its structure has changed since the late sixties. The Balassa (1965) index is applied to imports and relative import structures are analysed. The remaining of this section examines the external shape of the sectoral distribution and its intra-distribution dynamics, reproducing the analysis done previously on the export side. Section 6 presents some concluding remarks.

2 The Road to Trade Openness

The degree of openness of the Portuguese economy increased substantially over the last four decades, particularly when measured at constant prices (Figure 1(a)). At 2000 prices, total trade flows increased 55 percentage points between 1960 and 2005, to around 75 per cent of GDP; at current prices, total trade flows reached 65 per cent of GDP in the beginning of the eighties (35 per cent in 1960), remaining around that average figure over the next 20 years. The difference between the two measures reflects developments in nominal variables, including commodities prices, exchange rate regimes and domestic inflation developments, with diverse impacts on the relative path of exports, imports and GDP deflators. For example, the price increases following the

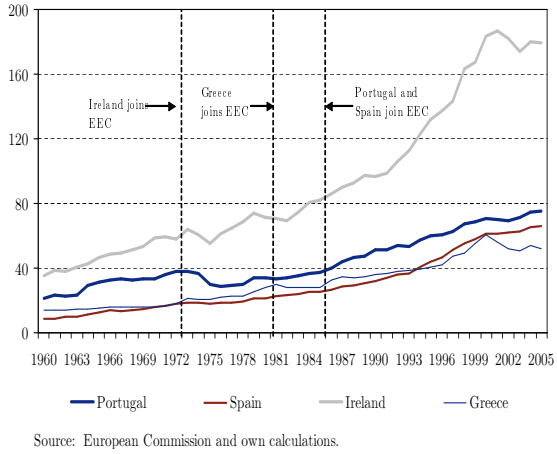
[3] In Amador et al. (2007), we introduced an alternative index - the so-called $B^{\star}$ -, with suitable cardinal properties for a cross-country analysis within one single sector. For the sake of comparability with other studies, this alternative index was not adopted in this paper.

Figure 1: Trade openness ratio
(imports and exports as a percentage of total GDP)



Source: European Commission and own calculations.

(a) Current vs constant prices of 2000



Source: European Commission and own calculations.

(b) Countries comparison (constant prices of 2000)

first (in 1973) and second (in 1979) oil shocks led to a visible increase in the degree of openness in nominal terms, whereas the opposite applies when oil prices dropped sharply in the mid-eighties. The increase in the degree of openness was strongly reversed in 1974-1976, both in nominal and real terms, following the political change that took place in April 1974. On the one hand, the revolutionary period lead to an increase in relative unit labour costs, which reduced real exports. In addition, there was a reduction in real imports resulting from the postponement of investment decisions. On the other hand, the decline in the degree of openness measured at current prices is also attributable to monetary shocks. The sharp increase in inflation that occurred after the Portuguese revolution was not accompanied by nominal exchange rate depreciations, leading to a an increase in the GDP deflator that was higher than that of exports and imports. The current account crisis that followed in 1977 forced changes in the exchange rate policy, initiating a long lived crawling-peg regime. The depreciation rate of the domestic currency continued during the 1978-1979 economic stabilization agreement with the IMF, and was only somewhat softened until the second IMF stabilization agreement of 1983-1984. The second half of the eighties was characterized by decreasing inflation rates and lower nominal currency depreciations. The regime of exchange rate stability directed at achieving nominal convergence, in place throughout the nineties, translated into GDP deflators higher than those of exports and imports. To a large extent, this was due to higher resilience of inflation in the non-tradables sector. Thereafter, until present, the Portuguese openness ratio measured at current prices grew less than at constant prices.

The increase in the openness ratio is visible in most economies and is attributable

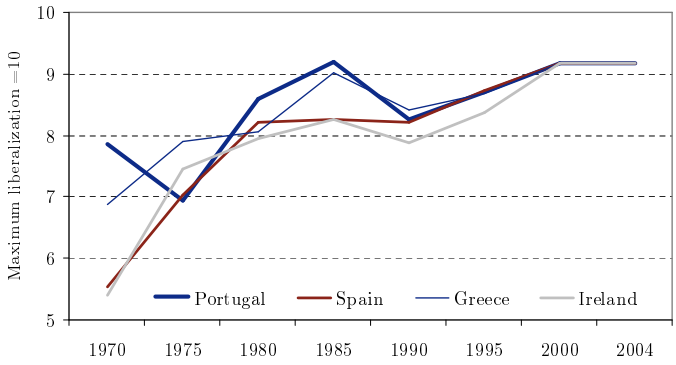
to several factors, including progressive trade liberalization, lower transport costs in some relevant exported goods, shorter distances, a greater variety of goods and services demanded by consumers and an increasing role of vertical specialization activities. At constant prices, Portugal presents a degree of openness that is slightly higher than that of Spain and Greece (Figure 1(b)), though these countries evolved along similar trends until recent years. Although acknowledging that many factors contributed to this path, the EEC accession in 1986 seems to mark an intensification of trade openness in Portugal and Spain. The case of Ireland is clearly different. Not only its starting point was higher than in the other countries, but it also recorded a sharper increase in openness, particularly after the beginning of the eighties, coinciding with the fast increase in its GDP per capita as a percentage of the EU average.

A very significant step towards trade liberalization was the accession of Portugal to the European Free Trade Association (EFTA) in 1960. This accession led to a substantial increase in international trade and a surge of export-oriented industries in sectors were Portugal held comparative advantage. Matching what the standard Heckscher-Ohlin model would suggest, given the relatively labour-abundant nature of the economy, the new exporting industries were labour intensive - mainly textiles, clothing and footwear. The enlargement of the European Economic Community (EEC) to the United Kingdom, Denmark and Ireland in 1972, reduced the relevance of EFTA as a trade agreement. As a result, Portugal settled a free trade agreement with the EEC.[4] In March 1977, the full accession to the EEC was required. The negotiating process was long and Portugal only officially entered the EEC on 1 January 1986, simultaneously with Spain. The accession to the EEC represented a second wave of liberalization in the Portuguese international trade, further increasing openness. The transition period set for the dismantlement of intra-EEC trade barriers and the adoption of the common trade policy ended by 1992. In 1993 Portugal joined the European single market and in 1999 was among the initial group of countries that adopted the euro.

As expected, the comparison against the other Cohesion countries reveals some similarities and, simultaneously, some clear differences. The liberalization process in Spain started latter than in Portugal. In the sixties, the country maintained trade quotas and relied on bilateral agreements. After 1975, when transition to democracy materialized, the ongoing process towards higher trade liberalization was conditioned by the

[4]The EFTA agreement was based on industrial goods and included United Kingdom, Portugal, Norway, Denmark, Austria, Switzerland and Sweden. The conditions negotiated by Portugal were quite favourable both in terms of the length of the transition period and in terms of the products included in the agreement. In particular, manufactured agricultural products, which Portugal could immediately export, such as wine and preserved fruit and vegetables, were included in the agreement from its start. More information on the motivation and the details of the Portuguese accession to EFTA can be found in Sousa (1995), Lopes (1999) and Alipio (2006). The non-democratic nature of the Portuguese regime, which lasted until April 1974, together with the differendum maintained with the international community regarding the African colonies made it impossible, even if desired, the accession to the EEC.

Figure 2: Index of economic freedom
(Trade liberalization)



Source: Economic Freedom of the World 2006 Annual Report

macroeconomic effects of the first oil shock. Trade liberalization only gained momentum during the eighties and EEC accession occurred in 1986. As for Ireland, the trade pattern has been shaped by the strong ties with the UK and the US economies that are also associated with large FDI inflows since the late fifties (see Barry and Bradley (1997)). These investments translated into strong vertical specialization activities, which can also explain the strong increase in trade flows. Finally, Greece experienced a democratization process roughly in the same period as Portugal and Spain. Despite the initial lack of public opinion support, it acceded the EEC in 1981 and subsequently increased trade liberalization (see Dimitras (1992)). Overall, the four Cohesion countries liberalized trade in the last four decades, naturally converging to the EU standards and to an identical trade liberalization index, measured by the index of economic freedom (Figure 2).[5]

The real costs of trade are important determinants of a country's ability to participate fully in the world economy. Trade costs, broadly defined, include all costs incurred in getting a good to a final user other than the marginal cost of producing the good itself, namely transportation costs (both freight costs and time costs), policy barriers (tariffs and nontariff barriers) and other costs of doing business internationally.[6] In some cases, the effective rate of protection provided by transport costs is comparable in size to, or even larger than, the one of tariffs.[7] Nevertheless, the accurate measurement of transport costs faces many difficulties and its evolution over time and across countries

[5]This composite index is published by the Heritage Foundation/Wall Street Journal (www.heritage.org/index) and it considers information on taxes on international trade (revenue, mean and standard deviation of tariffs); regulatory trade barriers (non-tariff barriers and compliance costs); actual size of trade sector compared with expected size; difference between official exchange rate and black market rate and international capital market controls (ownership controls and freedom to engage in capital market exchanges with foreigners)

[6]See Anderson and van Wincoop (2004) for a survey of trade costs.

[7]See, for instance, Hummels et al. (2007), who uses data for the US and Latin America.

is hard to assess and conditional on the type of transport.[8] Freight rates show wide dispersion over commodities and across countries (see Hummels (1999*b*)) and there is little systematic evidence documenting the decline of transport costs over the last decades. Hummels (1999*a*) found that ocean freight rates have increased while air freight rates have declined, that the cost of overland transport has declined relative to ocean transport and that freight costs associated with increased distance have declined. The ability to place certain products abroad is also conditional on distance, which is an important competitive factor and hence also a trade barrier. Distance affects both the volume of trade and the ability of firms to enter export markets, especially for products where time of delivery is sensitive (see Nordas et al. (2006) and Hummels (2001)). Time distances between regionally integrated economies, such as those of the EU, have decreased in the last decades due to technological progress, lighter customs procedures and better transport infrastructures. In fact, infrastructures are likely to have a considerable effect on the time costs of trade. Limão and Venables (2001) study the determinants of transport costs and conclude that the levels of infrastructure are a significant and quantitatively important determinant of transport costs and of bilateral trade flows. In Portugal, the road and telecommunications infrastructures improved substantially after mid-eighties, facilitating the expansion of trade with the rest of the European continent.

Behind the increase in world trade volumes is also the development of intra-industry trade, which concerns the trade of different varieties/qualities of the same good between countries as a result of agents' preferences for diversified consumption bundles and the existence of economies of scale (see Krugman (1979, 1980)). Nevertheless, this type of trade is difficult to quantify accurately. In particular, if a broad industry classification is used, different products are included in the same category and some trade is wrongly taken as intra-industry. According to Fontagné and Freudenberg (2002), who use bilateral trade information at a very detailed product level within the EU-12, the Portuguese share of intra-industry trade increased from 10 per cent in 1980 to about 40 per cent in 1999. A similar increase in percentage points is identified for the case of Spain, though starting from a level of 30 per cent in 1980. As for Ireland and Greece, the evidence points towards a relative stabilization of the share of intra-industry trade from 1980 to 1999. Nevertheless, in Greece this type of trade represented about 15 per cent of total intra EU-12 trade in 1999, while in Ireland it stood close to 40 per cent.

[8] Time-distances and transport costs matrices are scarce and international comparisons difficult to implement. Most trade models rely on versions of the the so-called "iceberg-cost assumption", *i.e.* transport costs increase with the value of the traded goods and the distance between countries (see McCann (2005)). Alternatively, there are three main sources of data for transport costs (see Anderson and van Wincoop (2004)). The most direct is industry or shipping firm information. National customs data in some cases provide detailed information on average transport costs. The most widely available are the aggregate bilateral c.i.f./f.o.b ratios produced by the IMF from UN international trade data, but this approach has been criticized in the literature (see Hummels and Lugovskyy (2006)).

Finally, world trade has also increased substantially due to the growing importance of vertical specialization activities.[9] These activities consist on the import of intermediate goods to transform domestically and subsequently export. This type of trade has always existed and it is difficult to measure its direct and indirect contribution to total trade flows. In fact, trade associated with vertical specialization tends to be considered as intra-industry trade if the analysis is carried out at a low product disaggregation level and as inter-industry trade at a higher breakdown level. Nevertheless, there is some indirect evidence at a low disaggregation level, which points to increasingly important vertical specialization activities in the high-tech sector, mostly in Asia (see Amador et al. (2007)). Among these four EU-15 Cohesion countries, Ireland stands out as the country where such activities appear as more relevant.

3 Data and methodology

The empirical analysis included in this paper is based on the CEPII - CHELEM database, which reports bilateral trade flows for goods in value terms (the unit being the US dollar). The sample period starts in 1967 and ends in 2004, with a product breakdown at the four digits level of the ISIC classification (rev.3), which includes 120 manufacturing products. These 120 manufactured goods are grouped in accordance with their technological intensity, following the OECD classification of R&D intensities. This widely used technological classification includes four main sectors: high-technology (HT), medium-high-technology (MHT), medium-low-technology (MLT) and low-technology (LT); and a second breakdown level contains twenty sub-sectors.[10] This is a generally accepted and methodologically reliable standard classification that can bring important insights on the evolution of trade patterns over the last forty years, but one needs to bear in mind the caveat that it relies on a relatively broad sectoral breakdown, which can include activities with different levels of technological complexity under the same category.[11] All intra-category relative changes, like the upgrading of quality and technology within existing activities, are not captured with this classification. Additionally, the industry-based technical characteristics of products used in international comparisons may not reflect the technologies used in their manufacture in a specific location.[12] Moreover, like all industry-based classifications,

[9] See Hummels et al. (2001) and Yi (2003).

[10] Appendix A reports all sub-sectors at the second breakdown level with the respective ISIC code.

[11] Not all the products included in a high-technology sector necessarily have a high technological content and some products in sectors classified as low-technology may incorporate a high degree of technological sophistication (see Gaulier et al. (2005)). See Fontagné et al. (1999) for a different methodology on the definition of technological products. Peneder (2003), which analyses the major classifications used in applied economic studies, concludes that, for the purpose of international comparisons, the OECD technological classification used here "might be considered the best choice".

[12] In particular, the sharp increase of vertical integration processes can disturb the analysis, as the normal assumption that products use the same technologies across countries no longer holds when the different stages of production can be separated and located in different countries. See Lall (2000) and Lall et al. (2005) for a discussion of the problems associated with the different product classifications, focusing on those dealing with technology intensities.

the existence of firm heterogeneity within each sector is not taken into account here.

The empirical trade literature suggests several methods to evaluate the trade specialization of a given country, most of them aiming at identifying the comparative advantages revealed ex-post by international trade. The methods solely based on trade flows can be divided in two broad groups. The first group only uses export data and the second uses both export and import data. The most widely used indicator in the first group is the Balassa index, as suggested in Balassa (1965), while the most popular in the second is the Lafay index, as suggested in Lafay (1992). The analysis carried out in this paper fits in the first group and is mainly based on the Balassa index.[13]

The Balassa index can be defined as follows. Assume that the world economy comprises N countries and m products. Country i exports of product j are x_{ij} and total exports of country i are given by $X_i = \sum_{j=1}^{m} x_{ij}$. World exports of product j amount to $x_{Wj} = \sum_{i=1}^{N} x_{ij}$, while total world exports can be either seen as the sum of all products or the sum of all countries, i.e. $X_W = \sum_{j=1}^{m} x_{Wj} = \sum_{i=1}^{N} X_i$.[14] To evaluate the revealed comparative advantage of country i in sector j, Balassa (1965) suggested the following index:

$$B_{ij} = \frac{\frac{x_{ij}}{x_{Wj}}}{\frac{X_i}{X_W}} \qquad \text{country } i = 1, 2 \dots N; \text{ product } j = 1, 2 \dots m \tag{1}$$

If the market share of country i in product j is higher than its total market share, i.e. if $(\frac{x_{ij}}{x_{Wj}}) > (\frac{X_i}{X_W})$, then the country is classified as having a *revealed* comparative advantage in sector j.

Equivalently, the Balassa index can also be written using relative export structures

$$B_{ij} = \frac{\frac{x_{ij}}{X_i}}{\frac{x_{Wj}}{X_W}} \qquad \text{country } i = 1, 2 \dots N; \text{ product } j = 1, 2 \dots m \tag{2}$$

According to (2), if the share of product j in total exports of country i is higher than the equivalent share of product j in world exports, i.e. $(\frac{x_{ij}}{X_i}) > (\frac{x_{Wj}}{X_W})$, then $B_{ij} > 1$ and

[13] The Lafay index, defined as the contribution of a product to the overall trade balance, is a country-based indicator of specialization that does not show the relative position vis-à-vis other countries. Therefore it is not the most appropriate indicator for the kind of analysis proposed here. Even if net exports are the theory-based measure of revealed comparative advantages, the Balassa index allows for comparisons between different countries with regard to a common benchmark, contrarily to the Lafay index. Nevertheless, we replicated most of the analysis using the Lafay index and, in the Portuguese case, the main results remain broadly unchanged. However, such outcome should not be seen as a general result for all countries. The most suited metrics and related theoretical motivations are a rather extensive subject in trade literature. For a discussion see Bowen (1983), Yeats (1985), Ballance et al. (1987), Vollrath (1991) and Iapadre (2001).

[14] Note that the "world" included in this definition can be interpreted as any well defined reference area and the number of products as any relevant basket. Balassa (1965) did not use the world as a whole, but an aggregate comprising 6 areas (European Common Market, USA, Canada, UK, Sweden and Japan). Primary products were also excluded from his analysis to ensure that trade patterns did reflect comparative advantages and not the impact of subsidies, quotas and other special arrangements.

country i is classified as having a *revealed* comparative advantage in sector j. Note also that, for each sector j, the denominator $\frac{x_{Wj}}{X_W}$ can be decomposed as a weighted average of all $\frac{x_{ij}}{X_i}$, where the weights are country-dependent and given by $\frac{X_i}{X_W}$. Henceforth, the denominator will be simply designated as "world average".

At any point in time, the cross-country differences of export specialization can be further examined by decomposing the differential of the Balassa indices in each broad technological category in the following way:

$$(B_{PT,J} - B_{i,J}) = \sum_j \alpha_j (B_{PT,j} - B_{i,j}) \quad \text{where} \quad \alpha_j = \frac{X_{Wj}}{X_{WJ}} \text{ and } \sum_j \alpha_j = 1 \qquad (3)$$

where PT stands for Portugal and i for the other countries; J represents the main aggregate (LT, MLT, MHT and HT sectors) and j all second-level sub-sectors of each aggregate J; α_j is a set of weights that are not country-dependent.[15] If, for instance, the Balassa index in the main aggregate J is higher in Portugal than in country i, then $(B_{PT,J} - B_{i,J}) > 0$ and this difference can be split into the contributions of all sub-sectors. In this example, there must exist at least one sub-sector j that verifies the condition $(B_{PT,j} - B_{i,j}) > 0$, which is simply implying a higher export share of that product in total Portuguese exports than in the other country. Thus, each term $\alpha_i(B_{PT,j} - B_{i,j})$ can be seen as the contribution of sub-sector j to the differential registered in the aggregate J.

The use of the Balassa index, which follows an asymmetric distribution with a fixed lower bound of 0, a variable upper bound and a variable mean, either across countries or across time, has been subject to several critiques, leading some authors to propose several modified versions. However, the popularity of the original suggestion remains in place and the traditional Balassa index has been used extensively in the literature.[16] Notwithstanding, the transformation suggested by Laursen (1998) is very useful to analyse the entire distribution of the specialization indicator, given the typical high asymmetry of the traditional B_{ij} index. Laursen (1998) labeled this new index as "Revealed Symmetric Comparative Advantage", which is defined as:

$$BS_{ij} = \frac{B_{ij} - 1}{B_{ij} + 1} \qquad (4)$$

[15] The weights are, nevertheless, changing in time.

[16] Modified versions of the original Balassa index may be found, for instance, in Proudman and Redding (1997, 2000) and in Amador et al. (2007). A list of references where the original version was used is included in Hinloopen and Marrewick (2001). See Widgrén (2005) for an application to Asian, American and European countries; and Shafaeddin (2004) and Hinloopen and Marrewick (2004) to China. US revealed comparative advantages by trading partner are mapped in Richardson and Zhang (1999). A recent application in another context can be found in Hidalgo et al. (2007). De Benedictis and Tamberi (2002), who discuss in detail the characteristics of the B_{ij} and the suggestion of Proudman and Redding (1997, 2000), still seem to prefer the original mean-variant formulation of the index. Vollrath (1991), who surveys alternative measures of revealed comparative advantage states that, among the measures using only export data, the traditional Balassa index is one of "the most satisfying".

Note that BS_{ij} ranges from -1 to 1 and has a threshold value in 0, leaving the rank-order and the specialization status of the sectors within each country unchanged.[17] The levels of the BS_{ij} have no longer an intuitive reading, with the exception of $BS_{ij} = 0$, which implies that $B_{ij} = 1$.

All indices can be replicated for the import side and they will be the basis of the analysis carried out in section 5. The Balassa (1965) index for imports will be designated by B_{ij}^{M} and when it assumes a value higher than one it means that country i is classified as being a relatively stronger importer in sector j.

4 Portuguese export specialization over four decades

4.1 Export structures and Balassa indices

This section examines the export structure of the Portuguese economy, *i.e.* the numerator of equation (2). The Portuguese export pattern underwent important changes over the last four decades. At the first product breakdown level, the most striking feature is the continuous decline over time of the LT sector share in total manufacturing exports (Figure 3(a)). On the contrary, the more marked increase took place in the MHT sector. Comparing the beginning and the end of the sample period at the second product breakdown level, there was a decline of the export share of all LT sub-sectors and, to a much lesser extent, of all chemical products (including pharmaceuticals), and an increase of the share in total exports of all other sub-sectors (Table 1).

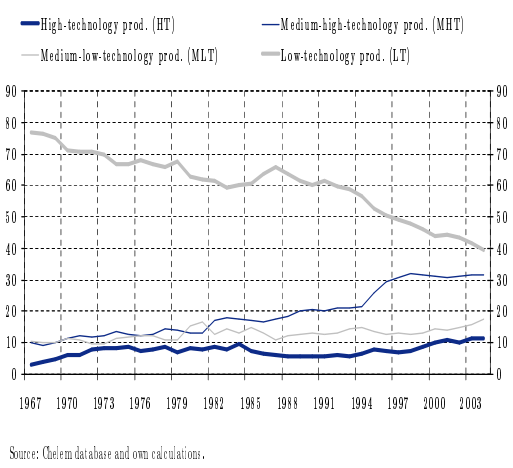
LT exports, which represented more than 75 per cent of Portuguese manufacturing exports in 1967-69, declined to around 40 per cent in the 2000-04 period. This decline was extensive to all sub-sectors, but was particularly sharp in "Food products, beverages and tobacco" and "Textiles, textile products, leather and footwear" (Figure 3(b)). The reduction of export share of the former was rather continuous until the beginning of the nineties, stabilizing at around 6.5 per cent of total Portuguese exports (from more than 20 per cent in 1967-69). In the latter, the loss of importance was only visible after 1993, since its export share has even increased until that year. Thereafter the decline of the share of textiles and footwear exports was rather marked, which may reflect, at least partly, the increased competition from some developing countries.[18] In spite of the strong decrease of the LT sector share, it is still the most important technological category in Portuguese manufacturing exports at present.

On the contrary, a very strong increase of the MHT exports has occurred: its share

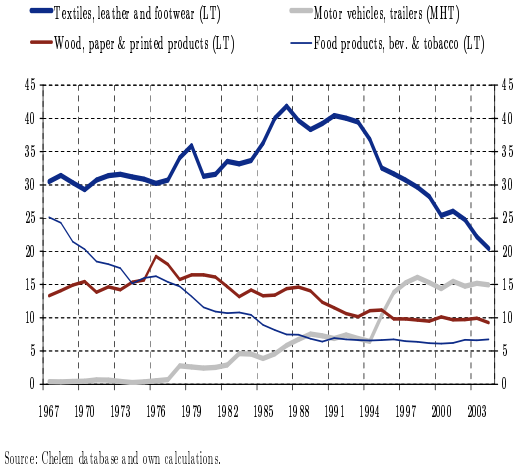
[17] See Laursen (1998) for a detailed discussion of this transformation, Dalum et al. (1998) for an application of this indicator to twenty OECD countries and Vollrath (1991) for an alternative log-transformation.

[18] For instance, Cabral and Esteves (2006), using a sample of 96 individual (product and geographical) markets representing 70 per cent of Portuguese manufacturing exports, found that in the markets where Portugal's export share losses were the most significant, namely in textiles, clothing and footwear products, the biggest share gains were mostly achieved by developing Asian economies and by Central and Eastern Europe countries.

Figure 3: Portuguese manufacturing exports by technological intensity
(Shares in total)



(a) Main four technological categories



(b) Main four sectors in Portuguese exports

in total Portuguese manufacturing exports rose from 10 per cent in 1967-69 to more than 30 per cent in 2000-2004. In particular, there was a strong increase of the export share of "Motor vehicles, trailers and semi-trailers", particularly in the second half of the nineties. This evolution was largely influenced by increases in the export capacity resulting from the entry into operation of industrial production units associated with foreign direct investment projects. Although marginally, the only sub-sector of MHT that has lost some ground over the last four decades was the "Chemicals excl. pharmaceuticals" sub-sector, specially due to its evolution since the second half of the eighties. In 2000-04, the aggregated MHT sector stands out as the second most important export sector in Portugal.

The share of MLT and HT sectors in total Portuguese exports also increased over the last four decades, but to a much lesser extent than the MHT sector. In HT products, all sectors increased their export share, with the exception of "Pharmaceuticals". The highest increase took place in "Radio, TV and communications equipment" (from 1.9 per cent in 1967-69 to 6.1 per cent in 2000-04). In MLT exports, the evolution was more similar across sub-sectors, with the main increase being in "Rubber and plastics products" (from 1.2 per cent in 1967-69 to 3.3 per cent in 2000-04).

Although the Portuguese export structure underwent major changes over the last decades, such developments must be placed in perspective against the world, which has also changed dramatically over the same period. In particular, the technological content of world manufacturing trade rose markedly over the last forty years. The share of high-tech goods increased by around 15 percentage points, accounting for more

Table 1 - Structure of Portuguese manufacturing exports by technological intensity

As a percentage of total exports

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
High-technology products	**4.0**	**7.7**	**7.9**	**8.5**	**6.1**	**6.0**	**7.7**	**10.8**
Aircraft and spacecraft	0.2	0.1	0.2	0.5	0.2	0.3	0.4	0.7
Pharmaceuticals	1.5	1.3	1.0	0.9	0.7	0.5	0.8	1.2
Office, accounting and computing machinery	0.3	1.2	1.2	1.6	0.8	0.5	0.4	1.8
Radio, TV and communications equipment	1.9	4.3	4.5	4.6	3.6	3.9	5.2	6.1
Medical, precision and optical instruments	0.2	0.7	1.1	0.9	0.6	0.8	1.1	1.0
Medium-high-technology products	**9.7**	**12.5**	**13.5**	**16.0**	**18.2**	**20.9**	**30.0**	**31.2**
Other electrical machinery and apparatus	1.5	2.3	2.3	1.7	2.9	5.2	7.0	5.7
Motor vehicles, trailers and semi-trailers	0.4	0.5	1.6	3.5	6.1	7.0	14.2	15.0
Chemicals excl. pharmaceuticals	5.3	6.3	5.1	6.6	5.3	4.2	3.8	4.5
Railroad equipment and other transport equip.	0.3	0.6	0.3	0.3	0.2	0.3	0.4	0.4
Other machinery and equipment	2.2	2.9	4.2	3.9	3.8	4.3	4.5	5.8
Medium-low-technology products	**10.2**	**10.7**	**11.5**	**14.4**	**12.7**	**13.7**	**13.1**	**15.6**
Coke, refined petroleum prod. and nuclear fuel	1.3	2.2	1.5	5.3	2.9	3.2	2.1	2.1
Rubber and plastics products	1.2	1.0	0.6	0.7	1.2	1.6	2.2	3.3
Other non-metallic mineral products	3.0	2.7	2.7	3.0	3.7	4.7	4.1	3.8
Building and repairing of ships and boats	0.1	0.8	1.4	0.7	0.9	0.5	0.3	0.2
Basic metals	2.1	1.4	2.8	2.2	1.8	1.3	1.5	2.9
Fabricated metal products, excl. machinery	2.5	2.5	2.6	2.5	2.2	2.4	2.8	3.3
Low-technology products	**76.0**	**69.2**	**67.0**	**61.1**	**63.1**	**59.3**	**49.2**	**42.4**
Other manufacturing and recycling	7.6	6.1	2.4	2.6	2.1	2.4	2.2	2.7
Wood, pulp, paper and printed products	14.2	14.7	16.9	14.9	14.1	11.1	10.0	9.7
Food products, beverages and tobacco	23.5	17.3	14.9	10.9	7.6	6.7	6.5	6.5
Textiles, textile products, leather and footwear	30.7	31.0	32.9	32.7	39.4	39.2	30.5	23.4

Source: Chelem database and own calculations.

than 25 per cent of total exports in the 2000-2004 period, while the share of low and medium-low-tech decreased by around 9 and 7 percentage points, respectively.

In general, the Portuguese manufacturing export structure converged towards the world weighted average, i.e. the denominator of (2). This can be illustrated by the evolution of the sectoral Balassa indices included in Table 2. Portuguese export shares above the world average showed a general downward movement; export shares below the world average tended to increase. The most striking exception is the HT sector: the Balassa index for this broad sector was 0.4 both in 1967-69 and 2000-04, pointing to the maintenance of a strong comparative disadvantage of the Portuguese economy in these products. In particular, the Portuguese "Pharmaceuticals" sub-sector moved in the opposite direction of that recorded in the world, particularly after the period 1970-74. The same has happened in the MHT sub-sector of "Chemicals excl. pharmaceuticals", but to a much lesser extent.

All Balassa indices higher than 1 are highlighted in Table 2. Conditional on this definition of comparative advantage, Portugal reveals a sustained and clear comparative advantage in the broad LT sector since 1967. The sub-sectors of "Textiles, textile

Table 2 - Relative export specialization of the Portuguese economy, Balassa index

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
High-technology products	**0.4**	**0.7**	**0.7**	**0.6**	**0.4**	**0.3**	**0.3**	**0.4**
Aircraft and spacecraft	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.3
Pharmaceuticals	0.9	0.9	0.7	0.7	0.5	0.3	0.3	0.4
Office, accounting and computing machinery	0.2	0.7	0.6	0.6	0.2	0.1	0.1	0.3
Radio, TV and communications equipment	0.6	1.2	1.1	1.0	0.6	0.6	0.6	0.6
Medical, precision and optical instruments	0.1	0.3	0.4	0.3	0.2	0.2	0.3	0.3
Medium-high-technology products	**0.3**	**0.4**	**0.4**	**0.4**	**0.5**	**0.6**	**0.8**	**0.9**
Other electrical machinery and apparatus	0.5	0.8	0.7	0.5	0.8	1.3	1.5	1.2
Motor vehicles, trailers and semi-trailers	0.0	0.0	0.1	0.3	0.5	0.6	1.2	1.3
Chemicals excl. pharmaceuticals	0.6	0.7	0.6	0.7	0.6	0.5	0.4	0.5
Railroad equipment and other transport equip.	0.5	0.7	0.4	0.4	0.3	0.4	0.8	0.7
Other machinery and equipment	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.6
Medium-low-technology products	**0.4**	**0.4**	**0.5**	**0.6**	**0.6**	**0.7**	**0.8**	**0.9**
Coke, refined petroleum prod. and nuclear fuel	0.3	0.5	0.3	0.7	0.6	0.9	0.7	0.6
Rubber and plastics products	0.7	0.6	0.3	0.3	0.5	0.6	0.8	1.1
Other non-metallic mineral products	1.8	1.6	1.5	1.7	2.2	2.7	2.6	2.6
Building and repairing of ships and boats	0.1	0.4	0.7	0.5	0.8	0.5	0.4	0.3
Basic metals	0.2	0.1	0.3	0.2	0.2	0.2	0.2	0.5
Fabricated metal products, excl. machinery	0.9	0.9	0.8	0.9	0.8	0.9	1.0	1.3
Low-technology products	**2.5**	**2.4**	**2.6**	**2.5**	**2.5**	**2.4**	**2.1**	**2.0**
Other manufacturing and recycling	2.2	1.8	0.8	0.9	0.6	0.7	0.7	0.9
Wood, pulp, paper and printed products	2.2	2.5	3.3	3.1	2.8	2.2	2.1	2.3
Food products, beverages and tobacco	2.1	1.6	1.6	1.2	1.0	0.9	0.9	1.1
Textiles, textile products, leather and footwear	3.3	3.5	3.9	4.0	4.4	4.3	3.7	3.1

Source: Chelem database and own calculations.

products, leather and footwear" and "Wood, pulp, paper & printed products" have rather high Balassa indices during the entire period. In the latter there is even a slight increase of the index from the first to the last period of the sample. The MLT sub-sector of "Other non-metallic mineral products" shows also high specialization coefficients over the whole period, with an upward trend since the eighties that leads to an increase of the difference with the world average from the beginning to the end of the sample. Other sub-sectors have $B_{ij} > 1$ but only over the last decade: "Fabricated metal products, excl. machinery", "Rubber and plastics products", "Other electrical machinery and apparatus" and "Motor vehicles, trailers and semi-trailers". Finally, there was a temporary revealed comparative advantage in "Radio, TV and communications equipment" in the seventies. All other sub-sectors have indices lower than 1.

In the most recent period and despite the changes that occurred over the past decades, the export structure of Portugal still differs substantially from the world. The proportion of the LT sector is still twice the world average, specially concentrated in "Textiles, textile products, leather and footwear" and in "Wood, pulp, paper & printed

products", which include cork products, where Portugal has a particularly high export market share.[19] In the MHT and MLT categories, the Balassa index remains below 1 in the broad sector but the difference with the world average is not very significant and has been decreasing over the last two decades. In the most recent period, Portuguese exports are relatively more specialized than the world average in some MLT sub-sectors, like "Other non-metallic mineral products", and, less importantly, "Fabricated metal products, excl. machinery" and "Rubber and plastics products". Portuguese exports also reveal a comparative advantage in some MHT sub-sectors in the most recent period, namely "Motor vehicles, trailers and semi-trailers" and "Other electrical machinery and apparatus". As regards HT products, the difference with the world export structure is considerable: the high-tech export share in Portugal is less than 1/2 the world average, with all sub-sectors revealing very low indices.

The analysis of the Portuguese relative export structure can be further enhanced with a direct comparison with the ones of Spain, Greece and Ireland. Figures 4(a) to 4(d) depict the evolution of the Balassa indices of the main sectors over the last forty years in these four countries and Table 3 reports the situation at a more disaggregated level for the period 2000-04. In order to explore the differences in these countries´ export structures at each point in time, the differential of the Balassa indices of the four broad sectors was subject to decomposition (3) as described in Section 3. Figures 5(a) to 5(l) plot the result of these decompositions.

In the LT broad sector, the main features can be summarized as: (i) Portugal has the highest specialization coefficient during most of the sample, although in a downward path since mid-eighties; (ii) the path of Greece is very similar to the Portuguese one since mid-eighties; (iii) Spain has the lowest index until the nineties, being the only country evidencing an upward trend in the last decade; (iv) having started with a Balassa index almost identical to the Portuguese one, Ireland has the sharpest downward trend during the whole period and ends up with the lowest index in this sector. Using decomposition (3), the contributions of the sub-sectors "Wood, pulp, paper and printed products" and "Textiles, textile products, leather and footwear" in Portugal against the benchmark countries are always positive, although in the latter sub-sector it has virtually disappeared against Greece in the last two decades. In comparison with Ireland, the diverging path depicted in Figure 4(a) is also explained by the less negative contribution of the sub-sector "Food products, beverages and tobacco", as the high share of this product in Irish exports declined steadily. On the contrary, Greece has a larger export share of "Food products, beverages and tobacco" than Portugal

[19] Recall that the Balassa index can also be written with export market shares, following (1). Regarding products of wood, articles of cork, straw and plaiting materials (ISIC 2029), almost 12 per cent of total world exports have their origin in Portugal, compared with a share in total world manufacturing exports of around 0.5 per cent in 2000/2004.

Figure 4: Balassa indices by technological intensity

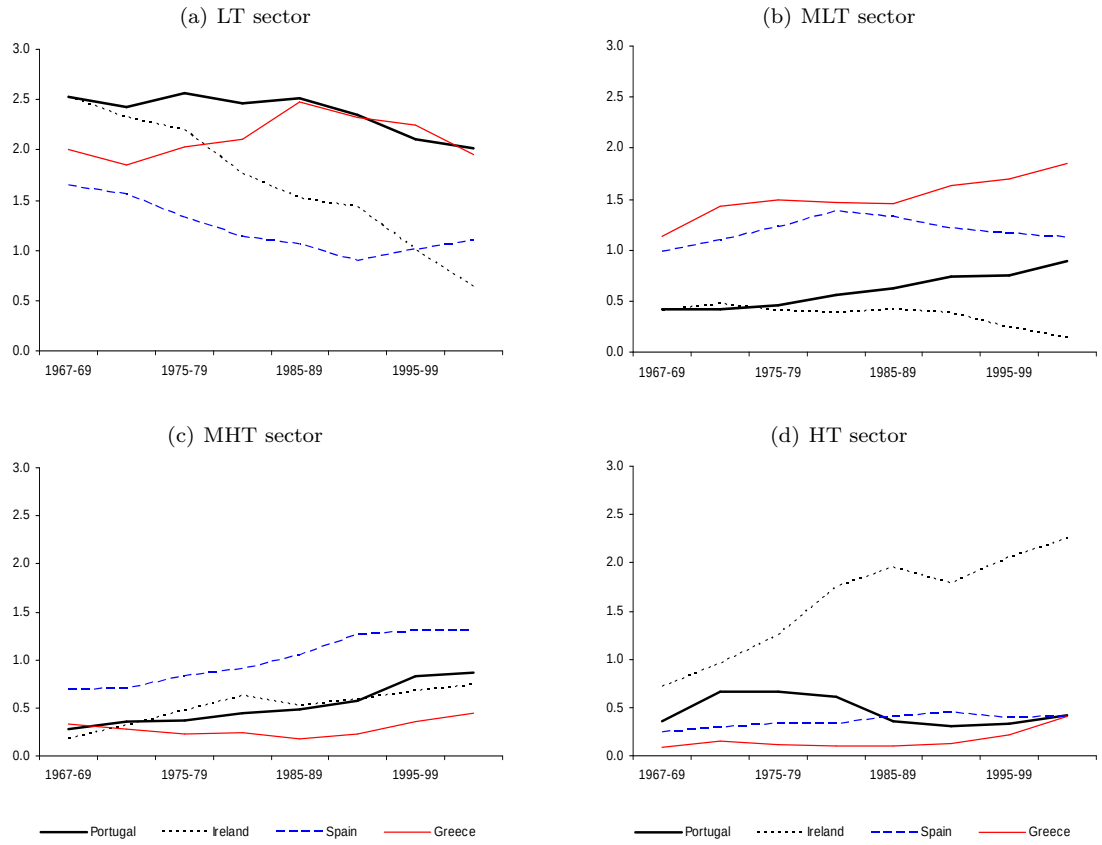


Table 3 - Manufacturing exports by technological intensity (shares in total exports and Balassa indices)

average 2000-2004

	Shares in total exports					Balassa indices			
	World	Portugal	Spain	Ireland	Greece	Portugal	Spain	Ireland	Greece
Memo Item:									
Share in total world manufacturing exports	100.0	0.5	2.2	1.5	0.2				
High-technology products	**26.0**	**10.8**	**10.6**	**57.7**	**10.6**	**0.4**	**0.4**	**2.2**	**0.4**
Aircraft and spacecraft	2.6	0.7	1.3	0.5	1.3	0.3	0.5	0.2	0.5
Pharmaceuticals	3.4	1.2	3.4	21.1	4.7	0.4	1.0	6.2	1.4
Office, accounting and computing machinery	6.1	1.8	1.3	22.0	0.8	0.3	0.2	3.6	0.1
Radio, TV and communications equipment	10.1	6.1	3.3	8.0	2.9	0.6	0.3	0.8	0.3
Medical, precision and optical instruments	3.8	1.0	1.4	6.1	1.0	0.3	0.4	1.6	0.3
Medium-high-technology products	**35.6**	**31.2**	**46.6**	**26.3**	**15.9**	**0.9**	**1.3**	**0.7**	**0.4**
Other electrical machinery and apparatus	4.6	5.7	3.7	2.3	2.8	1.2	0.8	0.5	0.6
Motor vehicles, trailers and semi-trailers	11.9	15.0	26.8	0.6	1.7	1.3	2.2	0.0	0.1
Chemicals excl. pharmaceuticals	8.6	4.5	7.9	21.2	6.6	0.5	0.9	2.5	0.8
Railroad equipment and other transport equip	0.6	0.4	0.9	0.0	0.1	0.7	1.5	0.1	0.3
Other machinery and equipment	9.8	5.8	7.3	2.1	4.6	0.6	0.7	0.2	0.5
Medium-low-technology products	**17.5**	**15.6**	**19.6**	**2.5**	**32.5**	**0.9**	**1.1**	**0.1**	**1.9**
Coke, refined petroleum prod. and nuclear fuel	3.7	2.1	3.1	0.3	10.3	0.6	0.8	0.1	2.8
Rubber and plastics products	2.9	3.3	3.5	0.7	3.2	1.1	1.2	0.2	1.1
Other non-metallic mineral products	1.5	3.8	3.6	0.5	3.1	2.6	2.4	0.3	2.1
Building and repairing of ships and boats	0.8	0.2	1.1	0.0	0.9	0.3	1.3	0.0	1.1
Basic metals	6.1	2.9	5.2	0.5	12.3	0.5	0.9	0.1	2.0
Fabricated metal products, excl. machinery	2.6	3.3	3.1	0.6	2.7	1.3	1.2	0.2	1.0
Low-technology products	**20.9**	**42.4**	**23.1**	**13.5**	**41.0**	**2.0**	**1.1**	**0.6**	**2.0**
Other manufacturing and recycling	3.2	2.7	2.4	0.7	1.3	0.9	0.8	0.2	0.4
Wood, pulp, paper and printed products	4.2	9.7	4.1	4.0	2.5	2.3	1.0	1.0	0.6
Food products, beverages and tobacco	6.1	6.5	9.5	7.9	16.1	1.1	1.6	1.3	2.7
Textiles, textile products, leather and footwea	7.5	23.4	7.1	0.8	21.1	3.1	0.9	0.1	2.8

Source: Chelem database and own calculations.

over the whole period.

In the MLT sector, Figure 4(b) reveals that (i) Greece is the country more specialized in this category during the whole period, evidencing an upward trend since mid-eighties; (ii) the specialization coefficient of Spain has been decreasing in the last 20 years; (iii) Portuguese indices increase over the whole sample, leading to a smaller gap with Spain in the most recent period; (iv) on the contrary, Ireland shows again a decreasing trend and has the lowest coefficient over the last three decades. Using decomposition (3), the stable negative contributions of the sub-sectors "Basic metals" and "Coke, refined petroleum prod. and nuclear fuel" explain the lower levels of the Balassa index for Portugal against Greece. Against Spain, a broad convergence has taken place over all sub-sectors of this aggregate, although "Basic metals" still account for a lower share in Portuguese exports. The increasing gap between Portugal and Ireland is broadly based across sub-sectors.

In general, the four countries tended to increase their specialization in the MHT sector over time, with the exception of Greece until the eighties (Figure 4(c)). Moreover, the Balassa indices were rather close among Portugal, Ireland and Greece in the beginning of the sample. Spain has the largest share of MHT exports over the whole period. The negative gap of Portugal against Spain, which has remained relatively stable over the last forty years, is basically explained by the sub-sector "Motor vehicles, trailers and semi-trailers". Against Greece and Ireland, Portugal shows a higher degree of specialization in this sub-sector, specially after mid-eighties. In the case of Ireland, this increasing gap has not created a larger difference in terms of specialization in the MHT sector as a whole, being compensated by the higher importance of the Irish sub-sector "Chemicals excl. pharmaceuticals", particularly since the eighties.

In the HT sector, Portugal, Spain and Greece show a high resemblance over the entire sample period, always with coefficients below 1. Portugal had a slightly higher specialization index than Spain and Greece until mid-eighties, but that difference disappeared in the most recent period. On the contrary, Ireland stands out by its substantial and increasing share of HT exports, which represent almost 60 per cent of total Irish manufacturing exports in the period 2000-04 (around 10 per cent in Portugal). Using decomposition (3), the diverging path of Ireland is mostly due to higher exports of "Office, accounting and computing machinery" and "Pharmaceuticals". The approximation between the indices of Portugal against both Greece and Spain reflects mainly the reduction of the positive gap in "Radio, TV and communication equipment".

Figure 5: Differential of the Balassa indices relatively to Portugal

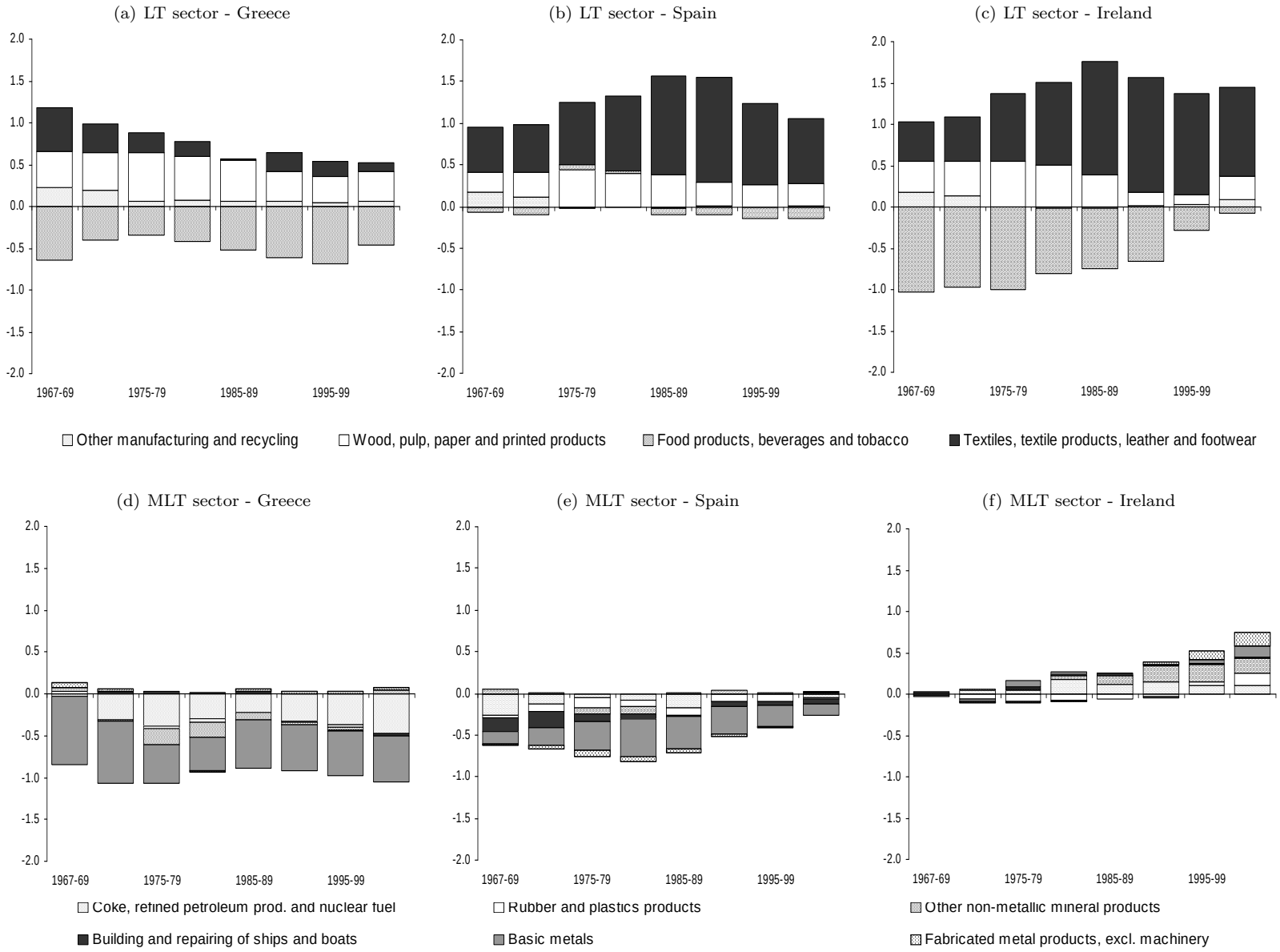
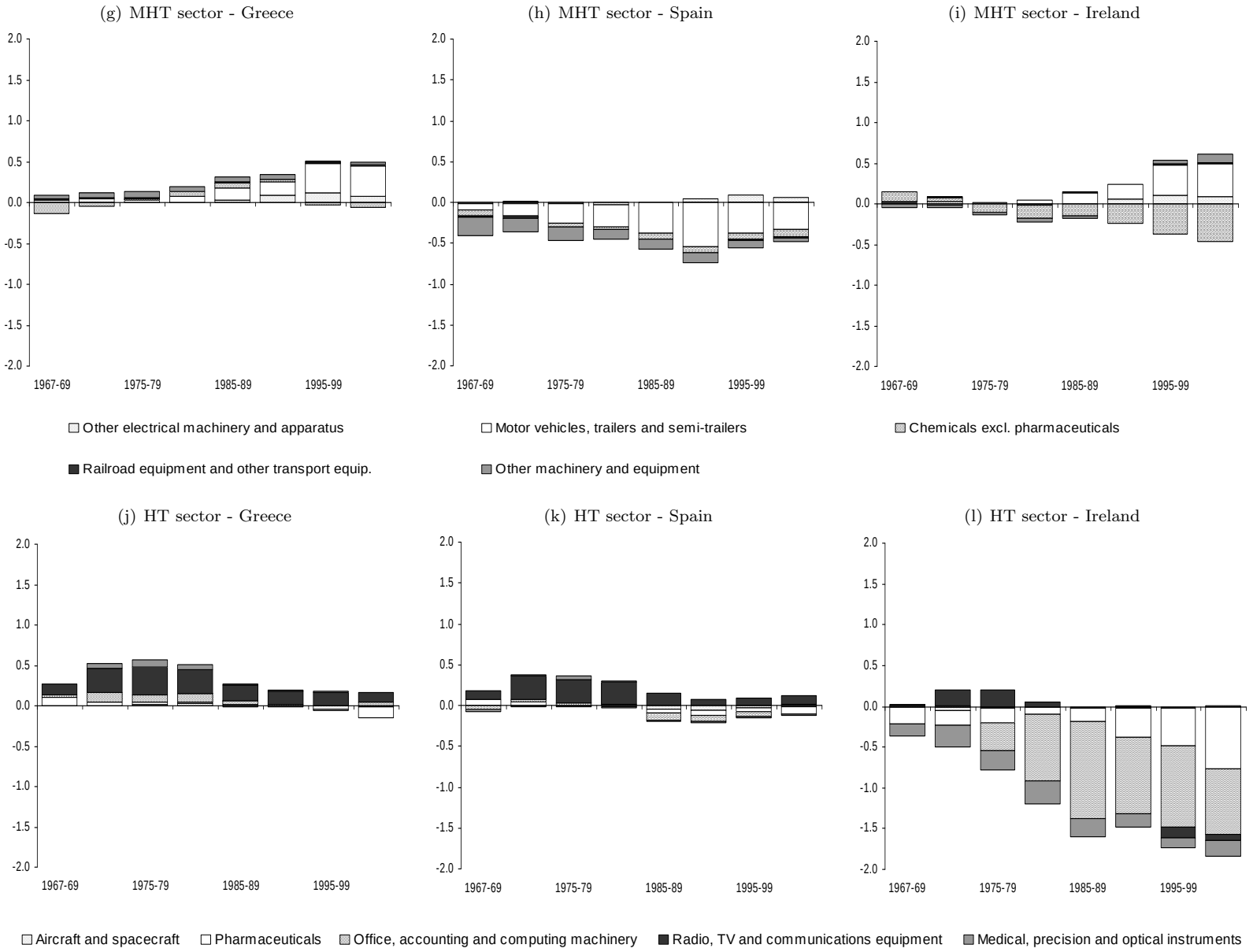


Figure 5: Differential of the Balassa indices relatively to Portugal



4.2 Distributional analysis of export specialization across industries

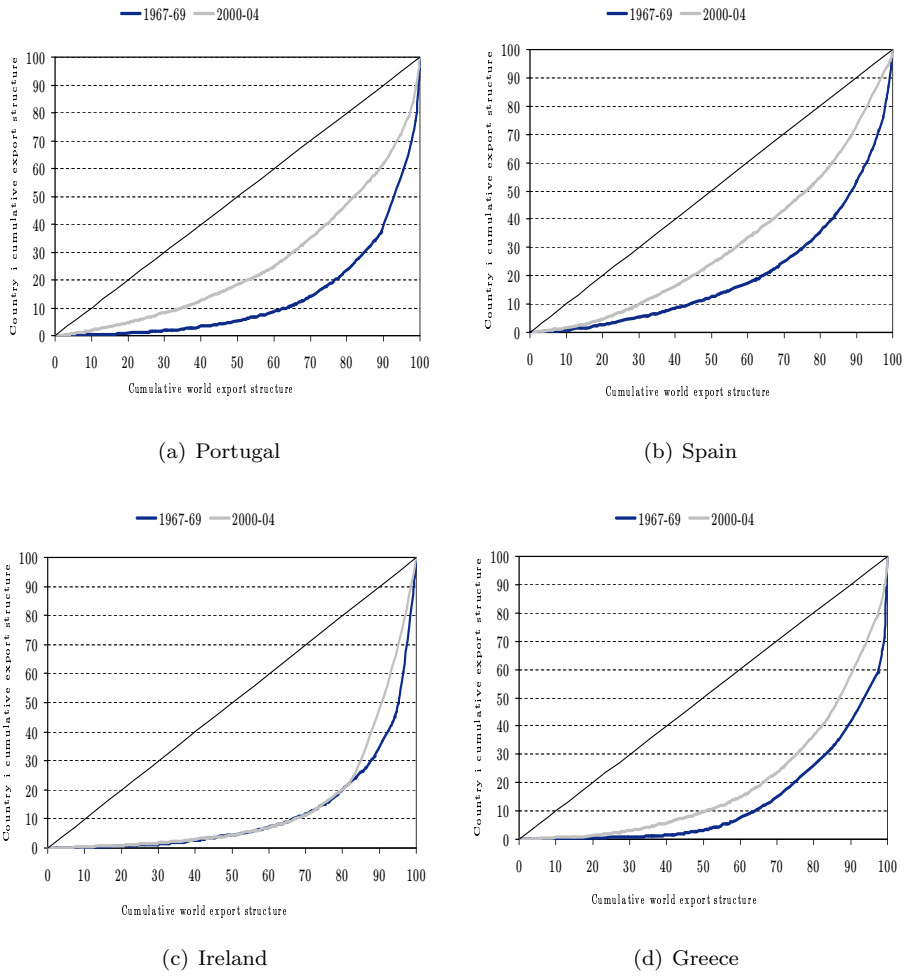
The export specialization pattern of a given country can be characterized by the cross-industry distribution of its Balassa indexes. In dynamic terms, the analysis of the specialization patterns requires the examination of the evolution of the entire distribution over time.[20] This type of analysis involves two different, although closely related, issues. First, changes in the overall extent of export specialization depend on whether there is an increasing specialization in a limited number of sectors or whether the degree of specialization tends to remain unchanged and uniformly distributed across industries. Second, there is the issue of persistence/mobility of initial patterns of export specialization, which focuses on the change in the relative position of individual industries within the given trade pattern and clarifies the probabilities of a sector moving within the distribution, for instance from the lower to the upper segment.

4.2.1 Overall specialization patterns

The questions raised by changes in the overall extent of export specialization relate to the evolution of the external shape of the distribution over time. A simple way of examining it is to plot the country pseudo-Lorenz curves, which compare the export structure of each country against the world.[21] The 45 degree line of perfect equality implies that country i has an export structure identical to the world, i.e. a $B_{ij} = 1$ in all products. The further away from the 45 degree line, the larger the difference between the two export structures and the higher the overall degree of export specialization of country i. If, for instance, the export shares of the first products are very small, the curve will start by being very close to the x-axis. As soon as it starts to incorporate products that are exported more intensively, the curve will depart from the x-axis. Figure (6) depicts the outcome for the first and last periods of our sample using 120 manufacturing products at the ISIC 4-digit breakdown level. According to Figure (6), the overall export specialization of Portugal was much higher in the beginning than at the end of the sample period. This outcome is consistent with the empirical evidence of Section 4.1 that the Portuguese export structure converged towards the world average over time. Taking into account the export shares of these 120 products, the same convergence movement was also evident in Spain and Greece. The Spanish curve is the closest to the 45 degree line in both periods, indicating that the degree of overall specialization of Spanish exports is always the lowest among this group of countries. In Ireland, on the contrary, the approximation to the world average is very feeble, indicating the maintenance of a highly specialized export pattern, with clear differences between the Irish and the world structures over the whole period. An

[20] See Proudman and Redding (1997, 2000), Brasili et al. (2000) and Mancusi (2001) for a discussion.
[21] See, for instance, Brülhart (2001) and De Benedictis and Tamberi (2004).

Figure 6: Exports - Lorenz curves - 1967-69 and 2000-2004



(a) Portugal

(b) Spain

(c) Ireland

(d) Greece

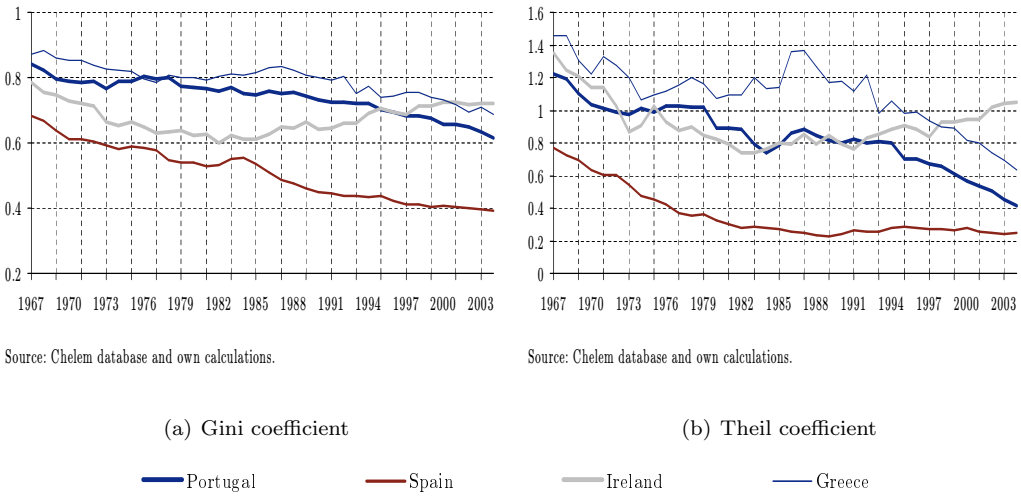
example where the Irish export shares have recently diverged from the world average is in the HT sector, as already mentioned in Section 4.1.

To quantify the empirical evidence provided by the Lorenz curves, the Gini coefficient and the Theil entropic index were computed and plotted in Figure 7.[22] If the export shares of each j product in country i are the same as in the world, i.e. $\frac{x_{ij}}{X_i} = \frac{x_{Wj}}{X_W}$, then there is no specialization and the Gini and Theil indices are equal to zero (its minimum). The higher the indices, the larger the difference between the export structure of country i and the world average and the more specialized this country is. The outcome corroborates the conclusions already mentioned. Both indicators are much lower in Spain than in the other countries and show, in general, decreasing trends in Spain Portugal and Greece, indicating a reduction of the overall extent of specialization.[23] In

[22]The Gini coefficient is defined as twice the area between the 45 degree line and the Lorenz curve. On the use of the Gini coefficient, see for instance Brülhart (2001), Amiti (1999) or Mancusi (2001). The Theil index is defined as the weighted sum of the logs of the sectoral B_{ij}, where the weights are the shares of each product j in total exports of country i. For an application of the Theil entropic index, as defined in Theil (1967), see De Benedictis et al. (2006).

[23]This result is in line with other empirical studies of specialization patterns using export data.

Figure 7: Measures of overall export specialization



Source: Chelem database and own calculations.

(a) Gini coefficient

Source: Chelem database and own calculations.

(b) Theil coefficient

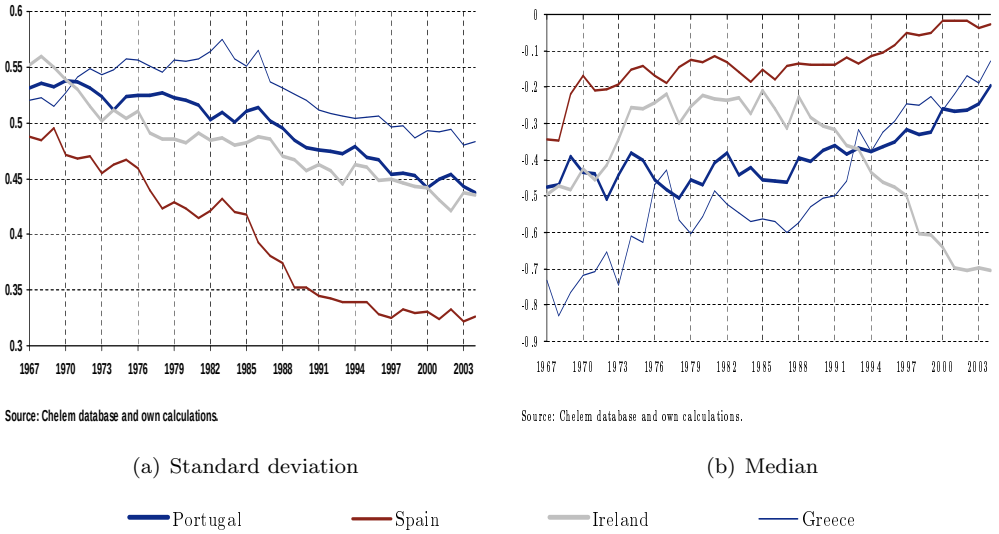
Ireland, although the beginning and the end of the sample period reveal a high degree of specialization, both indices show a decreasing trend until the mid-eighties, as in the other countries. Therefore, Ireland showed for some time a general tendency towards the world average, but the country repositioned itself over the last 20 years with a different export structure and, hence, a higher overall degree of specialization.

The standard deviation and the median have also been used to characterize the distribution and thus the overall extent of specialization. The standard deviation of the B_{ij} measures the dispersion, so the wider the distribution, the more specialized the country is in some sectors and unspecialized in others. However, beyond being insufficient to fully characterize the distribution, the standard deviation is strongly influenced by extreme values, a matter that can be especially severe in a distribution so asymmetric as this one. Moreover, the evolution of the standard deviation masks the evolution of the arithmetic mean of the B_{ij}, which can also change over time.[24] Given the high asymmetry of the traditional B_{ij} index, the standard deviation and the median were computed after transforming the indicator as proposed by Laursen (1998) (see Section 3). The standard deviation decreased in the four countries considered, broadly indicating a re-

Proudman and Redding (2000) that analyse the international trade dynamics of the G5 economies only find evidence of an increase of specialization in Japan. Brasili et al. (2000) examine the dynamics of trade patterns of some developed and emerging countries studying the shape of the sectoral distribution and conclude that, although emerging countries are still more specialized than the industrialized countries, both groups show a tendency towards a reduced polarization and a more symmetric distribution of the specialization index. Similarly, De Benedictis et al. (2005) and De Benedictis et al. (2006) conclude that sectoral export diversification tends to increase over time, as countries continuously diversify along their path of economic development.

[24] On the use of the standard deviation, see Proudman and Redding (2000). These authors report situations where the evolution of the sample standard deviation can result in misleading conclusions about changes in the overall degree of specialization. Additionally, the arithmetic mean is also a poor synthetic indicator when the distribution is characterized by a pronounced skewness. Moreover, as the B_{ij} is a relative index, the economic sense of the mean of the B_{ij} is also ambiguous (see De Benedictis and Tamberi (2002, 2004) for a discussion). This statistics, among others, were nevertheless calculated and are included in Appendix B.

Figure 8: Exports - Some descriptive statistics of the BS_{ij} index



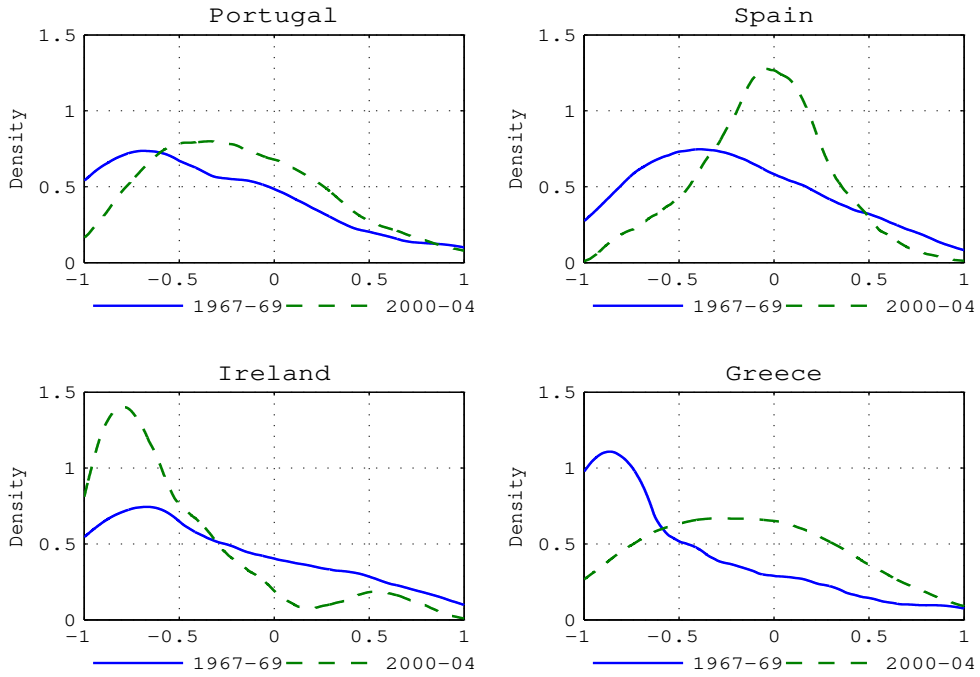
duction of specialization over time(Figure 8(a)). In the case of Ireland, and differently from the other countries, the results contradict the previous empirical evidence. However, the result is strongly influenced by extreme values and fully hides the fact that the arithmetic mean of the BS_{ij} in Ireland decreased sharply in the last decade. The median of the BS_{ij}, which is a localization measure of the distribution, also provides some evidence on whether a country has a concentrated structure of exports. A low median means that country i has a large share of sectors with low values of BS_{ij}; a high median means that the country has a large proportion of products in which it is specialized.[25] As shown in Figure 8(b), in the most recent period, the median has the highest value in Spain and the lowest in Ireland. Thus, there is a higher proportion of products in which Spain is specialized in the period 2000-04 (45 per cent of the sectors have $BS_{ij} > 0$), while the export specialization in Ireland relies in a smaller number of products (only 10 per cent of the sectors have $BS_{ij} > 0$). The median also shows different evolutions over time: a clearly increasing trend is visible from mid-eighties onwards for Spain, Greece and Portugal, indicating a rise in the number of products in which these countries specialize; the opposite happens in Ireland, pointing to a decline in the number of products with $BS_{ij} > 0$ and an increase of the share of these products in total exports.[26]

A more general picture of export patterns can be obtained by the analysis of the entire

[25] On the use of the median, see De Benedictis and Tamberi (2004). Contrarily to what happens with the arithmetic mean, the median is not influenced by extreme values. The evolutions of the median of the BS_{ij} and of the B_{ij} are basically the same. The median of the original B_{ij} indices are reported in Appendix B.

[26] De Benedictis and Tamberi (2004) show that there is a positive correlation between the median of the Balassa index and the number of sectors with $B_{ij} > 1$ and a negative correlation between the median and the share in total exports of sectors with $B_{ij} > 1$.

Figure 9: Exports - Estimated Kernel Densities



distribution of the specialization indices. Empirical research of the dynamics of trade patterns using the entire distribution was pioneered by Proudman and Redding (1997, 2000). Since then, several empirical studies analysed the product specialization of a given country (or group of countries) by estimating the entire (cross-sector) distributions over time.[27] Figure 9 shows the results of estimated kernel densities with 120 products, for each country, using an Epanechnikov kernel function in the first and last periods of the sample.[28] Since the high asymmetry of the traditional B_{ij} index complicates the interpretation of the estimated distribution, the original Balassa indices were subject to the transformation suggested by Laursen (1998) (see Section 3). The visual inspection of the density estimates confirms the previous results on the differences in terms of specialization among the four countries. In the Irish case, the density function is markedly more right skewed than that of the other countries, indicating a higher overall degree of specialization. On the contrary, the density function of Spain is much more symmetric and roughly centered around the demarcation value in the most recent period. Over time, the density estimates of Portugal, Spain and Greece tend to become more symmetric, pointing to a general decrease of the overall degree of

[27] See Brasili et al. (2000), De Benedictis (2005) and Di Maio and Tamagni (2006).

[28] Density estimates depend crucially on the choice of the bandwidth or smoothing parameter. Several bandwidths variations were tested and the results were qualitatively similar. We used the optimal bandwidth for estimating densities for the normal distribution as the optimal smoothing parameter for the Epanechnikov kernel function, as suggested by Silverman (1986), seemed to oversmooth the results.

specialization in these countries. The opposite happens with Ireland, whose distribution becomes more polarized in the most recent period, with the density concentrating more around extreme values.

4.2.2 Intra-distribution dynamics

The analysis of international specialization patterns through the use of the cross-industry distribution of each country raises the issue of "persistence" *vis-à-vis* "mobility" of the initial export pattern. The literature presents several techniques of examining the mobility of the different products within the B_{ij} distribution. The simplest approach consists in computing the linear correlation coefficient between the original Balassa indices in different time periods, as shown in Table 4. In general, the correlations between two different periods decline the further away those periods are. The values of the correlation coefficients between the two extreme periods are higher in Portugal and, specially in Greece, than in Spain or Ireland. This result suggests that the relative export basket of the latter two countries changed more significantly during the 1967-2004 period than in Portugal or Greece. In the case of Ireland, the correlations drop substantially in mid-eighties pointing to a significant change in the export structure in that period.

Another simple approach for examining changes in the sectoral specialization of a country over time is based on regression analysis. In order to compare the export structures in the beginning and end of the sample period, four scatter plots have been collected for each country and an OLS regression line was superimposed (Figure 10).[29] Given the high asymmetry of the traditional Balassa index, the transformation (4) was again implemented (see Section 3).[30] The horizontal and vertical lines drawn in the demarcation value $BS = 0$ define four distinct quadrants. The upper left/right quadrants will be designated by Quadrants I/II, while the equivalent lower left/right by Quadrants III and IV, respectively. The 45 degree line identifies situations of pure persistence in which the *level* of relative specialization remains constant, i.e. the BS is the same in 1967-69 and in 2000-04. This line crosses quadrants II and III, which define areas in which the index may have changed, but the classification of countries in terms of relative specialization has not. Quadrants I and IV contain countries that modified their relative specialization status, from specialized to unspecialized (quadrant IV) or vice-versa (quadrant I).

The most populated area in all countries is quadrant III. Therefore, the most striking feature of Figure 10 seems to be the persistence of a non-specialization status, i.e.

[29] See De Benedictis (2005) and Brasili et al. (2000) for a similar analysis.

[30] The skewed distribution of B_{ij} violates the assumption of normality of the error term in regression analysis, potentially leading to biased estimates and to unreliable t-statistics.

Table 4 - Exports - Balassa index: correlation matrices

Portuguese manufacturing exports

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
1967-69	1							
1970-74	0.95	1						
1975-79	0.87	0.96	1					
1980-84	0.79	0.92	0.98	1				
1985-89	0.78	0.89	0.95	0.98	1			
1990-94	0.74	0.86	0.93	0.96	0.99	1		
1995-99	0.71	0.84	0.91	0.93	0.97	0.99	1	
2000-04	0.71	0.84	0.90	0.92	0.95	0.98	0.99	1

Spanish manufacturing exports

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
1967-69	1							
1970-74	0.93	1						
1975-79	0.80	0.90	1					
1980-84	0.69	0.78	0.96	1				
1985-89	0.68	0.81	0.87	0.88	1			
1990-94	0.52	0.67	0.66	0.67	0.92	1		
1995-99	0.46	0.61	0.61	0.63	0.87	0.97	1	
2000-04	0.43	0.54	0.53	0.56	0.79	0.91	0.97	1

Irish manufacturing exports

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
1967-69	1							
1970-74	0.95	1						
1975-79	0.73	0.85	1					
1980-84	0.62	0.74	0.95	1				
1985-89	0.36	0.45	0.68	0.79	1			
1990-94	0.31	0.38	0.58	0.68	0.98	1		
1995-99	0.18	0.23	0.39	0.50	0.87	0.95	1	
2000-04	0.18	0.24	0.38	0.50	0.78	0.86	0.93	1

Greek manufacturing exports

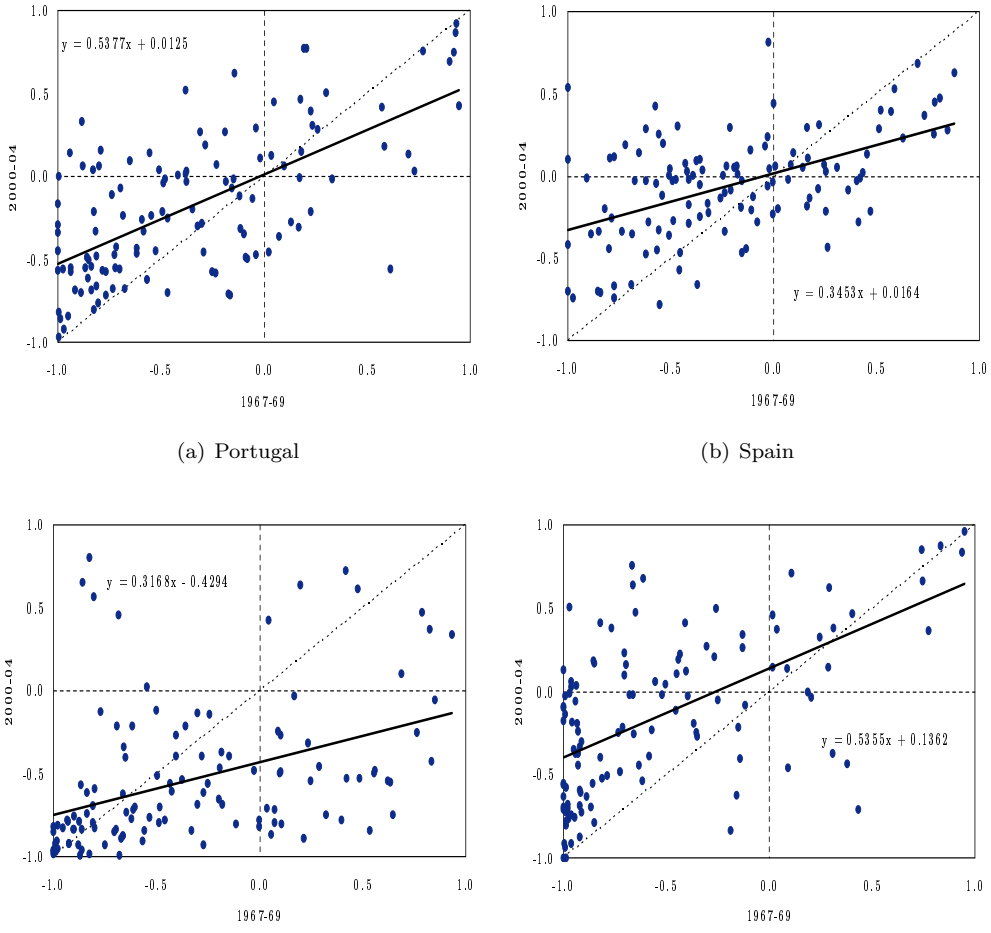
	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
1967-69	1							
1970-74	0.98	1						
1975-79	0.91	0.95	1					
1980-84	0.85	0.90	0.98	1				
1985-89	0.88	0.92	0.95	0.97	1			
1990-94	0.87	0.90	0.93	0.95	0.99	1		
1995-99	0.88	0.90	0.92	0.93	0.98	0.98	1	
2000-04	0.87	0.89	0.87	0.87	0.94	0.95	0.98	1

Source: Chelem database and own calculations.

sectors that had a $BS_{ij} < 0$ in 1967-69, had also a $BS_{ij} < 0$ in 2000-04. Looking at regression results, all regression lines are positively sloped, suggesting no evidence, on average, of a reversal of the specialization patterns between the two periods. Additionally, all regression lines are less steep than the 45 degree line, meaning that the phenomena sometimes referred to as "average strengthening of initial specialization" is also not present in our sample.

At the country level, Portugal and Greece have higher estimated coefficients and show also a lower dispersion around the line of perfect equality, pointing to a higher similarity between the export specialization of these countries in the two extreme periods. The opposite happens with Spain and Ireland, suggesting larger differences in the the cross-industry specialization in the two periods, in particular in the case of Ireland. This outcome is consistent with the correlation coefficient analysis shown in Table 4. In Ireland, most sectors are located below the 45 degree line, indicating a general decline

Figure 10: Exports - The BS_{ij} in 1967-69 and in 2000-04



(a) Portugal

(b) Spain

(c) Ireland

(d) Greece

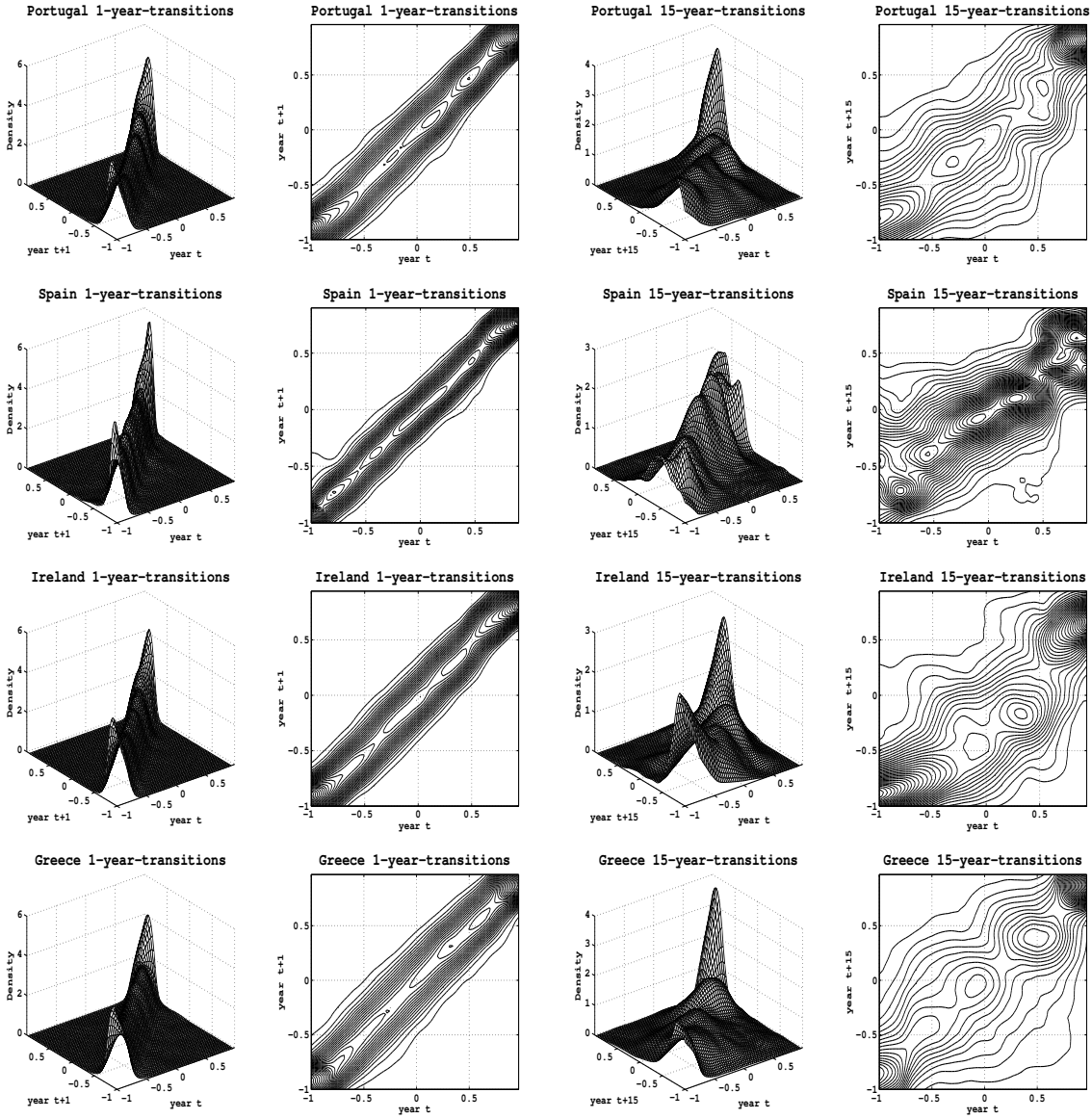
in the BS_{ij} values, while the opposite happens in the Greek case.

The previous regression analysis, although commonly used, gives only information on the average behaviour rather than on the actual dynamics within the distribution.[31] The methods of evaluating the intra-distribution dynamics were initiated by Quah (1993) in discrete time, applied to cross-country income convergence analysis, and extended afterwards towards a continuous time framework (see, in particular, Quah (1997)). The first application of intra-distribution dynamics to trade specialization patterns, using Markov transition matrices, was due to Proudman and Redding (1997, 2000). Brasili et al. (2000) extended this trade analysis to continuous time by estimating stochastic kernels and by drawing information from the conditional distributions at time $t + \tau$, given its value at time t.[32]

[31]The limits of the regression technique have been clarified within the debate on per capita income convergence by Quah (1993, 1996), in particular with respect to the so-called Galton´s fallacy. See Bliss (1999).

[32]Brasili et al. (2000) concentrated the analysis in $\tau = 15$. See also Mancusi (2001), who, in a different perspective, examines the pattern of technological specialization.

Figure 11: Exports - Estimated Stochastic Kernels - 1-year and 15-year transitions



The kernel density estimates of the distribution of BS_{ij} index at time $t+\tau$, conditional on its value at time t, were computed as follows. First, the joint density function of the distributions was estimated non-parametrically using Christian Beardah´s Kernel Density Estimation Matlab toolbox. An Epanechnikov kernel function was used, choosing the window width optimally as suggested by Silverman (1986). Second, the implied marginal probability distribution of the first period was calculated by numerical integration. Finally, the conditional distribution results from the ratio of the joint by the marginal densities. Figure 11 reports the estimated stochastic kernels for $\tau = 1$ and $\tau = 15$ and the respective contour plots. The interpretation of the 3-D figures

is straightforward: from any point on the year t axis, we extend parallel to the axis marked year $t+\tau$, the resulting stochastic kernel is a probability density function that integrates to unity.[33] Such estimated probability density gives the transitions over $t+\tau$ from any BS_{ij} value in period t. The 2-D contour plots are just vertical projections of the stochastic kernel.

Figure 11 points to a high persistence of the sectoral export pattern of all countries over 1-year periods, as most of the elements are concentrated along the 45 degree diagonal, implying that they tend to remain around the values where they started off. The degree of mobility increases substantially when we move to a 15-year horizon. This result could be expected, as export structures are not easily mobile in the very short-run.[34] In the 15-year transitions, all countries show a significant persistence of the high values of the index, pointing to some stability of the products with a high specialization status.[35] In Spain, where the transitions are more evenly distributed over the whole range of the 45 degree diagonal, there is a higher probability of movements towards zero, which is consistent with a decline of the overall degree of specialization and with a convergence towards the export structure of the world average. In Ireland, the distribution of the 15-year transitions peaks in the two extremes and dips in the middle. There also is some evidence of a higher probability mass below the 45 degree diagonal for values of the index between 0 and 0.5, pointing to general decline of mid-values of the index in Ireland.

The transitions implicit in the estimated stochastic kernels can also give information about changes in each country's overall degree of international specialization over time, as they allow the estimation of the "long term" or "stationary distribution" implicit in the conditional distribution, i.e. the ergodic distribution. This distribution can be interpreted as a limit to which the specialization pattern would tend if the evolutions seen so far went on indefinitely (see Brasili et al. (2000)). Its computation can be explained intuitively. Firstly, the conditional distribution is transformed into a very large Markov transition matrix, where all rows sum to unity. This matrix is then raised to a sufficiently large number so as to produce a matrix with virtually identical rows (i.e. of rank 1).[36] In this way, we obtain the "stationary distribution" towards which the pattern of international specialization is evolving, which corresponds to the

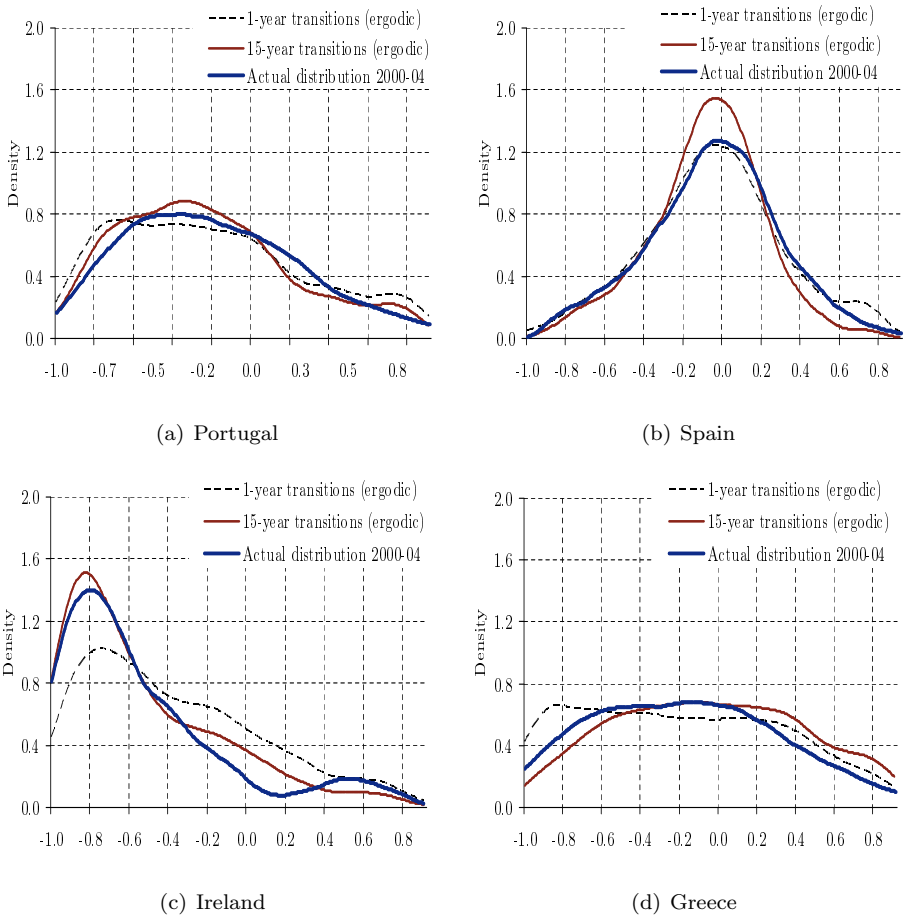
[33] That projection is similar to a row of a Markov transition probability matrix, with all entries non-negative and summing to 1. See Quah (1997).

[34] We have carried out the analysis using 5-year and 10-year lags, as well as 5-years average periods, and the results do not change the overall assessment.

[35] Proudman and Redding (2000) find considerable persistence of international trade patterns of the G5 countries, except in Japan. Brasili et al. (2000) find a substantial difference between the advanced and the emerging countries in terms of persistence: the former are characterized by a highly persistent trade pattern, while the specialization of the latter is highly mobile.

[36] In practical terms, the Markov transition matrix implicit in the estimated conditional density was iterated 1000000 times. On the computations of ergodig distributions in continuous time, see Juessen (2005) and Johnson (2004).

Figure 12: Exports - Actual and implicit ergodic distribution of BS_{ij}



(a) Portugal

(b) Spain

(c) Ireland

(d) Greece

unconditional probability of an industry having a particular BS_{ij} value, independently of its starting value. Figure 12 superimposes the ergodic distributions, obtained both from the 1-year and from the 15-year transitions, and the previously reported kernel densities estimated for the 2000-2004 period. In Portugal, the distributions are closer to each other than in any other country, which implies that the actual structure is not very different from the long-term distribution if the evolutions seen so far were to continue. In Spain, the ergodic distribution coming from $\tau = 15$ gives more mass to values close to zero, suggesting that if the transitions seen so far went on indefinitely, a further move towards the world average would occur. In Greece, both ergodic distributions are above the actual distribution in the right tail, which would indicate a increase of the overall extent of specialization if the ergodic distributions were to materialize. In Ireland, the most striking feature is that $\tau = 1$ and $\tau = 15$ ergodic distributions are different from each other and there is more mass around zero on both of them than on the actual distribution.

Finally, on a more descriptive approach, Table 5 reports the values of the Balassa index

for the 10 top and bottom ranked products in Portuguese manufacturing exports in the eight reference periods. The results for the other three countries are included in Appendix C. The products that are ranked in two consecutive periods and both in the first and last periods of our sample are highlighted in the table. In the Portuguese case, as previously mentioned, the pattern of export specialization seems rather persistent over time in what concerns the products with the highest specialization status. In most adjacent periods, the products ranked are practically the same and, even if we compare the two extreme reference periods, 50 per cent of the products appear in the top rank in both periods. All products ranked in the top 10 in the most recent period are low-tech to medium-low-tech, confirming the relatively modest technological content of Portuguese manufacturing exports. Two sectors at the ISIC 2 digit level have a special presence in the top ranked products. The low-tech sector ISIC 17 - Manufacture of textiles has three products among the 10 top positions in the most recent period, with two of them already appearing in the top 10 almost 40 years ago. The medium-low-tech sector ISIC 26 - Manufacture of other non-metallic mineral products has also three products ranked in the top 10 in 2000-2004, with one of them figuring in the first period as well.

Table 5 - Balassa index: Top10 and Bottom10 products in Portuguese manufacturing exports

1967-69			1970-74			1975-79			1980-84		
Industry		B	Industry		B	Industry		B	Industry		B
Wooden containers	LT	35.3	Other pr. of wood, cork, straw	LT	29.4	Other pr. of wood, cork, straw	LT	33.6	Other pr. of wood, cork, straw	LT	26.8
Other pr. of wood, cork, straw	LT	28.5	Cordage, rope, twine & netting	LT	26.1	Cordage, rope, twine & netting	LT	23.0	Cordage, rope, twine & netting	LT	21.1
Cordage, rope, twine & netting	LT	28.0	Wines	LT	19.1	Wines	LT	19.6	Made-up text. art. exc. appar.	LT	15.5
Wines	LT	23.9	Wooden containers	LT	17.8	Made-up text. art. exc. appar.	LT	13.8	Wines	LT	15.0
Cut stones	MLT	19.4	Cut stones	MLT	12.6	Cut stones	MLT	13.4	Cut stones	MLT	10.6
Made-up text. art. exc. appar.	LT	7.7	Made-up text. art. exc. appar.	LT	10.1	Wooden containers	LT	9.5	Knitted fabrics & articles	LT	6.5
Preserved fish & fish products	LT	6.3	Preserved fruit and vegetables	LT	5.3	Wearing apparel, except fur	LT	4.9	Wearing apparel, except fur	LT	4.8
Preserved fruit and vegetables	LT	5.7	Wearing apparel, except fur	LT	4.5	Weapons and ammunition	MHT	4.6	Footwear	LT	4.2
Jewellery and related articles	LT	4.2	Recycled metal waste & scrap	LT	4.2	Preserved fruit and vegetables	LT	4.0	Weapons and ammunition	MHT	3.9
Prepared text. fibres; fabrics	LT	3.8	Prepared text. fibres; fabrics	LT	3.6	Knitted fabrics & articles	LT	3.8	N-struct. n-refract. ceramic	MLT	3.7
Manufactured grain mill prod.	LT	0.01	Manufactured grain mill prod.	LT	0.03	Steam generators	MHT	0.05	Steam generators	MLT	0.08
Machinery for metallurgy	MHT	0.01	Musical instruments	LT	0.03	Machinery for food processing	MHT	0.05	Indust. process control equip.	HT	0.06
Manufactured sugar	LT	0.00	Motor vehicles	MHT	0.03	Pesticides, oth agro-chem. pr.	MHT	0.04	Machinery for mining & constr.	MHT	0.06
Manufactured coke oven prod.	MLT	0.00	Machinery for metallurgy	MHT	0.03	Ovens, furnaces and burners	MHT	0.04	Manufactured grain mill prod.	LT	0.06
Processed nuclear fuels	MLT	0.00	Processed nuclear fuels	MLT	0.02	Indust. process control equip.	HT	0.04	Refractory ceramic products	MLT	0.06
Service act. rel. to printing	LT	0.00	Service act. rel. to printing	LT	0.00	Musical instruments	LT	0.03	Musical instruments	LT	0.02
Indust. process control equip.	HT	0.00	Indust. process control equip.	HT	0.00	Machinery for metallurgy	MHT	0.03	Machinery for metallurgy	MHT	0.02
Build. repair. pleasure boats	MLT	0.00	Build. repair. pleasure boats	MLT	0.00	Manufactured grain mill prod.	LT	0.01	Manufactured coke oven prod.	MLT	0.01
Other transport equipment	MHT	0.00	Other transport equipment	MHT	0.00	Manufactured coke oven prod.	MLT	0.00	Recycled metal waste & scrap	LT	0.00
Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00

1985-89			1990-94			1995-99			2000-04		
Industry		B	Industry		B	Industry		B	Industry		B
Other pr. of wood, cork, straw	LT	23.1	Other pr. of wood, cork, straw	LT	24.3	Other pr. of wood, cork, straw	LT	23.8	Other pr. of wood, cork, straw	LT	24.3
Cordage, rope, twine & netting	LT	17.4	Cordage, rope, twine & netting	LT	15.6	Cordage, rope, twine & netting	LT	14.6	Cordage, rope, twine & netting	LT	13.8
Made-up text. art. exc. appar.	LT	12.9	Made-up text. art. exc. appar.	LT	10.6	Made-up text. art. exc. appar.	LT	9.6	Footwear	LT	7.7
Wines	LT	10.9	Wines	LT	9.6	Footwear	LT	9.0	N-struct. n-refract. ceramic	MLT	7.7
Cut stones	MLT	9.8	Cut stones	MLT	9.0	N-struct. n-refract. ceramic	MLT	8.3	Made-up text. art. exc. appar.	LT	7.2
Footwear	LT	7.4	Footwear	LT	8.7	Wines	LT	7.8	Wines	LT	7.1
Knitted fabrics & articles	LT	6.4	N-struct. n-refract. ceramic	MLT	7.7	Cut stones	MLT	6.2	Cut stones	MLT	5.5
Wearing apparel, except fur	LT	5.8	Knitted fabrics & articles	LT	6.3	Knitted fabrics & articles	LT	5.0	Knitted fabrics & articles	LT	4.3
N-struct. n-refract. ceramic	MLT	5.7	Wearing apparel, except fur	LT	5.1	Wearing apparel, except fur	LT	3.5	Tanks, reservoirs & containers	MLT	3.1
Wooden containers	LT	4.1	Struct. n-refract. ceramic pr.	MLT	3.4	Other electrical equipment	MHT	3.0	Struct. n-refract. ceramic pr.	MLT	3.0
Machinery for mining & constr.	MHT	0.08	Indust. process control equip.	HT	0.10	Machinery for mining & constr.	MHT	0.13	Recycled metal waste & scrap	LT	0.17
Agric. and forestry machinery	MHT	0.07	Starches and starch products	LT	0.10	Starches and starch products	LT	0.11	Manuf. cocoa, chocolate, sugar	LT	0.17
Pesticides, oth agro-chem. pr.	MHT	0.07	Steam generators	MLT	0.10	Steam generators	MLT	0.09	TV & radio transmitters & tel.	HT	0.17
Tobacco products	LT	0.07	Watches and clocks	HT	0.10	Manuf. cocoa, chocolate, sugar	LT	0.09	Agric. and forestry machinery	MHT	0.14
Prepared animal feeds	LT	0.06	Office and computing machinery	HT	0.10	Office and computing machinery	HT	0.06	Starches and starch products	LT	0.11
Manufactured sugar	LT	0.05	Tobacco products	LT	0.07	Engines, exc. vehicle engines	MHT	0.05	Manufactured coke oven prod.	MLT	0.10
Indust. process control equip.	HT	0.04	Prepared animal feeds	LT	0.07	Musical instruments	LT	0.05	Musical instruments	LT	0.09
Machinery for metallurgy	MHT	0.04	Machinery for metallurgy	MHT	0.06	Recycled metal waste & scrap	LT	0.05	Machinery for metallurgy	MHT	0.08
Manufactured coke oven prod.	MLT	0.02	Manufactured sugar	LT	0.05	Machinery for metallurgy	MHT	0.05	Engines, exc. vehicle engines	MHT	0.04
Musical instruments	LT	0.01	Musical instruments	LT	0.03	Processed nuclear fuels	MLT	0.03	Processed nuclear fuels	MLT	0.02

Source: Chelem database and own calculations.

Note:

Industry also in the Top 10 / Bottom 10 in the previous period.

In **Bold**, industry in the Top 10 / Bottom 10 in the 1967/69 and in the 2004/04 periods.

5 Portuguese import structure over four decades

In this section we study the structure of Portuguese manufacturing imports since 1967, as well as its distributional dynamics. This allows us to infer some results on the evolution of consumption patterns and on their similarity with other countries. In addition, the development of vertical specialization activities may explain why some countries import intensively certain products. Therefore, the comparison with the benchmark countries - Spain, Ireland and Greece - is maintained.

5.1 Import structures and Balassa indices

The structure of Portuguese manufacturing imports experienced important changes over the last four decades (Figure 13). Comparing the two extreme periods, there was a decline of import share of MHT and, to a lesser extent, MLT categories, while the shares in total manufacturing imports of HT and LT sectors increased. At the second product breakdown level, there were several changes in the import proportion of the different sub-sectors, without any clear pattern within each broad category (Table 6).

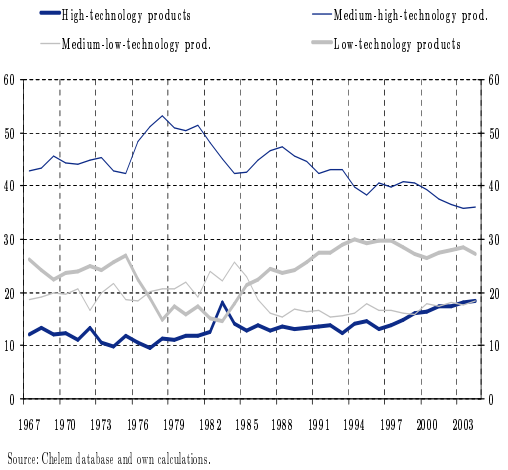
The share of the MHT category in total Portuguese manufacturing imports declined from 44 per cent in 1967-69 to 37 per cent in 2000-04. In spite of this decrease, it is still the most significant sector in Portuguese manufacturing imports during the whole period. The reduction of the import share of this broad category reflected mainly the substantial loss of share of "Other machinery and equipment" since the eighties (Figure 13(b)). On the contrary, there was an increase of imports of "Motor vehicles, trailers and semi-trailers", which is the most important sub-sector of Portuguese manufacturing import at this breakdown level in the period 2000-04, with a share of around 15 per cent.

The second most relevant category in Portuguese imports is the LT sector, accounting for more than 27 per cent of total imports in the period 2000-04. The import share of this broad category increased over the last four decades, specially since the eighties. In particular, there was a strong increase of the import share of "Textiles, textile products, leather and footwear", from 4 per cent in 1967-69 to 10.3 per cent in 2000-04 (Figure 13(b)).

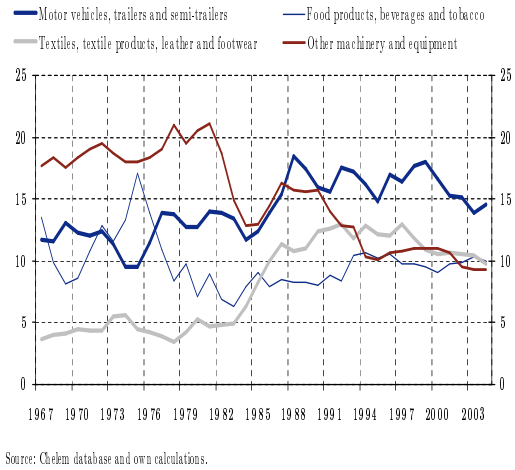
The import proportion of the HT category increased from 12.5 per cent in 1967-69 to 17.6 per cent in 2000-04, with the increase being mostly concentrated in the last 10 years. The higher import proportion of this category resulted chiefly from the increase of imports of "Radio, TV and communications equipment" and of "Office, accounting and computing machinery".

The share of MLT sector in total Portuguese imports declined somewhat from the first

Figure 13: Portuguese manufacturing imports by technological intensity
(Shares in total)



(a) Main four technological categories



(b) Main four sectors in Portuguese imports

to the last periods the sample, from 19.3 to 17.9 per cent. Within this category two sectors show significant and opposite evolutions: there was a reduction of the import share of the sub-sector "Basic metals" (from 9.6 to 6.0 per cent) and an increase of the share of the sub-sector "Rubber and plastics products" in total imports (from 1.2 to 3.6 per cent).

Similarly to what was found in Section 4 for exports, the evolution of the sectoral Balassa (1965) indices suggests an overall approximation of the structure of Portuguese manufacturing imports to the world average (Table 7). In general terms, the import shares that were above the world average in the beginning of the sample period evidenced a decline and import shares below the world average tended to increase. The main exceptions are the MLT sub-sector of "Building and repairing of ships and boats" and, to a lesser extent, the HT sub-sectors of "Office, accounting and computing machinery" and of "Medical, precision and optical instruments", which had below average import shares in the 1967-69 period and whose difference relatively to the world average increased over time.

The Balassa (1965) indices higher than 1 are highlighted in Table 7. Portuguese manufacturing imports of the MHT broad sector represent a higher proportion of total imports than in the world average over the whole period. In particular, the sub-sectors of "Motor vehicles, trailers and semi-trailers" and "Other machinery and equipment" have high Balassa indices during the entire period. In the first case, the positive difference relatively the world average is the same in the first and last periods of the sample, while in the second sub-sector there is some convergence to the world average.

Table 6 - Structure of Portuguese manufacturing imports by technological intensity

As a percentage of total imports

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
High-technology products	**12.5**	**11.1**	**10.9**	**13.6**	**13.3**	**13.5**	**14.5**	**17.6**
Aircraft and spacecraft	2.8	1.9	0.8	1.6	0.9	1.1	1.1	1.4
Pharmaceuticals	3.1	2.7	3.5	2.9	2.0	2.1	2.7	3.8
Office, accounting and computing machinery	0.9	1.1	1.1	2.1	3.0	3.0	2.9	3.1
Radio, TV and communications equipment	3.5	3.0	2.8	4.1	5.0	4.8	5.4	6.7
Medical, precision and optical instruments	2.2	2.4	2.8	2.9	2.4	2.5	2.4	2.6
Medium-high-technology products	**44.1**	**44.1**	**49.7**	**47.8**	**46.0**	**42.5**	**40.1**	**37.0**
Other electrical machinery and apparatus	3.0	3.1	3.6	3.3	3.3	4.0	4.3	4.0
Motor vehicles, trailers and semi-trailers	12.2	11.1	12.5	13.2	16.4	16.6	16.8	15.0
Chemicals excl. pharmaceuticals	9.9	10.7	13.7	13.1	10.6	8.2	7.6	7.6
Railroad equipment and other transport equip.	1.0	0.5	0.6	0.3	0.4	0.7	0.7	0.5
Other machinery and equipment	17.9	18.6	19.3	17.9	15.4	13.0	10.7	9.9
Medium-low-technology products	**19.3**	**20.0**	**19.9**	**22.5**	**17.1**	**16.0**	**16.6**	**17.9**
Coke, refined petroleum prod. and nuclear fuel	4.3	2.2	2.6	7.7	3.7	2.9	2.1	3.0
Rubber and plastics products	1.2	1.2	1.8	2.0	2.5	3.0	3.7	3.6
Other non-metallic mineral products	1.1	1.1	1.2	1.4	1.5	1.6	1.8	2.0
Building and repairing of ships and boats	0.9	2.6	0.8	0.2	0.2	0.3	0.3	0.2
Basic metals	9.6	10.3	11.0	9.2	7.1	5.6	5.8	6.0
Fabricated metal products, excl. machinery	2.3	2.6	2.4	1.9	2.0	2.6	2.9	3.0
Low-technology products	**24.1**	**24.8**	**19.5**	**16.1**	**23.6**	**28.0**	**28.8**	**27.5**
Other manufacturing and recycling	7.0	5.4	1.7	1.1	1.8	2.4	2.6	2.7
Wood, pulp, paper and printed products	2.8	2.5	2.3	2.4	2.9	3.7	4.3	4.7
Food products, beverages and tobacco	10.3	11.9	11.5	7.4	8.4	9.3	10.0	9.9
Textiles, textile products, leather and footwear	4.0	5.0	4.0	5.2	10.6	12.5	11.9	10.3

Source: Chelem database and own calculations.

All other MHT sub-sectors have $B_{ij}^M > 1$ in more than two periods. The HT sub-sector of "Pharmaceuticals" accounts also for a higher percentage of total imports in Portugal in all periods considered, but this gap has been decreasing over time. Additionally, the Portuguese economy has a higher than average import proportion of the LT broad category since the beginning of the nineties. In particular, the sub-sectors of "Food products, beverages and tobacco" and of "Textiles, textile products, leather and footwear" have above 1 Balassa indices since mid-eighties. In the first case, the Balassa indices are also above 1 during the seventies. Finally, in the last periods of the sample, there is an increase of the Balassa index of the MLT broad category, reflecting mostly the $B_{ij}^M > 1$ of three sub-sectors: "Other non-metallic mineral products", "Rubber and plastics products" and "Fabricated metal products, excluding machinery".

A comparison of the Portuguese import Balassa indices of the main technological categories with the ones of Greece, Spain and Ireland is reported in Figures (14(a)) to (14(d)). For the most recent period, Table 8 presents the comparative import structure at a more detailed level. The figures reporting the contributions of each sub-sector to the country-differences in import-structure in the main four technological categories

Table 7 - Relative import specialization of the Portuguese economy, Balassa index

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
High-technology products	1.1	1.0	0.9	1.0	0.8	0.7	0.6	0.7
Aircraft and spacecraft	1.2	1.0	0.4	0.7	0.4	0.4	0.4	0.5
Pharmaceuticals	2.0	1.8	2.6	2.3	1.4	1.1	1.2	1.1
Office, accounting and computing machinery	0.6	0.6	0.6	0.8	0.7	0.6	0.5	0.5
Radio, TV and communications equipment	1.2	0.8	0.7	0.9	0.8	0.7	0.6	0.7
Medical, precision and optical instruments	0.8	0.9	1.0	0.9	0.7	0.7	0.7	0.7
Medium-high-technology products	1.3	1.3	1.3	1.3	1.2	1.2	1.1	1.0
Other electrical machinery and apparatus	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9
Motor vehicles, trailers and semi-trailers	1.3	1.1	1.1	1.2	1.3	1.4	1.5	1.3
Chemicals excl. pharmaceuticals	1.2	1.2	1.5	1.4	1.1	1.0	0.9	0.9
Railroad equipment and other transport equip.	1.5	0.6	0.8	0.4	0.7	1.1	1.2	0.8
Other machinery and equipment	1.4	1.5	1.5	1.5	1.3	1.2	1.0	1.0
Medium-low-technology products	0.8	0.8	0.8	0.9	0.8	0.9	1.0	1.0
Coke, refined petroleum prod. and nuclear fuel	1.1	0.5	0.5	1.0	0.8	0.8	0.7	0.8
Rubber and plastics products	0.7	0.7	0.9	0.9	1.0	1.1	1.3	1.3
Other non-metallic mineral products	0.6	0.7	0.7	0.8	0.9	0.9	1.2	1.4
Building and repairing of ships and boats	0.5	1.3	0.4	0.2	0.2	0.4	0.3	0.2
Basic metals	0.8	0.8	1.1	1.0	0.9	0.8	0.9	1.0
Fabricated metal products, excl. machinery	0.8	0.9	0.8	0.6	0.8	1.0	1.1	1.2
Low-technology products	0.8	0.9	0.7	0.7	0.9	1.1	1.2	1.3
Other manufacturing and recycling	2.1	1.6	0.5	0.4	0.5	0.7	0.8	0.8
Wood, pulp, paper and printed products	0.4	0.4	0.4	0.5	0.6	0.8	0.9	1.1
Food products, beverages and tobacco	0.9	1.1	1.2	0.8	1.1	1.2	1.4	1.6
Textiles, textile products, leather and footwear	0.4	0.6	0.5	0.6	1.2	1.4	1.4	1.4

Source: Chelem database and own calculations.

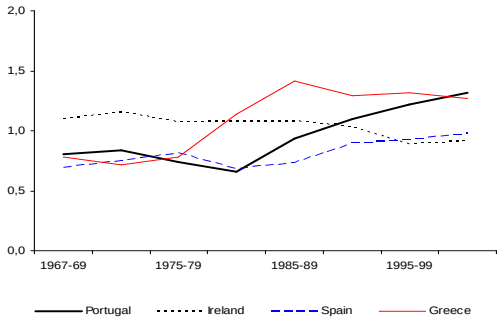
following the equivalent to decomposition (3) are presented in Appendix D.

Although these four countries show some non-negligible differences in terms of import structure, such differences are much smaller than the ones detected on the export side (Section 4). Some explanations can be put forward. The fact that the differences between countries are smaller in the import side may result from relative consumption preferences that are broadly similar between these countries. Additionally, we found several situations in which a country simultaneously exports and imports some products above the world average. This feature points to the existence of intra-industry trade, which is defined as the existence of simultaneous exports and imports within industries, 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 horizontally differentiated products). However, if the j category is sufficiently broad as to include goods involved in the different stages of its production chain, this can also be due to vertical specialization activities.[37] In our sample, given the broad product breakdown used in the two levels of aggregation, the intermediate good and the good then exported are typically classified under

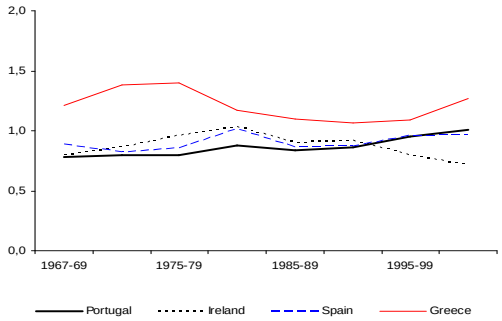
[37] On the link between vertical specialization and intra-industry trade, see Jones et al. (2002).

Figure 14: Import Balassa indices by technological intensity

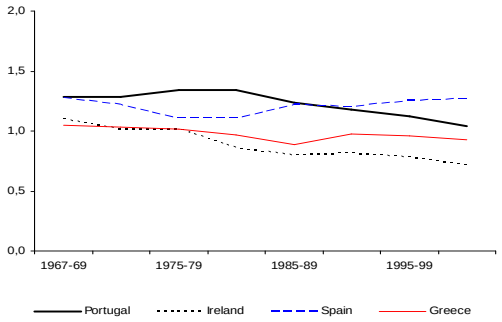
(a) LT sector



(b) MLT sector



(c) MHT sector



(d) HT sector

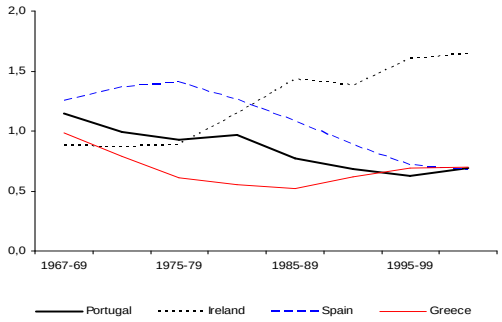


Table 8 - Manufacturing imports by technological intensity (shares in imports and Balassa indices)

average 2000-2004

	Shares in total imports					Balassa indices			
	World	Portugal	Spain	Ireland	Greece	Portugal	Spain	Ireland	Greece
Memo Item:									
Share in total world manufacturing imports	100.0	0.7	2.8	0.9	0.6				
High-technology products	**26.0**	**17.6**	**17.9**	**43.2**	**18.3**	**0.7**	**0.7**	**1.7**	**0.7**
Aircraft and spacecraft	2.6	1.4	1.7	3.0	2.2	0.5	0.7	1.2	0.8
Pharmaceuticals	3.4	3.8	4.3	5.1	5.8	1.1	1.3	1.5	1.7
Office, accounting and computing machinery	6.1	3.1	3.3	17.1	2.6	0.5	0.5	2.8	0.4
Radio, TV and communications equipment	10.1	6.7	5.6	13.8	4.8	0.7	0.5	1.4	0.5
Medical, precision and optical instruments	3.8	2.6	3.1	4.2	3.0	0.7	0.8	1.1	0.8
Medium-high-technology products	**35.6**	**37.0**	**44.3**	**25.5**	**33.0**	**1.0**	**1.2**	**0.7**	**0.9**
Other electrical machinery and apparatus	4.6	4.0	4.1	3.7	2.7	0.9	0.9	0.8	0.6
Motor vehicles, trailers and semi-trailers	11.9	15.0	19.9	6.7	10.8	1.3	1.7	0.6	0.9
Chemicals excl. pharmaceuticals	8.6	7.6	8.6	8.0	8.5	0.9	1.0	0.9	1.0
Railroad equipment and other transport equip	0.6	0.5	0.6	0.3	1.2	0.8	1.1	0.5	2.1
Other machinery and equipment	9.8	9.9	11.0	6.8	9.8	1.0	1.1	0.7	1.0
Medium-low-technology products	**17.5**	**17.9**	**17.1**	**12.1**	**22.8**	**1.0**	**1.0**	**0.7**	**1.3**
Coke, refined petroleum prod. and nuclear fuel	3.7	3.0	3.0	2.8	3.3	0.8	0.8	0.8	0.9
Rubber and plastics products	2.9	3.6	3.3	2.7	2.6	1.3	1.2	0.9	0.9
Other non-metallic mineral products	1.5	2.0	1.4	1.6	1.8	1.4	1.0	1.1	1.2
Building and repairing of ships and boats	0.8	0.2	0.6	0.2	6.7	0.2	0.7	0.2	8.1
Basic metals	6.1	6.0	6.0	2.5	5.8	1.0	1.0	0.4	1.0
Fabricated metal products, excl. machinery	2.6	3.0	2.8	2.4	2.6	1.2	1.1	0.9	1.0
Low-technology products	**20.9**	**27.5**	**20.7**	**19.1**	**25.9**	**1.3**	**1.0**	**0.9**	**1.2**
Other manufacturing and recycling	3.2	2.7	2.4	2.2	2.6	0.8	0.8	0.7	0.8
Wood, pulp, paper and printed products	4.2	4.7	4.1	4.7	4.6	1.1	1.0	1.1	1.1
Food products, beverages and tobacco	6.1	9.9	6.9	6.8	10.4	1.6	1.1	1.1	1.7
Textiles, textile products, leather and footwea	7.5	10.3	7.3	5.4	8.4	1.4	1.0	0.7	1.1

Source: Chelem database and own calculations.

the same product category. Therefore, both situations may be present, being impossible to disentangle their relative importance. However some extreme cases of very high specialization indices in both flows point to the existence of vertical specialization activities.[38]

The evolution of the Irish import specialization in the HT category is specially striking. Having started with a lower share in total imports, Ireland reached a value that is more than twice the ones of the other three countries in the last years (Figure (14(d))). The Irish export and import shares of the HT sub-sector of "Office, accounting and computing machinery" are simultaneously well above world average, with Balassa indices of 3.6 and 2.8 for exports and imports, respectively, in the 2000-04 period. This fact points to the likely existence of relevant international vertical linkages. A similar result, though with a much lower magnitude, is found in the MHT sub-sector of "Motor vehicles, trailers and semi-trailers" in Spain. The automobile industry is also important in Portugal, but the Balassa indexes for imports and exports, though above one, are lower than those of Spain, making it difficult to make a strong point on vertical specialization activities. Another interesting result is found on the MLT sub-sector of "Building and repairing ships and boats" in Greece. In this case the Balassa index for imports is very high (8.1) but for exports it is close to one (1.1), suggesting that Greece imports ships not as part of vertical specialization activities but as a means to export international maritime merchant services. Finally, high import Balassa indexes are found in the LT sub-sectors of "Textiles, textile products, leather and footwear" in Portugal, partly linked to the relevance of this industry in the Portuguese economy, and of "Food products, beverages and tobacco" in Portugal and Greece.

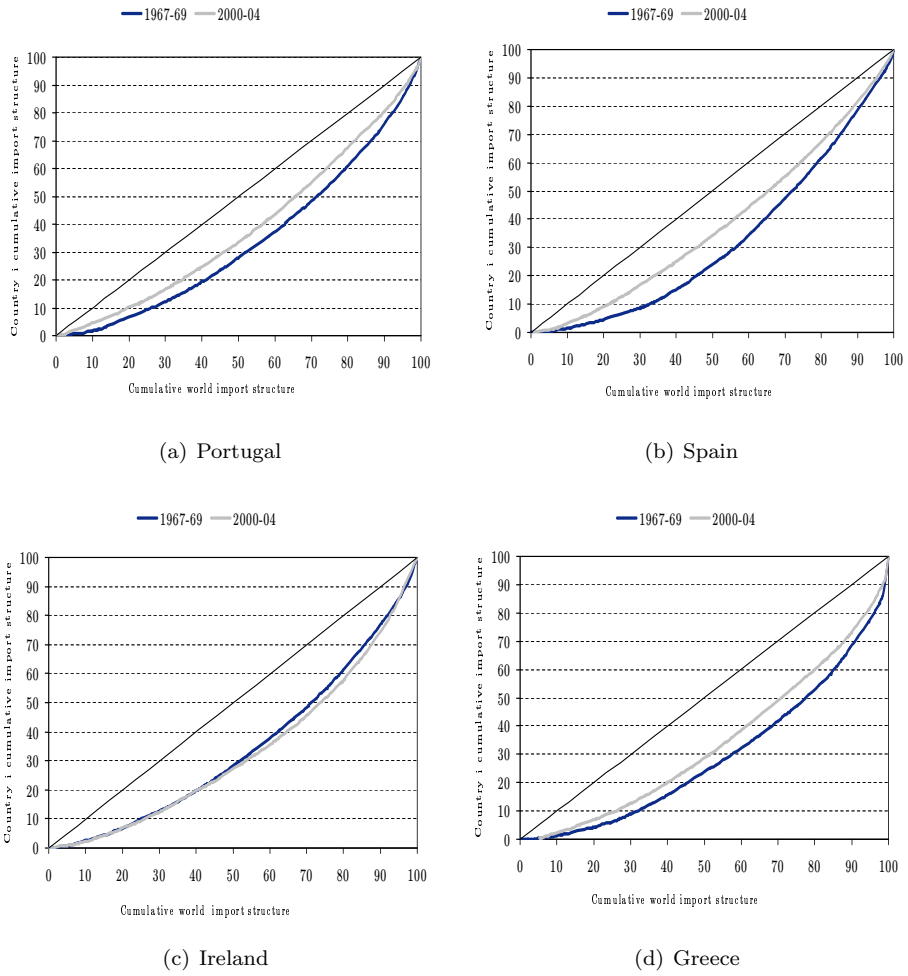
5.2 Distributional analysis of import specialization across industries

5.2.1 Overall specialization patterns

In this section, we use the Balassa (1965) index to examine the evolution of the Portuguese import structure over time, following the methodology applied in Section 4 for the case of exports. The computation of each country's Lorenz curves permits to assess the approximation of its import basket to the world average. Figure 15 includes the pseudo-Lorenz curves for the different countries in the first and last periods. The shapes of the curves are not substantially different among countries and a movement of the Lorenz curves to the left is evident in all countries, with the exception of Ireland. The approximation to the world import structure seems to be somewhat stronger in Spain than in the other countries. The usual measures of inequality of a distribution, like the Gini coefficient and the Theil (1967) index, can be utilized to measure the dispersion of the BS_{ij} indices and, hence, the overall degree of differentiation of a

[38] For a discussion, see Amador et al. (2007).

Figure 15: Imports - Lorenz curves - 1967-69 and 2000-2004



(a) Portugal

(b) Spain

(c) Ireland

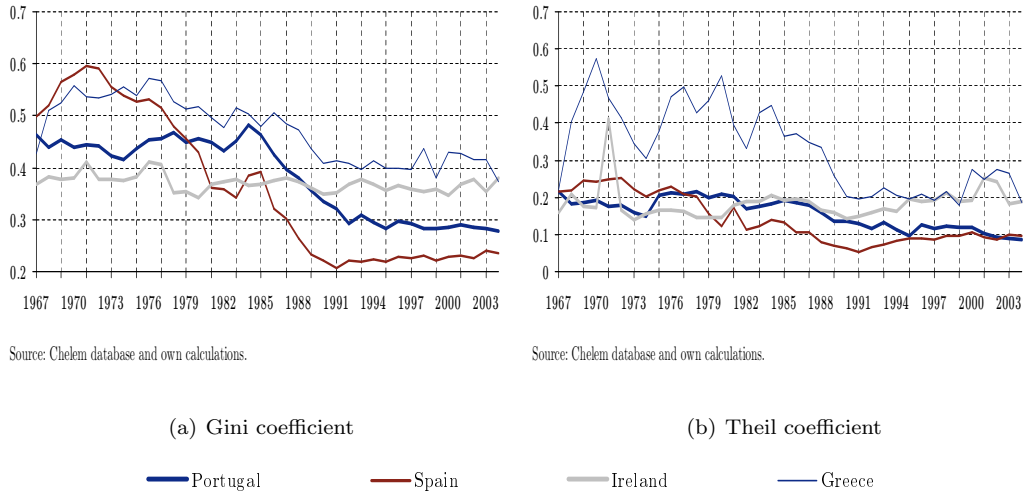
(d) Greece

country´s imports. The higher the value of these indicators, the larger are the differences between the import structure of a country and the corresponding world average. As shown in Figure 16, in the most recent period, the coefficients are higher for Greece and Ireland than for Portugal and Spain, which is the country closer to world average. The country coefficients show also distinct evolutions through time, clearer in the case of the Gini coefficients. A marked downward trend is evident from mid-eighties in Portugal and from the seventies in Spain and, to a lesser extent, in Greece, followed by a stabilization in the three countries since the beginning of the nineties. In Ireland, the computed inequality coefficients have a steadier evolution over the whole period, pointing to a higher stability of the Irish import structure.

Figure 17 includes the standard deviation and the median of the indexes of import specialization computed at the ISIC 4-digit breakdown level, using the Laursen (1998) BS_{ij} transformation.[39] Regarding the dispersion of the import specialization indexes

[39] A summary of the main descriptive statistics computed with the original Balassa index on the import side is included

Figure 16: Measures of overall import specialization



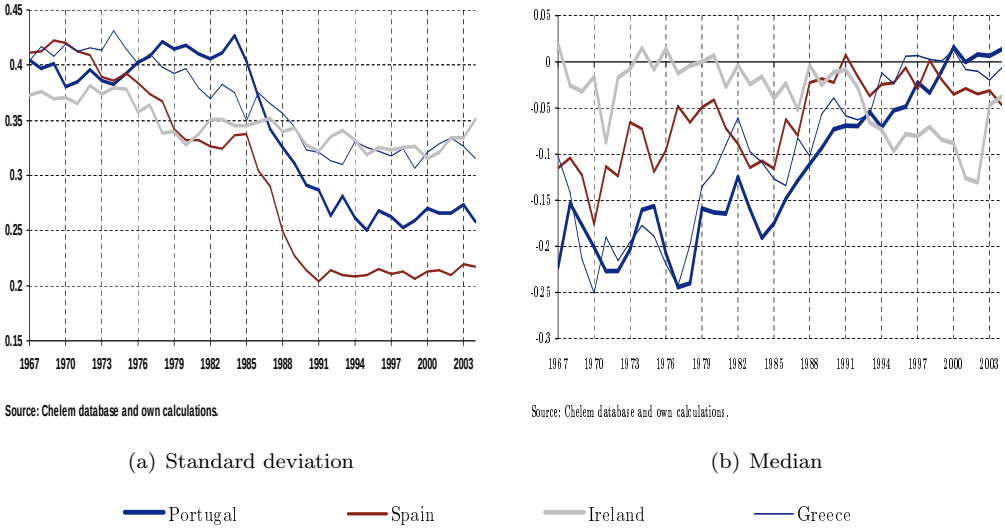
among industries, as measured by the standard deviation, a few points are worth noting (Figure 17(a)). Similarly to what was seen before, there is a marked approximation to the world import basket in Portugal and Spain, which is the country with less dispersion. At present, the dispersion is higher for Ireland and Greece, which suggests a higher inequality across products within these country's import structure. However, all the usual caveats mentioned on subsection 4.2.1 on the interpretation of the standard deviation as a measure of specialization are valid here. The median of the BS_{ij} also provides some indications. As shown in Figure 17(b), the median for Portugal recorded a sharp ascending trend since mid-eighties, pointing to a strong approximation of the Portuguese relative import basket to the world average in the last two decades. The same feature is visible for Spain and Greece. Ireland shows a different evolution: a long period of relative stabilization is followed by some decline of the median over the nineties and some increase in the most recent period.

A more complete portrait of the overall degree of import specialization can be obtained through the analysis of the product-distribution of the indices for each country. Figure 18 shows the estimated kernel density of the symmetric Laursen (1998) BS_{ij} index for each country in the first and last periods of the sample.[40] In the 2000-2004 period, all sectoral distributions are notably centered around the demarcation value of 0, although in different extents. Specially in Spain and Portugal, there is a clear convergence of the import basket towards the world average between the two extreme periods, which is consistent with the previous results. The same feature is evident in Greece, but in a

in Appendix E.

[40] As in the export side, an Epanechnikov kernel function was used and diverse bandwidths were tested. Again, we ended up choosing the optimal bandwidth for estimating densities for the normal distribution.

Figure 17: Imports - Some descriptive statistics of the BS_{ij} index



(a) Standard deviation

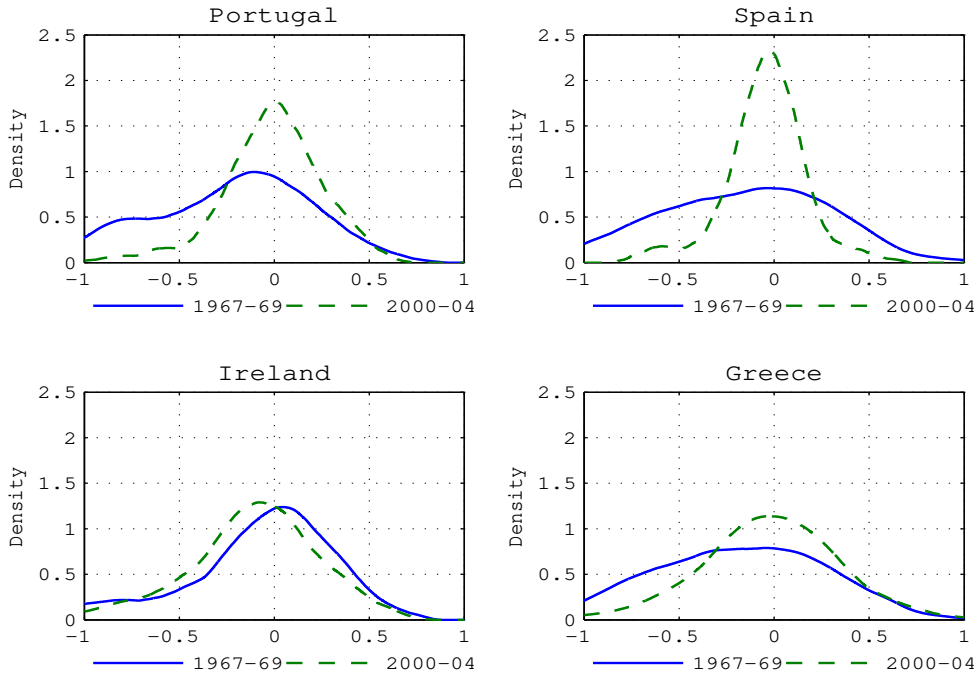
(b) Median

Portugal Spain Ireland Greece

lesser extent. The density estimates of the Irish import structure appear quite stable over time, with no substantial differences in the shape of the distribution between the two extreme periods. If anything, there is a small shift of the estimated Irish kernel to the left in the most recent period, i.e. in the opposite direction of the other countries.

The comparison of Figures 9 and 18 reveals some interesting differences between the cross-industry export and import distributions. In general terms, there are more differences in terms of product composition on the export than on the import side for the four countries analysed, both relatively to the world average and between each other. The density functions estimated for exports are markedly more right skewed than those obtained on the import side, indicating a higher overall degree of specialization, in particular in the first period. On the contrary, the density functions of imports, especially in the last period, are symmetric and roughly centered around the demarcation value, pointing to more similar product import shares across all countries.

Figure 18: Imports - Estimated Kernel Densities



5.2.2 Intra-distribution dynamics

To assess the dynamics of the import structure of each country, we start by calculating the linear correlation coefficients (Table 9). For Portugal and Spain, the linear correlation coefficients between the two extreme periods are close to zero, indicating the existence of substantial changes in these countries' import composition in the last four decades. In Portugal, a major change seems to have occurred in the second half of the eigthies leading to a sharp decline of the correlation coefficients. The same evolution is evident in Spain but in the beginning of the nineties. In the other two countries, the initial patterns of import specialization show a higher stability over time, in particular in Greece where a correlation coefficient of over 60 per cent is found between the first and last periods of our sample.

In order to compare the import structure of each country in the beginning and end of the sample, Figure 19 displays four scatter plots with the respective OLS regression line using the symmetric transformation of the BS_{ij} index. Recall that the lines drawn in the BS_{ij} demarcation value of 0 define four distinct quadrants that are crossed by the 45 degree line of pure persistence. Contrary to what happened in the export side, quadrant III is no longer the most populated area in all countries and, even when that happens, the number of products that maintain a non-specialization status in both periods is much smaller than on the export side. In Portugal, the most populated

Table 9 - Imports - Balassa index: correlation matrices

Portuguese manufacturing imports

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
1967-69	1							
1970-74	0.85	1						
1975-79	0.66	0.80	1					
1980-84	0.52	0.66	0.86	1				
1985-89	0.34	0.48	0.66	0.75	1			
1990-94	0.20	0.34	0.44	0.51	0.89	1		
1995-99	0.08	0.23	0.33	0.36	0.75	0.89	1	
2000-04	-0.01	0.14	0.27	0.29	0.56	0.70	0.87	1

Spanish manufacturing imports

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
1967-69	1							
1970-74	0.97	1						
1975-79	0.95	0.99	1					
1980-84	0.87	0.88	0.91	1				
1985-89	0.63	0.63	0.67	0.79	1			
1990-94	-0.11	-0.12	-0.08	0.11	0.54	1		
1995-99	0.01	0.01	0.06	0.22	0.61	0.85	1	
2000-04	-0.08	-0.11	-0.08	0.05	0.39	0.69	0.85	1

Irish manufacturing imports

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
1967-69	1							
1970-74	0.93	1						
1975-79	0.54	0.67	1					
1980-84	0.49	0.66	0.90	1				
1985-89	0.40	0.56	0.79	0.90	1			
1990-94	0.34	0.46	0.66	0.80	0.94	1		
1995-99	0.26	0.39	0.56	0.71	0.83	0.92	1	
2000-04	0.24	0.35	0.48	0.64	0.74	0.84	0.93	1

Greek manufacturing imports

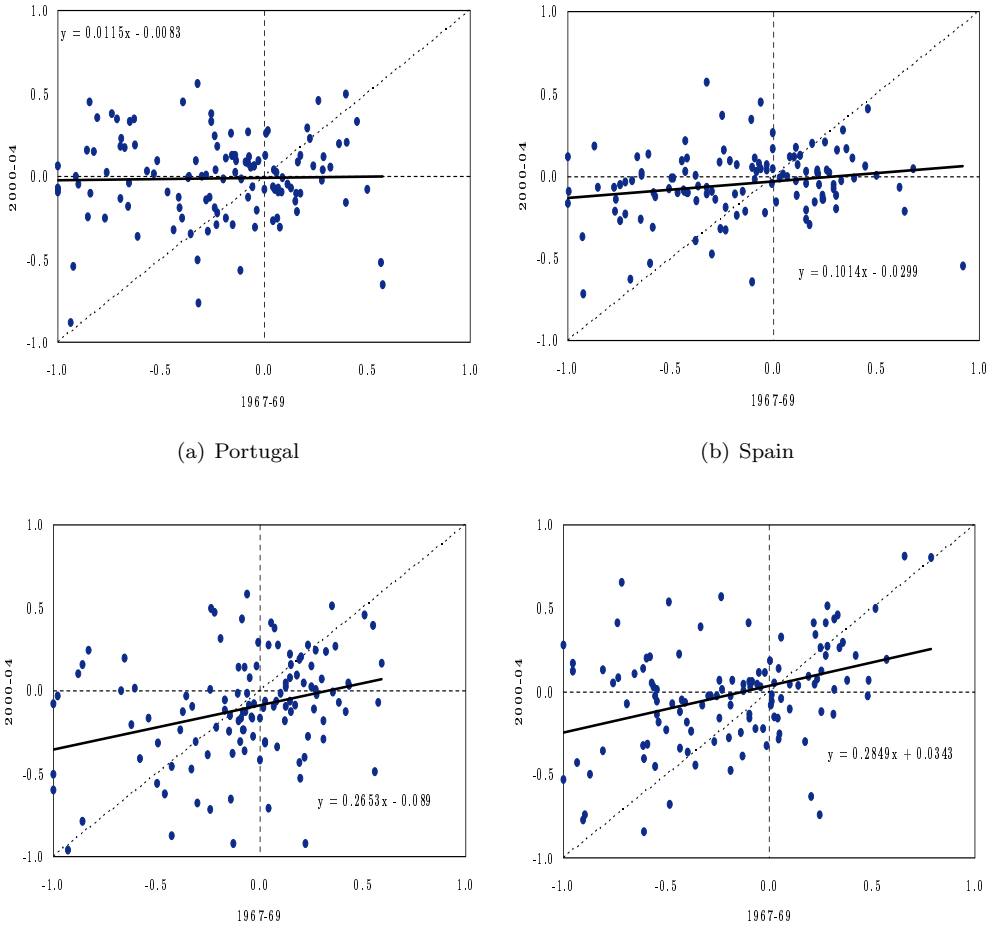
	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
1967-69	1							
1970-74	0.87	1						
1975-79	0.77	0.83	1					
1980-84	0.69	0.76	0.86	1				
1985-89	0.55	0.63	0.76	0.96	1			
1990-94	0.53	0.60	0.70	0.91	0.97	1		
1995-99	0.51	0.57	0.69	0.89	0.94	0.98	1	
2000-04	0.67	0.63	0.73	0.82	0.79	0.85	0.87	1

Source: Chelem database and own calculations.

quadrant is quadrant I, as more than 35 percent of the products changed their status from unspecialized to specialized from the first to the last period. Looking at the OLS regression, no significant relation between the import specialization indexes in the two extreme periods is estimated for Portugal or even for Spain, with the data points seeming to be relatively clustered around 0 in the most recent period. A positive relation is still obtained for Greece and Ireland, although much weaker than the one estimated for exports.

To get a more accurate picture of the intra-distribution dynamics of import specialization, Figure 20 reports the estimated stochastic kernels for 1-year and 15-year transitions of the BS_{ij} index for each country. As it happened on the export side, the results of the 1-year transitions point to a significant persistence of the sectoral import structure of all countries. Again, the degree of persistence declines substantially over longer transition horizons and relevant differences between countries appear. The es-

Figure 19: Imports - The BS_{ij} in 1967-69 and in 2000-04



(a) Portugal

(b) Spain

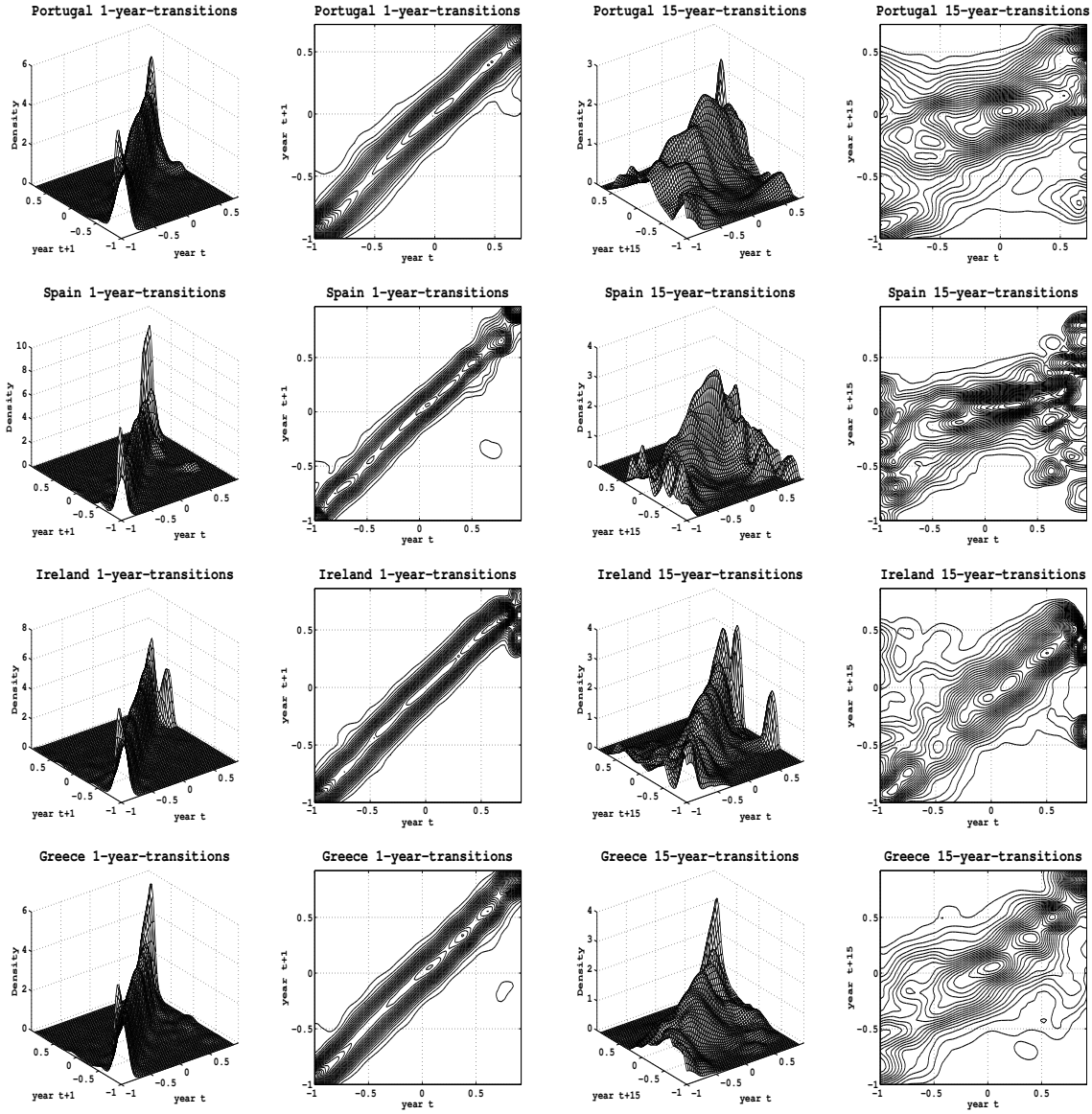
(c) Ireland

(d) Greece

timated transitions over a 15-year horizon suggest a higher degree of mobility of the import structures of Spain and Portugal than those of Greece and Ireland. Specially in Spain, a substantial part of the probability mass is concentrated around the demarcation value of 0, meaning that its import structure tended to converge to the world average over a 15-year horizon. This feature is also visible in the Portuguese case, though less markedly, as a relatively strong persistence appears for the highest values of the index. The probability mass of the other two countries is more clustered around the main diagonal, with the kernel rising to its maximum in the higher values of the specialization index in the case of Greece. In Ireland, there is some tendency to reduction in the higher values of the index, while the lower values of the BS_{ij} show a remarkable persistence.

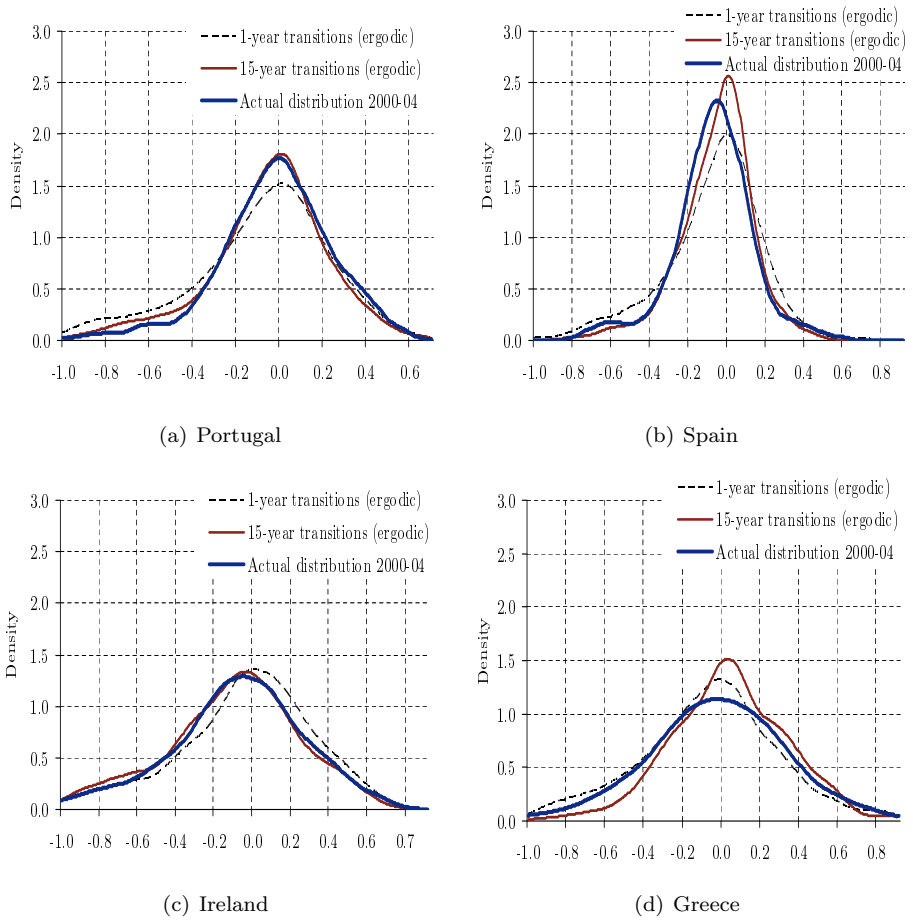
The evolution of the external shape of the distribution of the relative import structures can be further examined by estimating the limit to which the specialization pattern of

Figure 20: Imports - Estimated Stochastic Kernels - 1-year and 15-year transitions



each country would tend if the transitions implicit in the period under analysis went on indefinitely, i.e. the ergodic distribution. Figure (21) includes both the ergodic distributions, obtained from the 1-year and from the 15-year transitions, and the univariate kernel density estimated for the 2000-2004 period. Again, for each country, the density functions are fairly similar, which suggests that the "long term" distribution implied by the transitions is not substantially different from the actual distribution estimated for the most recent period. In Greece, both ergodic distributions have a higher probability mass around the BS_{ij} demarcation value of 0, indicating a further decline in the overall degree of specialization of this country if the transitions seen so

Figure 21: Imports - Actual and implicit ergodic distribution of BS_{ij}



(a) Portugal

(b) Spain

(c) Ireland

(d) Greece

far were to continue. The same feature is visible in the $\tau = 15$ ergodic distribution of Spain.

Finally, on a more descriptive approach, Table 10 includes the values of the B_{ij}^M index for the 10 top and bottom ranked products in Portuguese manufacturing imports in each period. The results for the other three countries are included in Appendix F. A first inspection of this table points to the existence of only one product, a food item, that is present in the top 10 in the beginning and end of the sample. In fact, the historical dependence of the Portuguese economy on imports of food and food related products is evident in this table, as 2 or 3 products of the sector ISIC 15 - Manufacture of food products and beverages are ranked in the top 10 imports in every period. Another product always ranked in the top 10 in all five-year periods but the last (but with a B_{ij}^M clearly above 1 even in this period) is the ISIC 2926 - Machinery of textile products, highlighting the importance of the textile industry in the Portuguese manufacturing structure. Imports of some intermediate products, notably leather and textiles fibres to the clothing and footwear industries, probably to be subsequently

Table 10 - Balassa index: Top10 and Bottom10 products in Portuguese manufacturing imports

1967-69			1970-74			1975-79			1980-84		
Industry		B	Industry		B	Industry		B	Industry		B
Manufactured coke oven prod.	MLT	3.7	Machinery for textile prod.	MHT	2.7	Manufactured sugar	LT	3.9	Machinery for textile prod.	MHT	3.6
Jewellery and related articles	LT	3.6	Preserved fish & fish products	LT	2.6	Prepared animal feeds	LT	2.8	Tanned & dressed leather pr.	LT	2.6
Other publishing	LT	3.0	Domestic appliances n.e.c.	MHT	2.6	Pharmaceuticals	HT	2.6	Manufactured sugar	LT	2.5
Manufactured sugar	LT	2.7	Jewellery and related articles	LT	2.4	Machinery for textile prod.	MHT	2.5	Service act. rel. to printing	LT	2.3
Domestic appliances n.e.c.	MHT	2.3	Other publishing	LT	2.4	Plastics and synthetic rubber	MHT	2.3	Pharmaceuticals	HT	2.3
Railway & tramway locomotives	MHT	2.3	Manufactured sugar	LT	2.3	Preserved fish & fish products	LT	2.1	Ovens, furnaces and burners	MHT	2.2
Preserved fish & fish products	LT	2.3	Prepared animal feeds	LT	1.9	Domestic appliances n.e.c.	MHT	2.1	Other publishing	LT	2.1
Machinery for textile prod.	MHT	2.2	Pharmaceuticals	HT	1.8	Agric. and forestry machinery	MHT	2.0	Agric. and forestry machinery	MHT	2.1
Pharmaceuticals	HT	2.0	Plastics and synthetic rubber	MHT	1.8	Oth. general purpose machinery	MHT	1.7	Refractory ceramic products	MLT	2.0
Machinery for food processing	MHT	1.8	Ovens, furnaces and burners	MHT	1.8	Refractory ceramic products	MLT	1.7	Prepared animal feeds	LT	1.9
Other transport equipment	MHT	0.08	Footwear	LT	0.12	Footwear	LT	0.09	Footwear	LT	0.09
Footwear	LT	0.08	Plywood, particle board & oth.	LT	0.10	Art. concrete, cement, plaster	MLT	0.08	Luggage, handbags, saddlery	LT	0.09
Carpets and rugs	LT	0.05	Other transport equipment	MHT	0.07	Fur; articles of fur	LT	0.07	Plywood, particle board & oth.	LT	0.09
Wines	LT	0.04	Wines	LT	0.05	Sawmilled and planed woods	LT	0.07	Processed nuclear fuels	MLT	0.06
Recycled metal waste & scrap	LT	0.04	Processed nuclear fuels	MLT	0.03	Carpets and rugs	LT	0.05	Carpets and rugs	LT	0.05
Processed nuclear fuels	MLT	0.03	Recycled metal waste & scrap	LT	0.01	Struct. n-refract. ceramic pr.	MLT	0.05	Struct. n-refract. ceramic pr.	MLT	0.04
Service act. rel. to printing	LT	0.00	Service act. rel. to printing	LT	0.00	Recycled metal waste & scrap	LT	0.05	Wines	LT	0.03
Indust. process control equip.	HT	0.00	Indust. process control equip.	HT	0.00	Processed nuclear fuels	MLT	0.04	Soft drinks; mineral waters	LT	0.03
Build. repair. pleasure boats	MLT	0.00	Build. repair. pleasure boats	MLT	0.00	Soft drinks; mineral waters	LT	0.03	Recycled metal waste & scrap	LT	0.02
Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00

1985-89			1990-94			1995-99			2000-04		
Industry		B	Industry		B	Industry		B	Industry		B
Tanned & dressed leather pr.	LT	5.3	Tanned & dressed leather pr.	LT	5.0	Tanned & dressed leather pr.	LT	4.3	Tanned & dressed leather pr.	LT	3.5
Machinery for textile prod.	MHT	3.5	Preserved fish & fish products	LT	2.7	Preserved fish & fish products	LT	2.8	Preserved fish & fish products	LT	3.0
Manufactured sugar	LT	3.0	Prepared text. fibres; fabrics	LT	2.4	Prepared text. fibres; fabrics	LT	2.3	Prepared animal feeds	LT	2.7
Preserved fish & fish products	LT	2.6	Motorcycles	MHT	2.1	Prepared animal feeds	LT	2.3	Cement, lime and plaster	MLT	2.6
Agric. and forestry machinery	MHT	2.4	Spirits; ethyl alcohol	LT	2.0	Spirits; ethyl alcohol	LT	2.3	Newspapers journals periodic.	LT	2.6
Prepared text. fibres; fabrics	LT	2.3	Machinery for textile prod.	MHT	2.0	Newspapers journals periodic.	LT	2.2	Art. concrete, cement, plaster	MLT	2.2
Other textiles n.e.c.	LT	2.0	Other textiles n.e.c.	LT	1.9	Struct. n-refract. ceramic pr.	MLT	2.2	Prepared text. fibres; fabrics	LT	2.2
Parts for motor vehicles	MHT	1.7	Manufactured sugar	LT	1.7	Machinery for textile prod.	MHT	2.0	Struct. n-refract. ceramic pr.	MLT	2.1
Prepared animal feeds	LT	1.7	Insulated wire and cable	MHT	1.7	Other textiles n.e.c.	LT	2.0	Bakery products	LT	2.1
Service act. rel. to printing	LT	1.6	Paints, printing ink & mastics	MHT	1.7	Paints, printing ink & mastics	MHT	1.9	Other pr. of wood, cork, straw	LT	2.1
Preserved fruit and vegetables	LT	0.26	Aircraft and spacecraft	HT	0.38	Fertilizers & nitrogen comp.	MHT	0.43	Office and computing machinery	HT	0.50
Builders' carpentry & joinery	LT	0.22	Electronic valves and tubes	HT	0.36	Aircraft and spacecraft	HT	0.42	Fertilizers & nitrogen comp.	MHT	0.49
Plywood, particle board & oth.	LT	0.20	Jewellery and related articles	LT	0.31	Tobacco products	LT	0.42	Fur; articles of fur	LT	0.47
Building & repairing of ships	MLT	0.19	Building & repairing of ships	MLT	0.30	Electronic valves and tubes	HT	0.38	Machinery for metallurgy	MHT	0.33
Jewellery and related articles	LT	0.18	Sawmilled and planed woods	LT	0.29	Steam generators	MLT	0.33	Jewellery and related articles	LT	0.31
Art. concrete, cement, plaster	MLT	0.18	Tobacco products	LT	0.23	Building & repairing of ships	MLT	0.29	Recycled metal waste & scrap	LT	0.29
Sawmilled and planed woods	LT	0.14	Cement, lime and plaster	MLT	0.22	Engines, exc. vehicle engines	MHT	0.27	Engines, exc. vehicle engines	MHT	0.28
Cut stones	MLT	0.10	Manufactured coke oven prod.	MLT	0.19	Machinery for metallurgy	MHT	0.27	Manufactured coke oven prod.	MLT	0.21
Tobacco products	LT	0.07	Cut stones	MLT	0.18	Manufactured coke oven prod.	MLT	0.15	Building & repairing of ships	MLT	0.13
Processed nuclear fuels	MLT	0.05	Processed nuclear fuels	MLT	0.07	Processed nuclear fuels	MLT	0.07	Processed nuclear fuels	MLT	0.06

Source: Chelem database and own calculations.

Note:

Industry also in the Top 10 / Bottom 10 in the previous period.

In **Bold**, industry in the Top 10 / Bottom 10 in the 1967/69 and in the 2004/04 periods.

incorporated in exports, represent also a high proportion of Portuguese imports from mid-eighties onwards.

6 Conclusions

This paper focuses on the evolution of the international trade pattern of Portugal over the last forty years and confronts it with developments in the other EU15 Cohesion countries (Spain, Greece and Ireland). In general, the changes seen in Portugal bear similarities with those observed in Spain and Greece. Conversely, Ireland shows remarkable differences in many aspects of the evolution of its pattern of international specialization.

Over the last decades, Portugal and the other EU15 Cohesion countries significantly increased their trade openness. In Ireland, however, the gap relatively to the other countries has increased over time and, at present, its degree of openness is substantially higher than that of Portugal, Spain and Greece, which are clustered around similar figures.

The aggregation of the available 120 manufacturing products into four broad categories with distinct technological intensities (high, medium-high, medium-low and low-technology) reveals that one striking feature of the evolution of Portuguese international trade was the continuous decline in the export share of low-tech products over the last four decades. This decline was particularly sharp in "Food products, beverages and tobacco" and "Textiles, textile products, leather and footwear". On the contrary, there was a marked increase of the share of medium-high-tech exports, in particular "Motor vehicles, trailers and semi-trailers" since the second half of the nineties.

The four countries considered have become less specialized in low-tech products over the last four decades, as measured by the evolution of the Balassa (1965) index of revealed comparative advantage. This trend was especially strong in Ireland, which is the only country where a specialization in low-tech products is not evident presently. On the contrary, Portugal still has a clear specialization in this type of products in the 2000-04 period, similar to that of Greece. In what concerns medium-low-tech products, there was an increase of its export share in Portugal, although still showing a Balassa index below 1. The same upward trend was observed in Greece, whose specialization index has always been the highest. On the contrary, Ireland and Spain showed a decreasing trend over the last 20 years, although the later country maintains a higher specialization in these products. As for medium-high-tech products, all countries increased their export share of these products, though Spain shows values substantially higher than those of the other countries and above the world average since mid-eighties.

In the case of high-tech products, Portugal, Spain and Greece show a high resemblance over the entire sample period, always with coefficients below 1. Portugal had a slightly higher specialization index than Spain and Greece until mid-eighties, but that difference disappeared in the most recent period. The specialization index in Portugal is broadly similar in the beginning and the end of the sample period, pointing to the maintenance of a strong comparative disadvantage of the Portuguese economy in these products. The striking point in this technological category is the sharp increase of export specialization observed in Ireland, partly associated with its participation in vertical specialization activities.

Our results point to a decline of the overall degree of specialization of Portuguese exports between 1967-69 and 2000-04. There is evidence of some diversification of the range of products in which Portugal specializes, with smaller differences among them. However, in spite of the convergence of the Portuguese export structure to the world average, significant differences still remain. The same convergence movement is evident in Greece and, in a much larger extent, in Spain, which is the least specialized of the four countries. On the contrary, the Irish export structure is the most concentrated of all countries and substantially different from the world benchmark, with its specialization relying in fewer products. Although Irish exports showed some increase in diversification during the seventies and the eighties, this behaviour was reversed in subsequent years and, hence, the overall extent of specialization is higher now than in the beginning of the sample period. These results are robust to the use of different statistical procedures to measure export specialization.

The empirical evidence on intra-distribution dynamics reveals some signs of persistence of the export specialization pattern of these countries. In Portugal, the rank of the products in most of the adjacent five-year periods is broadly similar and, if we compare the beginning and the end of the sample, 50 per cent of the products appear in the top rank in both periods. All products ranked in the top 10 in the most recent period belong either to the low-tech or to the medium-low-tech groups, confirming the relatively low technological content of Portuguese manufacturing exports. Using 1-year transitions over the entire sample period, the results point to a strong persistence of the sectoral export pattern of all countries, as it would be expected. However, the degree of mobility increases substantially using 15-year transitions, but a significant persistence of the high values of the index is still detected, pointing to some stability of the products with a high specialization status.

On the import side, differences between Portugal and the other countries are clearly lower than in exports. In general terms, the density functions estimated for exports are markedly more right skewed than those obtained on the import side, indicating

a higher degree of specialization, in particular in the first period considered. On the contrary, the density functions of imports, especially in the last period, are symmetric and roughly centered around the demarcation value, pointing to a more similar product composition across countries. These similarities may reflect close relative consumer preferences. Nevertheless, some differences are identified at the more disaggregated level. These may be associated with vertical specialization activities, notably the high and rising importance of imports of some high-tech products in Ireland.

The diversification of the product structure over the last four decades in Portugal is stronger for imports than for exports. In the recent period, the level of specialization of imports is higher in Greece and Ireland than in Portugal and Spain, which is the most diversified country. In the Portuguese case, there is a clear convergence of the import basket towards the world average over the last four decades, specially strong in the second half of the eighties. A marked downward trend in specialization indicators is also evident in Spain and Greece in the first decades of the sample. However, it seems that the diversification of import structures stabilized since the beginning of the nineties in these three countries. In Ireland, the different indicators show a more steady evolution over the whole period. As for the intra-distribution dynamics, measured by the estimated transitions over a 15-year horizon, the results suggest a higher degree of mobility of the import structures of Spain and Portugal than those of Greece and Ireland. In the Portuguese case, we find that the degree of persistence of import patterns is lower than that of exports, in particular over longer horizons.

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Appendices

A Product classification by technological intensity

		ISIC rev.3
High-technology products	**HT**	
Aircraft and spacecraft	HT1	353
Pharmaceuticals	HT2	2423
Office, accounting and computing machinery	HT3	30
Radio, TV and communications equipment	HT4	32
Medical, precision and optical instruments	HT5	33
Medium-high-technology products	**MHT**	
Other electrical machinery and apparatus	MHT1	31
Motor vehicles, trailers and semi-trailers	MHT2	34
Chemicals excl. pharmaceuticals	MHT3	24 excl. 2423
Railroad equipment and other transport equip.	MHT4	352 + 359
Other machinery and equipment	MHT5	29
Medium-low-technology products	**MLT**	
Coke, refined petroleum prod. and nuclear fuel	MLT1	23
Rubber and plastics products	MLT2	25
Other non-metallic mineral products	MLT3	26
Building and repairing of ships and boats	MLT4	351
Basic metals	MLT5	27
Fabricated metal products, excl. machinery	MLT6	28
Low-technology products	**LT**	
Other manufacturing and recycling	LT1	36-37
Wood, pulp, paper and printed products	LT2	20-22
Food products, beverages and tobacco	LT3	15-16
Textiles, textile products, leather and footwear	LT4	17-19
Total manufacturing		15-37

Source: Chelem database.

The product breakdown used here and available in the CEPII - CHELEM database follows the OECD classification of manufacturing industries according to technology intensity using the ISIC Rev. 3 breakdown of activity. This classification was based on the analysis of R&D expenditure and output of 12 OECD countries in the period 1991-99. For more information, see OECD (2005).

B Exports - Balassa index: descriptive statistics

Portugal

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
Min.	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.02
Max.	35.31	29.38	33.61	26.81	23.09	24.34	23.78	24.29
Median	0.36	0.42	0.40	0.39	0.39	0.45	0.49	0.62
Mean	1.84	1.66	1.63	1.47	1.38	1.36	1.33	1.39
St Dev.	5.51	4.41	4.45	3.76	3.24	3.15	2.95	2.81
Kurtosis	21.44	23.10	28.69	25.37	22.80	27.50	31.88	39.93
Skewness	4.62	4.68	5.06	4.82	4.47	4.80	5.14	5.70
Count B > 1	29	32	25	28	25	27	33	41
Export share of B > 1	79.0	77.7	73.1	68.5	64.2	67.1	72.4	69.4

Spain

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
Min.	0,00	0,00	0,00	0,00	0,09	0,09	0,11	0,12
Max.	15,37	11,00	9,56	10,84	6,82	8,17	9,42	9,59
Median	0,61	0,69	0,77	0,76	0,73	0,80	0,87	0,95
Mean	1,33	1,30	1,28	1,22	1,10	1,06	1,14	1,16
St Dev.	2,29	1,83	1,73	1,63	1,22	1,11	1,16	1,12
Kurtosis	16,39	9,30	9,98	15,93	8,47	17,97	24,24	27,80
Skewness	3,76	2,90	3,06	3,64	2,83	3,77	4,21	4,39
Count B > 1	36	42	42	41	39	43	46	55
Export share of B > 1	70,6	62,2	63,6	55,5	67,6	62,9	61,0	63,6

Ireland

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
Min.	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00
Max.	28,70	16,86	12,06	9,91	13,26	15,03	16,35	9,15
Median	0,34	0,51	0,58	0,62	0,60	0,48	0,30	0,18
Mean	1,38	1,32	1,26	1,18	1,12	1,01	0,79	0,60
St Dev.	3,31	2,42	2,06	1,76	1,98	2,01	1,81	1,29
Kurtosis	40,39	17,73	13,22	10,55	20,89	28,55	47,44	20,16
Skewness	5,64	3,88	3,49	3,11	4,23	4,93	6,17	4,15
Count B > 1	35	38	43	43	32	23	19	13
Export share of B > 1	83,5	77,1	79,5	78,9	74,8	71,1	77,0	80,9

Greece

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
Min.	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00
Max.	40,42	39,03	33,52	32,86	48,03	47,30	50,54	54,74
Median	0,17	0,23	0,32	0,29	0,32	0,41	0,56	0,69
Mean	1,24	1,30	1,44	1,50	1,56	1,61	1,79	1,82
St Dev.	4,83	4,46	4,26	4,23	5,24	5,10	5,28	5,35
Kurtosis	49,18	51,52	37,20	35,32	56,02	57,19	63,48	81,75
Skewness	6,79	6,86	5,89	5,65	7,00	7,03	7,37	8,48
Count B > 1	22	27	30	36	28	31	41	44
Export share of B > 1	86,4	86,0	85,7	87,7	83,8	79,9	77,8	76,3

Source: Chelem database and own calculations.

C Exports - Balassa index: Top10 and Bottom10 products

Spain

1967-69			1970-74			1975-79			1980-84		
Industry		B	Industry		B	Industry		B	Industry		B
Wines	LT	15.4	Wines	LT	11.0	Wooden containers	LT	9.6	Wooden containers	LT	10.8
Wooden containers	LT	11.8	Wooden containers	LT	7.6	Cement, lime and plaster	MLT	9.1	Cement, lime and plaster	MLT	9.5
Preserved fruit and vegetables	LT	9.4	Footwear	LT	7.6	Wines	LT	8.4	Wines	LT	6.2
Books,brochures, musical books	LT	8.2	Books,brochures, musical books	LT	7.5	Books,brochures, musical books	LT	6.1	Struct. n-refract. ceramic pr.	MLT	5.7
Other pr. of wood, cork, straw	LT	8.1	Preserved fruit and vegetables	LT	7.1	Cut stones	MLT	5.9	Books,brochures, musical books	LT	5.3
Footwear	LT	6.5	Fur; articles of fur	LT	5.9	Footwear	LT	5.8	Fur; articles of fur	LT	4.7
Cut stones	MLT	5.7	Other pr. of wood, cork, straw	LT	5.5	Preserved fruit and vegetables	LT	5.3	Cut stones	MLT	4.6
Preserved fish & fish products	LT	4.4	Rubber tyres and tubes	MLT	5.0	Fur; articles of fur	LT	5.0	Preserved fruit and vegetables	LT	3.7
Fur; articles of fur	LT	3.8	Cut stones	MLT	4.6	Rubber tyres and tubes	MLT	4.3	Footwear	LT	3.5
Vegetable & animal oils & fats	LT	3.7	Preserved fish & fish products	LT	3.7	Struct. n-refract. ceramic pr.	MLT	3.8	Rubber tyres and tubes	MLT	3.1
Sawmilled and planed woods	LT	0.09	Engines, exc. vehicle engines	MHT	0.10	Watches and clocks	HT	0.11	Electronic valves and tubes	HT	0.14
Aircraft and spacecraft	HT	0.08	Watches and clocks	HT	0.09	Indust. process control equip.	HT	0.10	TV & radio receivers, record.	HT	0.14
Recycled metal waste & scrap	LT	0.08	Sawmilled and planed woods	LT	0.09	Sawmilled and planed woods	LT	0.10	Malt liquors and malt	LT	0.14
Watches and clocks	HT	0.06	Recycled metal waste & scrap	LT	0.08	Processed nuclear fuels	MLT	0.09	Optical instr. & photo equip.	HT	0.14
Manufactured dairy products	LT	0.05	Manufactured sugar	LT	0.07	Recycled metal waste & scrap	LT	0.07	Macaroni, couscous and similar	LT	0.10
Manufactured sugar	LT	0.01	Manufactured dairy products	LT	0.03	Malt liquors and malt	LT	0.06	Watches and clocks	HT	0.09
Indust. process control equip.	HT	0.00	Indust. process control equip.	HT	0.00	Manufactured dairy products	LT	0.04	Manufactured dairy products	LT	0.04
Build. repair. pleasure boats	MLT	0.00	Build. repair. pleasure boats	MLT	0.00	Manufactured coke oven prod.	MLT	0.01	Manufactured coke oven prod.	MLT	0.02
Other transport equipment	MHT	0.00	Other transport equipment	MHT	0.00	Manufactured sugar	LT	0.00	Manufactured sugar	LT	0.02
Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00

1985-89			1990-94			1995-99			2000-04		
Industry		B	Industry		B	Industry		B	Industry		B
Struct. n-refract. ceramic pr.	MLT	6.8	Struct. n-refract. ceramic pr.	MLT	8.2	Struct. n-refract. ceramic pr.	MLT	9.4	Struct. n-refract. ceramic pr.	MLT	9.6
Fur; articles of fur	LT	6.0	Fur; articles of fur	LT	5.7	Cut stones	MLT	5.6	Cut stones	MLT	5.4
Cut stones	MLT	5.6	Cut stones	MLT	5.5	Fur; articles of fur	LT	4.9	Wines	LT	4.4
Wines	LT	5.3	Wines	LT	4.8	Wines	LT	4.6	Build. repair. pleasure boats	MLT	3.4
Wooden containers	LT	5.1	Preserved fruit and vegetables	LT	2.9	Rubber tyres and tubes	MLT	2.7	Fur; articles of fur	LT	3.3
Cement, lime and plaster	MLT	4.3	Rubber tyres and tubes	MLT	2.9	Motor vehicles	MHT	2.7	Preserved fruit and vegetables	LT	2.8
Preserved fruit and vegetables	LT	3.8	Motor vehicles	MHT	2.6	Books,brochures, musical books	LT	2.6	Books,brochures, musical books	LT	2.6
Books,brochures, musical books	LT	3.3	Footwear	LT	2.4	Footwear	LT	2.6	Newspapers journals periodic.	LT	2.6
Footwear	LT	3.2	Books,brochures, musical books	LT	2.3	Preserved fruit and vegetables	LT	2.6	Motor vehicles	MHT	2.5
Rubber tyres and tubes	MLT	3.1	Vegetable & animal oils & fats	LT	2.3	Build. repair. pleasure boats	MLT	2.5	Rubber tyres and tubes	MLT	2.3
Tobacco products	LT	0.22	Jewellery and related articles	LT	0.26	Watches and clocks	HT	0.28	Carpets and rugs	LT	0.28
Bicycles and invalid carriages	MHT	0.21	Recycled n-metal waste & scrap	LT	0.26	Office and computing machinery	HT	0.28	Office and computing machinery	HT	0.21
TV & radio receivers, record.	HT	0.21	Watches and clocks	HT	0.22	Indust. process control equip.	HT	0.25	Engines, exc. vehicle engines	MHT	0.20
Malt liquors and malt	LT	0.20	Recorded media	LT	0.18	Tobacco products	LT	0.24	Jewellery and related articles	LT	0.20
Engines, exc. vehicle engines	MHT	0.17	Bicycles and invalid carriages	MHT	0.18	Jewellery and related articles	LT	0.24	Recycled metal waste & scrap	LT	0.18
Watches and clocks	HT	0.16	Electronic valves and tubes	HT	0.15	Engines, exc. vehicle engines	MHT	0.20	Other transport equipment	MHT	0.17
Electronic valves and tubes	HT	0.15	Optical instr. & photo equip.	HT	0.14	Electronic valves and tubes	HT	0.14	Sawmilled and planed woods	LT	0.17
Optical instr. & photo equip.	HT	0.15	Processed nuclear fuels	MLT	0.13	Optical instr. & photo equip.	HT	0.13	Manufactured sugar	LT	0.15
Sawmilled and planed woods	LT	0.14	Sawmilled and planed woods	LT	0.10	Sawmilled and planed woods	LT	0.13	Electronic valves and tubes	HT	0.15
Macaroni, couscous and similar	LT	0.09	Tobacco products	LT	0.09	Recycled metal waste & scrap	LT	0.11	Optical instr. & photo equip.	HT	0.12

Source: Chelem database and own calculations.

Note:

Industry also in the Top 10 / Bottom 10 in the previous period.

In **Bold**, industry in the Top 10 / Bottom 10 in the 1967/69 and in the 2004/04 periods.

C Exports - Balassa index: Top10 and Bottom10 products

Ireland

1967-69			1970-74			1975-79			1980-84		
Industry		B	Industry		B	Industry		B	Industry		B
Malt liquors and malt	LT	28.7	Malt liquors and malt	LT	16.9	Manufactured dairy products	LT	12.1	Other publishing	LT	9.9
Manuf. cocoa, chocolate, sugar	LT	12.2	Manufactured dairy products	LT	10.6	Other publishing	LT	11.4	Other manuf. food prod. n.e.c.	LT	8.9
Other publishing	LT	11.2	Manuf. cocoa, chocolate, sugar	LT	9.5	Other manuf. food prod. n.e.c.	LT	8.8	Manufactured dairy products	LT	8.7
Meat and meat products	LT	10.5	Prepared animal feeds	LT	9.2	Meat and meat products	LT	8.7	Meat and meat products	LT	6.6
Manufactured dairy products	LT	8.4	Meat and meat products	LT	9.0	Malt liquors and malt	LT	7.7	Malt liquors and malt	LT	5.5
Prepared animal feeds	LT	7.4	Other publishing	LT	8.2	Manuf. cocoa, chocolate, sugar	LT	6.0	Spirits; ethyl alcohol	LT	5.4
Bakery products	LT	5.4	Carpets and rugs	LT	4.7	Prepared animal feeds	LT	5.5	Manuf. cocoa, chocolate, sugar	LT	4.9
Tanned & dressed leather pr.	LT	4.6	Tanned & dressed leather pr.	LT	4.4	Medical & surgical equip.	HT	4.1	Office and computing machinery	HT	4.7
Refractory ceramic products	MLT	4.5	Bakery products	LT	4.3	Carpets and rugs	LT	3.3	Medical & surgical equip.	HT	4.2
Carpets and rugs	LT	4.3	Medical & surgical equip.	HT	4.1	Office and computing machinery	HT	2.8	Prepared animal feeds	LT	4.1
Ovens, furnaces and burners	MHT	0.01	Sawmilled and planed woods	LT	0.04	Railway & tramway locomotives	MHT	0.07	Building & repairing of ships	MLT	0.07
Motor vehicles	MHT	0.01	Parts for motor vehicles	MHT	0.02	Machinery for metallurgy	MHT	0.07	Manufactured coke oven prod.	MLT	0.05
Machinery for metallurgy	MHT	0.01	Steam generators	MLT	0.02	Struct. n-refract. ceramic pr.	MLT	0.06	Struct. n-refract. ceramic pr.	MLT	0.05
Motorcycles	MHT	0.00	Machinery for metallurgy	MHT	0.02	Steam generators	MLT	0.04	Wines	LT	0.04
Parts for motor vehicles	MHT	0.00	Motorcycles	MHT	0.01	Manufactured grain mill prod.	LT	0.04	Manufactured grain mill prod.	LT	0.04
Processed nuclear fuels	MLT	0.00	Processed nuclear fuels	MLT	0.00	Wines	LT	0.03	Recycled metal waste & scrap	LT	0.02
Service act. rel. to printing	LT	0.00	Service act. rel. to printing	LT	0.00	Motorcycles	MHT	0.01	Processed nuclear fuels	MLT	0.01
Build. repair. pleasure boats	MLT	0.00	Build. repair. pleasure boats	MLT	0.00	Weapons and ammunition	MHT	0.00	Motorcycles	MHT	0.01
Other transport equipment	MHT	0.00	Other transport equipment	MHT	0.00	Processed nuclear fuels	MLT	0.00	Weapons and ammunition	MHT	0.01
Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00

1985-89			1990-94			1995-99			2000-04		
Industry		B	Industry		B	Industry		B	Industry		B
Other manuf. food prod. n.e.c.	LT	13.3	Recorded media	LT	15.0	Recorded media	LT	16.4	Recorded media	LT	9.2
Recorded media	LT	12.5	Other manuf. food prod. n.e.c.	LT	12.5	Other manuf. food prod. n.e.c.	LT	7.7	Pharmaceuticals	HT	6.2
Manufactured dairy products	LT	7.8	Manufactured dairy products	LT	6.5	Pharmaceuticals	HT	5.0	Basic chemicals, exc. fertil.	MHT	4.8
Spirits; ethyl alcohol	LT	5.9	Spirits; ethyl alcohol	LT	5.0	Manufactured dairy products	LT	4.3	Other manuf. food prod. n.e.c.	LT	4.5
Meat and meat products	LT	5.4	Meat and meat products	LT	4.7	Office and computing machinery	HT	3.9	Medical & surgical equip.	HT	4.2
Office and computing machinery	HT	4.9	Malt liquors and malt	LT	4.6	Basic chemicals, exc. fertil.	MHT	3.7	Office and computing machinery	HT	3.6
Malt liquors and malt	LT	4.3	Pharmaceuticals	HT	4.1	Spirits; ethyl alcohol	LT	3.0	Manufactured dairy products	LT	2.8
Other publishing	LT	4.0	Office and computing machinery	HT	3.9	Meat and meat products	LT	3.0	Other chemical products n.e.c.	MHT	2.7
Manuf. cocoa, chocolate, sugar	LT	4.0	Manuf. cocoa, chocolate, sugar	LT	3.3	Malt liquors and malt	LT	2.8	Spirits; ethyl alcohol	LT	2.5
Medical & surgical equip.	HT	2.9	Other publishing	LT	2.7	Medical & surgical equip.	HT	2.7	Meat and meat products	LT	2.2
Ovens, furnaces and burners	MHT	0.07	Steam generators	MLT	0.07	Recycled metal waste & scrap	LT	0.05	Motorcycles	MHT	0.03
Motor vehicles	MHT	0.06	Watches and clocks	HT	0.07	Wines	LT	0.05	Railway & tramway locomotives	MHT	0.02
Musical instruments	LT	0.06	Bearings, gears	MHT	0.06	Motorcycles	MHT	0.05	Recycled n-metal waste & scrap	LT	0.02
Building & repairing of ships	MLT	0.05	Building & repairing of ships	MLT	0.04	Motor vehicles	MHT	0.04	Building & repairing of ships	MLT	0.02
Accumulators and primary cells	MHT	0.04	Motor vehicles	MHT	0.04	Building & repairing of ships	MLT	0.04	Build. repair. pleasure boats	MLT	0.02
Recycled metal waste & scrap	LT	0.03	Motorcycles	MHT	0.03	Musical instruments	LT	0.03	Machinery for metallurgy	MHT	0.02
Motorcycles	MHT	0.02	Railway & tramway locomotives	MHT	0.03	Railway & tramway locomotives	MHT	0.02	Fur; articles of fur	LT	0.01
Manufactured coke oven prod.	MLT	0.01	Manufactured coke oven prod.	MLT	0.02	Processed nuclear fuels	MLT	0.01	Processed nuclear fuels	MLT	0.01
Processed nuclear fuels	MLT	0.01	Weapons and ammunition	MHT	0.01	Manufactured coke oven prod.	MLT	0.01	Manufactured coke oven prod.	MLT	0.00
Weapons and ammunition	MHT	0.00	Processed nuclear fuels	MLT	0.01	Weapons and ammunition	MHT	0.00	Weapons and ammunition	MHT	0.00

Source: Chelem database and own calculations.

Note:

Industry also in the Top 10 / Bottom 10 in the previous period.

In Bold, industry in the Top 10 / Bottom 10 in the 1967/69 and in the 2004/04 periods.

C Exports - Balassa index: Top10 and Bottom10 products

Greece

1967-69			1970-74			1975-79			1980-84		
Industry		B	Industry		B	Industry		B	Industry		B
Fur; articles of fur	LT	40.4	Fur; articles of fur	LT	39.0	Fur; articles of fur	LT	33.5	Fur; articles of fur	LT	32.9
Preserved fruit and vegetables	LT	31.6	Preserved fruit and vegetables	LT	26.3	Cement, lime and plaster	MLT	24.3	Cement, lime and plaster	MLT	26.0
Cement, lime and plaster	MLT	11.0	Cement, lime and plaster	MLT	13.4	Preserved fruit and vegetables	LT	21.9	Preserved fruit and vegetables	LT	17.4
Wines	LT	7.8	Wines	LT	5.2	Macaroni, couscous and similar	LT	5.2	Cut stones	MLT	9.8
Vegetable & animal oils & fats	LT	6.9	Carpets and rugs	LT	4.5	Cut stones	MLT	4.4	Macaroni, couscous and similar	LT	6.3
Recycled metal waste & scrap	LT	6.7	Recycled metal waste & scrap	LT	4.4	Art. concrete, cement, plaster	MLT	4.2	Knitted fabrics & articles	LT	6.1
Starches and starch products	LT	2.5	Art. concrete, cement, plaster	MLT	4.2	Knitted fabrics & articles	LT	4.0	Prepared animal feeds	LT	4.8
Manuf. basic non-ferr. metals	MLT	2.4	Macaroni, couscous and similar	LT	3.2	Recycled metal waste & scrap	LT	3.8	Manufactured grain mill prod.	LT	4.2
Other chemical products n.e.c.	MHT	2.2	Spirits; ethyl alcohol	LT	3.2	Wines	LT	3.4	Recycled metal waste & scrap	LT	4.1
Spirits; ethyl alcohol	LT	1.9	Starches and starch products	LT	3.1	Insulated wire and cable	MHT	3.4	Refractory ceramic products	MLT	3.6
Motorcycles	MHT	0.00	Lifting and handling equipment	MHT	0.01	Watches and clocks	HT	0.01	Aircraft and spacecraft	HT	0.02
Watches and clocks	HT	0.00	Weapons and ammunition	MHT	0.00	Ovens, furnaces and burners	MHT	0.01	Optical instr. & photo equip.	HT	0.02
Weapons and ammunition	MHT	0.00	Railway & tramway locomotives	MHT	0.00	Musical instruments	LT	0.01	Watches and clocks	HT	0.01
Bicycles and invalid carriages	MHT	0.00	Watches and clocks	HT	0.00	Bicycles and invalid carriages	MHT	0.01	Machinery for metallurgy	MHT	0.01
Service act. rel. to printing	LT	0.00	Processed nuclear fuels	MLT	0.00	Office and computing machinery	HT	0.01	Musical instruments	LT	0.01
Manufactured coke oven prod.	MLT	0.00	Service act. rel. to printing	LT	0.00	Machinery for metallurgy	MHT	0.01	Processed nuclear fuels	MLT	0.00
Indust. process control equip.	HT	0.00	Indust. process control equip.	HT	0.00	Railway & tramway locomotives	MHT	0.01	Bicycles and invalid carriages	MHT	0.00
Build. repair. pleasure boats	MLT	0.00	Build. repair. pleasure boats	MLT	0.00	Processed nuclear fuels	MLT	0.00	Railway & tramway locomotives	MHT	0.00
Other transport equipment	MHT	0.00	Other transport equipment	MHT	0.00	Indust. process control equip.	HT	0.00	Motorcycles	MHT	0.00
Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00

1985-89			1990-94			1995-99			2000-04		
Industry		B	Industry		B	Industry		B	Industry		B
Fur; articles of fur	LT	48.0	Fur; articles of fur	LT	47.3	Fur; articles of fur	LT	50.5	Fur; articles of fur	LT	54.7
Cement, lime and plaster	MLT	25.3	Cement, lime and plaster	MLT	23.3	Cement, lime and plaster	MLT	21.8	Cement, lime and plaster	MLT	14.5
Preserved fruit and vegetables	LT	16.3	Preserved fruit and vegetables	LT	14.7	Preserved fruit and vegetables	LT	13.4	Recycled metal waste & scrap	LT	12.3
Cut stones	MLT	9.8	Cut stones	MLT	11.8	Cut stones	MLT	9.6	Preserved fruit and vegetables	LT	11.4
Knitted fabrics & articles	LT	8.8	Knitted fabrics & articles	LT	9.0	Recycled metal waste & scrap	LT	9.4	Cut stones	MLT	7.3
Vegetable & animal oils & fats	LT	5.5	Vegetable & animal oils & fats	LT	7.6	Vegetable & animal oils & fats	LT	8.9	Knitted fabrics & articles	LT	5.9
Wearing apparel, except fur	LT	4.6	Wearing apparel, except fur	LT	4.5	Knitted fabrics & articles	LT	8.1	Tobacco products	LT	5.3
Refractory ceramic products	MLT	4.1	Wines	LT	3.8	Tobacco products	LT	4.1	Vegetable & animal oils & fats	LT	5.0
Made-up text. art. exc. appar.	LT	3.8	Made-up text. art. exc. appar.	LT	3.3	Macaroni, couscous and similar	LT	4.0	Cordage, rope, twine & netting	LT	4.5
Wines	LT	3.3	Refined petroleum products	MLT	2.8	Wearing apparel, except fur	LT	3.3	Macaroni, couscous and similar	LT	4.3
TV & radio receivers, record.	HT	0.02	Bearings, gears	MHT	0.06	Steam generators	MLT	0.07	Office and computing machinery	HT	0.12
Musical instruments	LT	0.02	Office and computing machinery	HT	0.05	Watches and clocks	HT	0.07	Optical instr. & photo equip.	HT	0.12
Office and computing machinery	HT	0.02	Motorcycles	MHT	0.05	Motor vehicles	MHT	0.06	Sports goods	LT	0.11
Electronic valves and tubes	HT	0.02	Musical instruments	LT	0.04	Indust. process control equip.	HT	0.05	Rubber tyres and tubes	MLT	0.09
Watches and clocks	HT	0.01	Steam generators	MLT	0.04	Musical instruments	LT	0.05	Motor vehicles	MHT	0.06
Manufactured coke oven prod.	MLT	0.01	Motor vehicles	MHT	0.03	Railway & tramway locomotives	MHT	0.04	Bearings, gears	MHT	0.04
Bicycles and invalid carriages	MHT	0.01	Bicycles and invalid carriages	MHT	0.02	Bearings, gears	MHT	0.04	Railway & tramway locomotives	MHT	0.04
Motor vehicles	MHT	0.00	Watches and clocks	HT	0.02	Electronic valves and tubes	HT	0.01	Electronic valves and tubes	HT	0.03
Motorcycles	MHT	0.00	Electronic valves and tubes	HT	0.02	Processed nuclear fuels	MLT	0.01	Manufactured coke oven prod.	MLT	0.00
Processed nuclear fuels	MLT	0.00	Processed nuclear fuels	MLT	0.00	Manufactured coke oven prod.	MLT	0.01	Processed nuclear fuels	MLT	0.00

Source: Chelem database and own calculations.

Note:

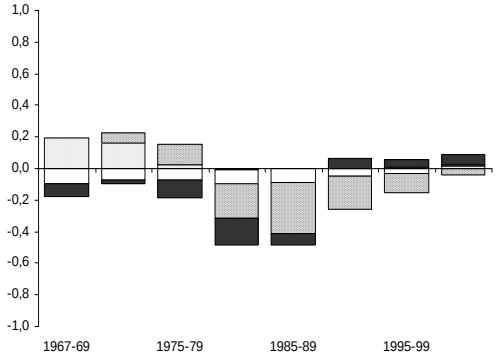
Industry also in the Top 10 / Bottom 10 in the previous period.

In **Bold**, industry in the Top 10 / Bottom 10 in the 1967/69 and in the 2004/04 periods.

D Imports - the decomposition $(B_{PT,J} - B_{i,J})$

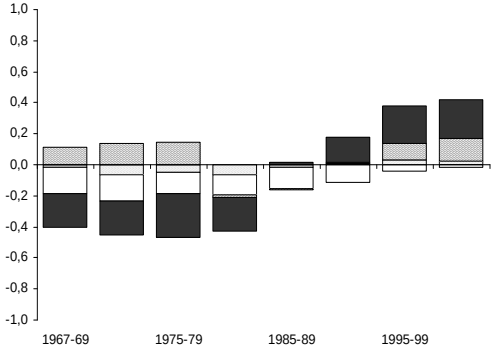
Differential of the Balassa indices relatively to Portugal

(a) LT sector - Greece



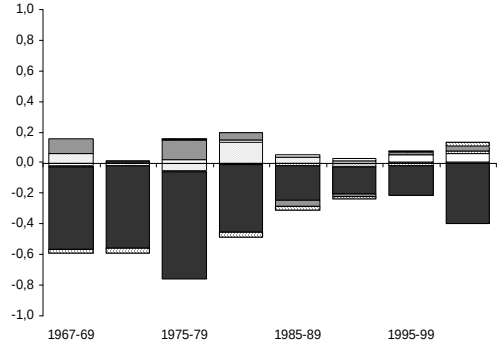
(b) LT sector - Spain

(c) LT sector - Ireland



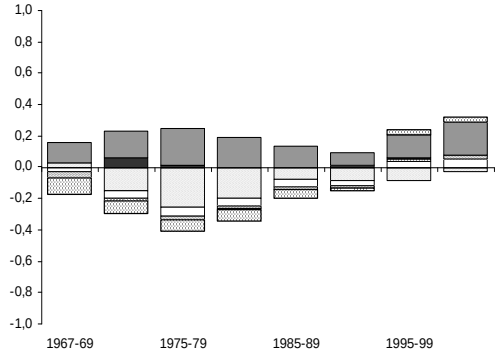
Other manufacturing and recycling | Wood, pulp, paper and printed products | Food products, beverages and tobacco | Textiles, textile products, leather and footwear

(d) MLT sector - Greece



(e) MLT sector - Spain

(f) MLT sector - Ireland



Coke, refined petroleum prod. and nuclear fuel | Rubber and plastics products | Other non-metallic mineral products

Building and repairing of ships and boats | Basic metals | Fabricated metal products, excl. machinery

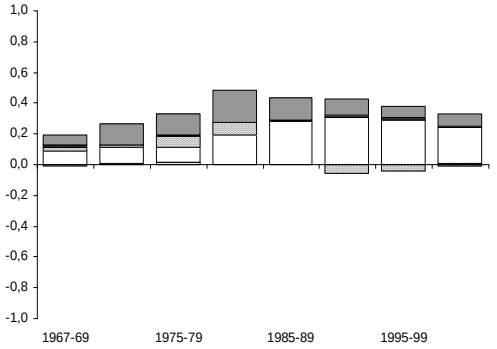
D Imports - the decomposition $(B_{PT,J} - B_{i,J})$

Differential of the Balassa indices relatively to Portugal

(g) MHT sector - Greece

(h) MHT sector - Spain

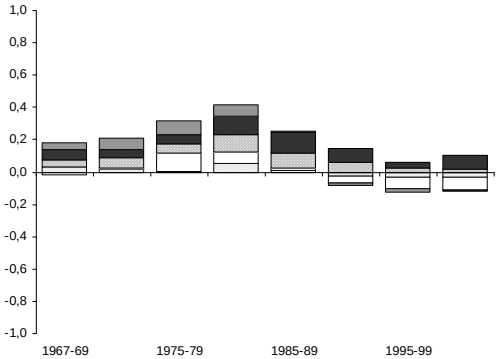
(i) MHT sector - Ireland



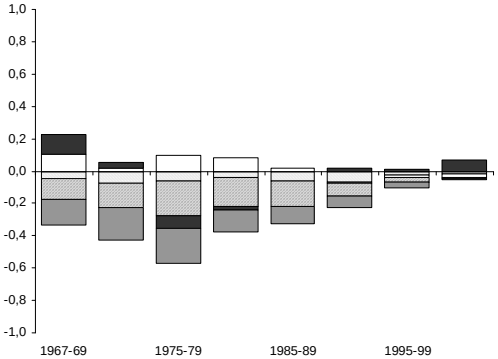
Other electrical machinery and apparatus | Motor vehicles, trailers and semi-trailers | Chemicals excl. pharmaceuticals

Railroad equipment and other transport equip. | Other machinery and equipment

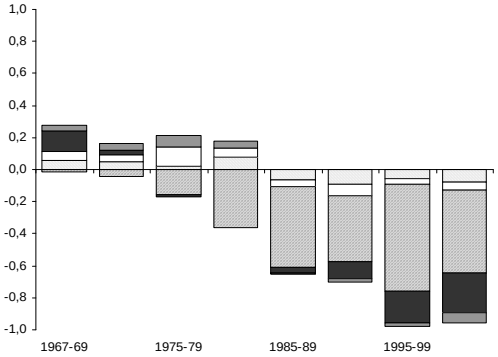
(j) HT sector - Greece



(k) HT sector - Spain



(l) HT sector - Ireland



Aircraft and spacecraft | Pharmaceuticals | Office, accounting and computing machinery | Radio, TV and communications equipment | Medical, precision and optical instruments

E Imports - Balassa index: descriptive statistics

Portugal

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
Min.	0.00	0.00	0.00	0.00	0.05	0.07	0.07	0.06
Max.	3.73	2.66	3.86	3.65	5.26	5.02	4.30	3.51
Median	0.71	0.69	0.70	0.79	0.75	0.89	0.94	1.01
Mean	0.84	0.82	0.83	0.85	0.91	0.97	1.06	1.11
St Dev.	0.71	0.62	0.66	0.67	0.70	0.60	0.58	0.59
Kurtosis	3.50	0.90	3.38	1.75	13.44	16.98	8.11	2.61
Skewness	1.61	1.03	1.45	1.11	2.88	2.99	2.04	1.33
Count B > 1	39	37	39	42	43	49	56	61
Import share of B > 1	64.2	61.6	68.7	72.9	64.0	59.4	61.8	62.8

Spain

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
Min.	0,00	0,00	0,00	0,00	0,09	0,19	0,24	0,17
Max.	24,65	43,52	31,65	8,68	4,26	2,39	2,74	3,68
Median	0,81	0,87	0,91	0,87	0,93	0,99	0,96	0,94
Mean	1,18	1,29	1,20	0,94	0,96	0,98	0,99	1,00
St Dev.	2,33	3,94	2,86	0,86	0,52	0,36	0,41	0,47
Kurtosis	87,49	113,10	110,04	55,19	12,30	1,95	4,40	9,91
Skewness	8,77	10,49	10,28	6,21	2,33	0,70	1,43	2,29
Count B > 1	45	48	55	50	56	57	57	51
import share of B > 1	70,6	74,4	77,7	74,2	74,9	61,2	67,3	62,7

Ireland

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
Min.	0,00	0,00	0,00	0,00	0,04	0,05	0,05	0,02
Max.	3,91	4,06	4,39	4,98	4,58	4,43	3,50	3,82
Median	0,94	0,95	0,97	0,97	0,94	0,94	0,89	0,84
Mean	1,11	1,09	1,14	1,13	1,14	1,10	0,97	0,98
St Dev.	0,77	0,76	0,76	0,78	0,79	0,75	0,65	0,67
Kurtosis	2,49	2,62	2,91	5,81	3,85	3,44	3,23	3,12
Skewness	1,32	1,36	1,38	1,86	1,60	1,57	1,58	1,53
Count B > 1	57	57	59	56	57	56	45	44
import share of B > 1	67,2	59,7	59,6	62,6	62,8	59,0	57,0	61,7

Greece

	1967-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
Min.	0,00	0,00	0,02	0,02	0,06	0,10	0,09	0,09
Max.	8,34	8,14	10,65	18,07	18,77	13,58	14,81	9,61
Median	0,77	0,67	0,70	0,84	0,89	0,94	1,02	1,01
Mean	0,98	1,01	0,97	1,15	1,22	1,20	1,28	1,27
St Dev.	1,05	1,36	1,48	1,83	1,82	1,36	1,46	1,29
Kurtosis	20,56	16,43	28,21	63,96	72,93	57,65	62,57	24,55
Skewness	3,62	3,80	5,05	7,30	7,78	6,65	6,98	4,41
Count B > 1	44	41	34	44	51	54	61	61
import share of B > 1	62,2	66,1	61,6	61,0	60,3	61,1	60,4	65,2

Source: Chelem database and own calculations.

F Imports - Balassa index: Top10 and Bottom10 products

Spain

1967-69			1970-74			1975-79			1980-84		
Industry		B	Industry		B	Industry		B	Industry		B
Recycled metal waste & scrap	LT	24.6	Recycled metal waste & scrap	LT	43.5	Recycled metal waste & scrap	LT	31.7	Recycled metal waste & scrap	LT	8.7
Steam generators	MLT	5.2	Processed nuclear fuels	MLT	3.3	Tobacco products	LT	2.9	Preserved fish & fish products	LT	2.2
Processed nuclear fuels	MLT	4.5	Watches and clocks	HT	2.7	Watches and clocks	HT	2.7	Watches and clocks	HT	2.0
Machinery for metallurgy	MHT	4.2	Tobacco products	LT	2.7	Processed nuclear fuels	MLT	2.3	Musical instruments	LT	1.9
Ovens, furnaces and burners	MHT	3.0	Bearings, gears	MHT	2.3	Bearings, gears	MHT	2.1	Basic chemicals, exc. fertil.	MHT	1.9
Tobacco products	LT	2.7	Steam generators	MLT	2.3	Medical & surgical equip.	HT	2.1	Tobacco products	LT	1.8
Machinery for mining & constr.	MHT	2.6	Machinery for mining & constr.	MHT	2.3	Basic chemicals, exc. fertil.	MHT	1.9	Bearings, gears	MHT	1.6
Engines, exc. vehicle engines	MHT	2.3	Machinery for metallurgy	MHT	2.2	Office and computing machinery	HT	1.9	Processed nuclear fuels	MLT	1.6
Watches and clocks	HT	2.2	Oth. special purpose machinery	MHT	1.9	Other rubber products	MLT	1.8	Office and computing machinery	HT	1.6
Wooden containers	LT	2.1	Basic chemicals, exc. fertil.	MHT	1.9	Tanned & dressed leather pr.	LT	1.8	Other rubber products	MLT	1.6
Manuf. cocoa, chocolate, sugar	LT	0.13	Art. concrete, cement, plaster	MLT	0.16	Art. concrete, cement, plaster	MLT	0.19	Cement, lime and plaster	MLT	0.18
Soft drinks; mineral waters	LT	0.13	Soft drinks; mineral waters	LT	0.13	Plywood, particle board & oth.	LT	0.19	Carpets and rugs	LT	0.17
Macaroni, couscous and similar	LT	0.13	Motorcycles	MHT	0.13	Structural metal products	MLT	0.19	Macaroni, couscous and similar	LT	0.16
Footwear	LT	0.08	Footwear	LT	0.11	Footwear	LT	0.17	Structural metal products	MLT	0.15
Motorcycles	MHT	0.07	Building & repairing of ships	MLT	0.09	Carpets and rugs	LT	0.14	Wines	LT	0.13
Building & repairing of ships	MLT	0.04	Macaroni, couscous and similar	LT	0.06	Macaroni, couscous and similar	LT	0.12	Building & repairing of ships	MLT	0.13
Manufactured grain mill prod.	LT	0.04	Manufactured grain mill prod.	LT	0.01	Wines	LT	0.10	Manufactured grain mill prod.	LT	0.12
Indust. process control equip.	HT	0.00	Indust. process control equip.	HT	0.00	Building & repairing of ships	MLT	0.06	Manufactured sugar	LT	0.12
Service act. rel. to printing	LT	0.00	Service act. rel. to printing	LT	0.00	Manufactured grain mill prod.	LT	0.03	Art. concrete, cement, plaster	MLT	0.12
Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00

1985-89			1990-94			1995-99			2000-04		
Industry		B	Industry		B	Industry		B	Industry		B
Recycled metal waste & scrap	LT	4.3	Spirits; ethyl alcohol	LT	2.4	Build. repair. pleasure boats	MLT	2.7	Build. repair. pleasure boats	MLT	3.7
Build. repair. pleasure boats	MLT	2.4	Preserved fish & fish products	LT	2.0	Spirits; ethyl alcohol	LT	2.7	Spirits; ethyl alcohol	LT	2.7
Spirits; ethyl alcohol	LT	2.1	Tanks, reservoirs & containers	MLT	1.9	Preserved fish & fish products	LT	2.1	Tobacco products	LT	2.4
Processed nuclear fuels	MLT	2.0	Motorcycles	MHT	1.8	Parts for motor vehicles	MHT	2.1	Preserved fish & fish products	LT	2.2
Motorcycles	MHT	2.0	Parts for motor vehicles	MHT	1.7	Tanks, reservoirs & containers	MLT	1.7	Parts for motor vehicles	MHT	2.1
Preserved fish & fish products	LT	1.8	Build. repair. pleasure boats	MLT	1.7	Agric. and forestry machinery	MHT	1.7	Cement, lime and plaster	MLT	1.8
Parts for motor vehicles	MHT	1.7	Tanned & dressed leather pr.	LT	1.7	Tanned & dressed leather pr.	LT	1.7	Tanks, reservoirs & containers	MLT	1.7
Indust. process control equip.	HT	1.7	Domestic appliances n.e.c.	MHT	1.6	Motorcycles	MHT	1.6	Motor vehicles	MHT	1.5
Tanned & dressed leather pr.	LT	1.6	Fur; articles of fur	LT	1.5	Rubber tyres and tubes	MLT	1.5	Agric. and forestry machinery	MHT	1.5
Tanks, reservoirs & containers	MLT	1.5	Other manuf. food prod. n.e.c.	LT	1.4	Service act. rel. to printing	LT	1.5	Lifting and handling equipment	MHT	1.5
Corrugated paper & paperboard	LT	0.38	Carpets and rugs	LT	0.49	Cut stones	MLT	0.49	Printed products	LT	0.51
Wearing apparel, except fur	LT	0.37	Macaroni, couscous and similar	LT	0.41	Weapons and ammunition	MHT	0.44	Other publishing	LT	0.51
Carpets and rugs	LT	0.34	Footwear	LT	0.41	Railway & tramway locomotives	MHT	0.43	Manufactured grain mill prod.	LT	0.46
Weapons and ammunition	MHT	0.25	Recycled metal waste & scrap	LT	0.38	Jewellery and related articles	LT	0.39	Manufactured coke oven prod.	MLT	0.44
Jewellery and related articles	LT	0.24	Manufactured grain mill prod.	LT	0.38	Manufactured grain mill prod.	LT	0.37	Struct. n-refract. ceramic pr.	MLT	0.36
Manufactured grain mill prod.	LT	0.23	Jewellery and related articles	LT	0.35	Art. concrete, cement, plaster	MLT	0.35	Jewellery and related articles	LT	0.31
Footwear	LT	0.23	Struct. n-refract. ceramic pr.	MLT	0.34	Wines	LT	0.32	Recycled metal waste & scrap	LT	0.29
Art. concrete, cement, plaster	MLT	0.20	Electronic valves and tubes	HT	0.31	Building & repairing of ships	MLT	0.29	Wines	LT	0.23
Wines	LT	0.19	Wines	LT	0.22	Struct. n-refract. ceramic pr.	MLT	0.28	Electronic valves and tubes	HT	0.21
Building & repairing of ships	MLT	0.09	Building & repairing of ships	MLT	0.19	Electronic valves and tubes	HT	0.24	Building & repairing of ships	MLT	0.17

Source: Chelem database and own calculations.

Note:

Industry also in the Top 10 / Bottom 10 in the previous period.

In **Bold**, industry in the Top 10 / Bottom 10 in the 1967/69 and in the 2004/04 periods.

F Imports - Balassa index: Top10 and Bottom10 products

Ireland

1967-69			1970-74			1975-79			1980-84		
Industry		B	Industry		B	Industry		B	Industry		B
Tanks, reservoirs & containers	MLT	3.9	Corrugated paper & paperboard	LT	4.1	Bakery products	LT	4.4	Bakery products	LT	5.0
Machinery for food processing	MHT	3.7	Tanks, reservoirs & containers	MLT	3.6	Corrugated paper & paperboard	LT	3.6	Corrugated paper & paperboard	LT	4.2
Jewellery and related articles	LT	3.5	Jewellery and related articles	LT	3.3	Service act. rel. to printing	LT	3.3	Manuf. cocoa, chocolate, sugar	LT	3.2
Corrugated paper & paperboard	LT	3.4	Machinery for food processing	MHT	3.3	Fertilizers & nitrogen comp.	MHT	2.8	Prepared animal feeds	LT	2.8
Newspapers journals periodic.	LT	3.1	Newspapers journals periodic.	LT	2.8	Starches and starch products	LT	2.8	Art. concrete, cement, plaster	MLT	2.6
Other manuf. food prod. n.e.c.	LT	2.5	Other manuf. food prod. n.e.c.	LT	2.7	Agric. and forestry machinery	MHT	2.8	Office and computing machinery	HT	2.6
Insulated wire and cable	MHT	2.5	Bakery products	LT	2.7	Newspapers journals periodic.	LT	2.5	Starches and starch products	LT	2.5
Steam generators	MLT	2.4	Fertilizers & nitrogen comp.	MHT	2.5	Other transport equipment	MHT	2.4	Service act. rel. to printing	LT	2.3
Knitted fabrics & articles	LT	2.2	Wooden containers	LT	2.4	Art. concrete, cement, plaster	MLT	2.3	Soap and detergents, perfumes	MHT	2.3
Agric. and forestry machinery	MHT	2.2	Knitted fabrics & articles	LT	2.2	Other manuf. food prod. n.e.c.	LT	2.3	Newspapers journals periodic.	LT	2.2
Meat and meat products	LT	0.20	Manufactured dairy products	LT	0.15	Macaroni, couscous and similar	LT	0.21	Watches and clocks	HT	0.31
Prepared animal feeds	LT	0.09	Manufactured coke oven prod.	MLT	0.14	Building & repairing of ships	MLT	0.20	Malt liquors and malt	LT	0.29
Macaroni, couscous and similar	LT	0.08	Cut stones	MLT	0.13	Machinery for metallurgy	MHT	0.19	Aircraft and spacecraft	HT	0.23
Machinery for metallurgy	MHT	0.08	Macaroni, couscous and similar	LT	0.09	Motorcycles	MHT	0.18	Motorcycles	MHT	0.17
Manufactured dairy products	LT	0.07	Weapons and ammunition	MHT	0.07	Weapons and ammunition	MHT	0.17	Recycled metal waste & scrap	LT	0.16
Processed nuclear fuels	MLT	0.04	Processed nuclear fuels	MLT	0.03	Malt liquors and malt	LT	0.14	Building & repairing of ships	MLT	0.15
Other transport equipment	MHT	0.01	Other transport equipment	MHT	0.01	Manufactured coke oven prod.	MLT	0.11	Manufactured coke oven prod.	MLT	0.11
Service act. rel. to printing	LT	0.00	Service act. rel. to printing	LT	0.00	Recycled metal waste & scrap	LT	0.08	Weapons and ammunition	MHT	0.09
Build. repair. pleasure boats	MLT	0.00	Build. repair. pleasure boats	MLT	0.00	Processed nuclear fuels	MLT	0.04	Processed nuclear fuels	MLT	0.02
Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00	Recycled n-metal waste & scrap	LT	0.00

1985-89			1990-94			1995-99			2000-04		
Industry		B	Industry		B	Industry		B	Industry		B
Bakery products	LT	4.6	Bakery products	LT	4.4	Soft drinks; mineral waters	LT	3.5	Art. concrete, cement, plaster	MLT	3.8
Corrugated paper & paperboard	LT	4.2	Corrugated paper & paperboard	LT	3.6	Office and computing machinery	HT	3.2	Bakery products	LT	3.1
Manuf. cocoa, chocolate, sugar	LT	3.1	Malt liquors and malt	LT	3.1	Bakery products	LT	3.0	Soft drinks; mineral waters	LT	2.9
Prepared animal feeds	LT	3.1	Newspapers journals periodic.	LT	2.9	Art. concrete, cement, plaster	MLT	2.9	Office and computing machinery	HT	2.8
Service act. rel. to printing	LT	2.8	Soft drinks; mineral waters	LT	2.9	Corrugated paper & paperboard	LT	2.8	Newspapers journals periodic.	LT	2.7
Office and computing machinery	HT	2.7	Manuf. cocoa, chocolate, sugar	LT	2.9	Recorded media	LT	2.6	Malt liquors and malt	LT	2.5
Other publishing	LT	2.6	Prepared animal feeds	LT	2.5	Newspapers journals periodic.	LT	2.5	Medical & surgical equip.	HT	2.4
Art. concrete, cement, plaster	MLT	2.5	Art. concrete, cement, plaster	MLT	2.5	Manuf. cocoa, chocolate, sugar	LT	2.1	Corrugated paper & paperboard	LT	2.3
Newspapers journals periodic.	LT	2.3	Office and computing machinery	HT	2.3	Prepared animal feeds	LT	2.1	Recorded media	LT	2.2
Fertilizers & nitrogen comp.	MHT	2.3	Oth art. of paper & paperboard	LT	2.3	Malt liquors and malt	LT	1.9	Builders' carpentry & joinery	LT	1.9
Tanned & dressed leather pr.	LT	0.30	Watches and clocks	HT	0.26	Bearings, gears	MHT	0.24	Building & repairing of ships	MLT	0.24
Parts for motor vehicles	MHT	0.24	Parts for motor vehicles	MHT	0.25	Motorcycles	MHT	0.19	Motorcycles	MHT	0.21
Building & repairing of ships	MLT	0.21	Jewellery and related articles	LT	0.22	Build. repair. pleasure boats	MLT	0.19	Bearings, gears	MHT	0.19
Machinery for metallurgy	MHT	0.19	Manufactured coke oven prod.	MLT	0.21	Parts for motor vehicles	MHT	0.19	Machinery for textile prod.	MHT	0.17
Motorcycles	MHT	0.16	Motorcycles	MHT	0.21	Machinery for metallurgy	MHT	0.14	Parts for motor vehicles	MHT	0.17
Fur; articles of fur	LT	0.13	Tanned & dressed leather pr.	LT	0.14	Manufactured coke oven prod.	MLT	0.11	Machinery for metallurgy	MHT	0.12
Manufactured coke oven prod.	MLT	0.10	Building & repairing of ships	MLT	0.12	Tanned & dressed leather pr.	LT	0.09	Manufactured coke oven prod.	MLT	0.07
Recycled metal waste & scrap	LT	0.08	Weapons and ammunition	MHT	0.10	Weapons and ammunition	MHT	0.08	Tanned & dressed leather pr.	LT	0.04
Weapons and ammunition	MHT	0.08	Fur; articles of fur	LT	0.08	Processed nuclear fuels	MLT	0.05	Fur; articles of fur	LT	0.04
Processed nuclear fuels	MLT	0.04	Processed nuclear fuels	MLT	0.05	Fur; articles of fur	LT	0.05	Processed nuclear fuels	MLT	0.02

Source: Chelem database and own calculations.

Note:

Industry also in the Top 10 / Bottom 10 in the previous period.

In **Bold**, industry in the Top 10 / Bottom 10 in the 1967/69 and in the 2004/04 periods.

F Imports - Balassa index: Top10 and Bottom10 products

Greece

1967-69			1970-74			1975-79			1980-84		
Industry		B	Industry		B	Industry		B	Industry		B
Building & repairing of ships	MLT	8.3	Fur; articles of fur	LT	8.1	Fur; articles of fur	LT	10.6	Fur; articles of fur	LT	18.1
Fur; articles of fur	LT	4.9	Building & repairing of ships	MLT	7.9	Building & repairing of ships	MLT	9.5	Building & repairing of ships	MLT	8.1
Steam generators	MLT	3.6	Steam generators	MLT	7.8	Wooden containers	LT	8.2	Meat and meat products	LT	3.7
Railway & tramway locomotives	MHT	3.1	Wooden containers	LT	5.6	Machinery for textile prod.	MHT	2.6	Build. repair. pleasure boats	MLT	3.4
Machinery for metallurgy	MHT	2.9	Prepared animal feeds	LT	3.5	Prepared animal feeds	LT	2.6	Manufactured dairy products	LT	3.3
Wooden containers	LT	2.8	Ovens, furnaces and burners	MHT	3.4	Service act. rel. to printing	LT	2.3	Wooden containers	LT	3.2
Ovens, furnaces and burners	MHT	2.5	Build. repair. pleasure boats	MLT	2.4	Agric. and forestry machinery	MHT	2.1	Machinery for food processing	MHT	2.6
Agric. and forestry machinery	MHT	2.2	Machinery for textile prod.	MHT	2.1	Paints, printing ink & mastics	MHT	2.0	Agric. and forestry machinery	MHT	2.4
Pesticides, oth agro-chem. pr.	MHT	2.1	Refractory ceramic products	MLT	2.0	Machinery for food processing	MHT	2.0	Paints, printing ink & mastics	MHT	2.0
Pharmaceuticals	HT	2.0	Machinery for food processing	MHT	2.0	Meat and meat products	LT	1.8	Steam generators	MLT	2.0
Bakery products	LT	0.11	Jewellery and related articles	LT	0.12	Carpets and rugs	LT	0.12	Carpets and rugs	LT	0.21
Other transport equipment	MHT	0.11	Luggage, handbags, saddlery	LT	0.12	Indust. process control equip.	HT	0.10	Luggage, handbags, saddlery	LT	0.21
Jewellery and related articles	LT	0.07	Processed nuclear fuels	MLT	0.10	Preserved fruit and vegetables	LT	0.08	Manufactured grain mill prod.	LT	0.19
Processed nuclear fuels	MLT	0.06	Wearing apparel, except fur	LT	0.09	Art. concrete, cement, plaster	MLT	0.06	Preserved fruit and vegetables	LT	0.19
Cement, lime and plaster	MLT	0.05	Preserved fruit and vegetables	LT	0.08	Manufactured grain mill prod.	LT	0.06	Builders' carpentry & joinery	LT	0.17
Wines	LT	0.03	Bakery products	LT	0.07	Footwear	LT	0.06	Art. concrete, cement, plaster	MLT	0.11
Preserved fruit and vegetables	LT	0.02	Cement, lime and plaster	MLT	0.04	Builders' carpentry & joinery	LT	0.05	Cut stones	MLT	0.11
Footwear	LT	0.02	Footwear	LT	0.02	Wines	LT	0.05	Wines	LT	0.06
Service act. rel. to printing	LT	0.00	Service act. rel. to printing	LT	0.00	Cement, lime and plaster	MLT	0.03	Recycled metal waste & scrap	LT	0.04
Indust. process control equip.	HT	0.00	Indust. process control equip.	HT	0.00	Processed nuclear fuels	MLT	0.02	Processed nuclear fuels	MLT	0.02

1985-89			1990-94			1995-99			2000-04		
Industry		B	Industry		B	Industry		B	Industry		B
Fur; articles of fur	LT	18.8	Fur; articles of fur	LT	13.6	Fur; articles of fur	LT	14.8	Fur; articles of fur	LT	9.6
Building & repairing of ships	MLT	5.1	Building & repairing of ships	MLT	4.0	Building & repairing of ships	MLT	4.2	Building & repairing of ships	MLT	9.0
Manufactured dairy products	LT	4.6	Struct. n-refract. ceramic pr.	MLT	4.0	Struct. n-refract. ceramic pr.	MLT	4.0	Weapons and ammunition	MHT	4.8
Meat and meat products	LT	4.6	Manufactured dairy products	LT	3.7	Spirits; ethyl alcohol	LT	3.7	Struct. n-refract. ceramic pr.	MLT	3.6
Struct. n-refract. ceramic pr.	MLT	3.3	Spirits; ethyl alcohol	LT	3.4	Manufactured dairy products	LT	3.1	Spirits; ethyl alcohol	LT	3.3
Build. repair. pleasure boats	MLT	2.6	Meat and meat products	LT	3.3	Weapons and ammunition	MHT	3.0	Manufactured dairy products	LT	3.1
Spirits; ethyl alcohol	LT	2.4	Build. repair. pleasure boats	MLT	2.6	Meat and meat products	LT	3.0	Railway & tramway locomotives	MHT	3.0
Other manuf. food prod. n.e.c.	LT	2.4	Other manuf. food prod. n.e.c.	LT	2.2	Prepared animal feeds	LT	2.6	Build. repair. pleasure boats	MLT	2.7
Wooden containers	LT	2.3	Tanks, reservoirs & containers	MLT	2.2	Tanks, reservoirs & containers	MLT	2.4	Meat and meat products	LT	2.6
Paints, printing ink & mastics	MHT	2.3	Weapons and ammunition	MHT	2.2	Other manuf. food prod. n.e.c.	LT	2.4	Tanks, reservoirs & containers	MLT	2.4
Office and computing machinery	HT	0.31	Office and computing machinery	HT	0.36	Office and computing machinery	HT	0.38	Tanned & dressed leather pr.	LT	0.38
Aircraft and spacecraft	HT	0.29	Indust. process control equip.	HT	0.33	Insulated wire and cable	MHT	0.38	Bearings, gears	MHT	0.36
Jewellery and related articles	LT	0.21	Wines	LT	0.31	Cut stones	MLT	0.31	Jewellery and related articles	LT	0.33
Recycled metal waste & scrap	LT	0.19	Jewellery and related articles	LT	0.27	Wines	LT	0.27	Indust. process control equip.	HT	0.31
Art. concrete, cement, plaster	MLT	0.16	Recycled metal waste & scrap	LT	0.25	Manufactured coke oven prod.	MLT	0.25	Recycled n-metal waste & scrap	LT	0.23
Electronic valves and tubes	HT	0.15	Cut stones	MLT	0.20	Recycled metal waste & scrap	LT	0.20	Recycled metal waste & scrap	LT	0.19
Wines	LT	0.12	Cement, lime and plaster	MLT	0.14	Processed nuclear fuels	MLT	0.20	Manufactured coke oven prod.	MLT	0.15
Cut stones	MLT	0.08	Manufactured sugar	LT	0.13	Recycled n-metal waste & scrap	LT	0.17	Processed nuclear fuels	MLT	0.15
Processed nuclear fuels	MLT	0.07	Processed nuclear fuels	MLT	0.11	Cement, lime and plaster	MLT	0.11	Cement, lime and plaster	MLT	0.13
Cement, lime and plaster	MLT	0.06	Electronic valves and tubes	HT	0.10	Electronic valves and tubes	HT	0.09	Electronic valves and tubes	HT	0.09

Source: Chelem database and own calculations.

Note:

Industry also in the Top 10 / Bottom 10 in the previous period.

In **Bold**, industry in the Top 10 / Bottom 10 in the 1967/69 and in the 2004/04 periods.

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