Export performance, competitiveness and commodity composition

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Bank of Greece

May 2010

EXPORT PERFORMANCE, COMPETITIVENESS AND COMMODITY COMPOSITION

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ABSTRACT

The study of export performance, especially for countries with serious external imbalances, is essential for economic decision-making. This study attempts to evaluate Greek export performance during the 1996-2001 period, using detailed panel data on bilateral trade by product. Factors explaining Greek export market shares are analysed with the method of Constant Market Shares. In addition, the dynamics of the specialization pattern of Greek exports and the effect of price competitiveness on export market shares are examined. The results show a considerable change in export structure, mainly the geographical structure, with a favourable effect on market shares. Although the pattern of comparative advantages and the technological intensity of Greek exports have improved, exports remain concentrated in low- and medium-technology sectors, while product variety and quality have declined. Finally, the results show heterogeneity among the panels. In the aggregate, export market shares are inelastic with respect to relative and absolute prices, which would call for focus on non-price factors to improve competitiveness in international markets. However, elasticities are greater than one for a considerable proportion of commodities.

Keywords: export performance; market shares; New Trade Theory; comparative advantages; Markov matrix; price and non-price competitiveness.

Acknowledgements: The views presented in this paper are personal and do not necessarily reflect the views of the Bank of Greece. We would like to thank Heather Gibson for comments and participants in the Bank of Greece workshop.

JEL classification codes: C22; F12; F14; O14.

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1. Introduction

Export performance is an important factor that must be taken into consideration in economic policy decision making, especially under the current circumstances, with financial market turmoil already showing detrimental effects on the real sector of the economy. The study of export performance, in particular for countries like Greece, with serious external imbalances, might prove crucial for the choice of policies aimed at addressing these imbalances. In spite of the fact that Greece is a member of the EU and EMU, Greek export performance cannot be characterized as impressive, since total exports of goods remain low at about 7.6% of GDP and cover no more than one third of total imports. This picture reflects the limited competitiveness of Greek products, and their inadequate differentiation and penetration into foreign markets.

This paper attempts to evaluate Greek export performance during the period 1996-2006. The data used are very detailed in terms of products included and markets covered (279 exported products and 95 countries) and represent approximately 95% of total Greek exports. As far as we know, this is the first time that Greek export performance has been approached with such a detailed data set spanning a substantial period of time.

Given the competition that Greek exports - as well as exports of other developed economies - face in international markets from countries like China, Greek export performance may be considered rather satisfactory. In the second half of the 90s, the geographic composition of destination markets for Greek exports demonstrated a significant change. The share of the South-Eastern European (SE Europe) and Mediterranean-Middle Eastern (MME) markets in total exports increased. This shift had a favourable effect on Greek market shares. In addition, the technological intensity of Greek exports improved, as products of medium and high technology represented an increasing share of total exports. In addition, the change in commodity specialization of exports occurred mainly in new markets such as those of SE Europe. However, a further improvement in this direction is necessary, in order to fully exploit the fast-growing international demand for high-technology products. At the same time, the structure of exports in terms of product variety and quality is among the main factors constraining export performance. As far as specialization is concerned, Greek exports remained focused on low- and medium-technology products during the period under review. In 1996, 66% of products showed comparative disadvantages, while at the end of the period the

majority of the exported products showed comparative advantages. Finally, the price competitiveness of Greek exports seems to be rather limited. It is therefore necessary to consider additional, non-price factors that could increase total competitiveness in international markets.

The present study is organized as follows. The degree of exposure of the Greek economy to international trade and particularly the structure of exports by commodity and area of destination are analyzed in section 2. In section 3, the method of Constant Market Share Analysis (CMSA) is applied in order to measure the factors underlying changes in Greek export market shares. The role of the commodity (variety and quality) composition of Greek exports is described in section 4. Section 5 presents the competitive position of Greek exports in international markets and an analysis (both static and dynamic) of the specialization pattern of Greek exports. Finally, the effect of price competitiveness on export market shares is examined. Section 6 summarizes the results and the conclusions of this analysis.

2. Greek export structure and international trade exposure of the Greek economy

2.1. Greek export structure by product type, technological intensity and geographical destination area

The structure of Greek exports by product and geographical destination changed considerably during the 1996-2006 period. The contribution of foodstuff and other manufactured products in exports declined in favor of products in the categories of chemicals, machinery and transportation equipment. Overall, the participation of medium- and high-technology products in exports improved significantly, although their share in total exports is still rather low. At the same time, Greek exports shifted away from their traditional destination of the EU market towards new destinations in the SE Europe region.

The structure of Greek exports by product (one-digit category of the Standard International Trade Classification (SITC),[1] indicates that, the combined share of "foodstuff" and "other manufactured" products[2] in total Greek exports fell from 80% in 1996 to 64% in

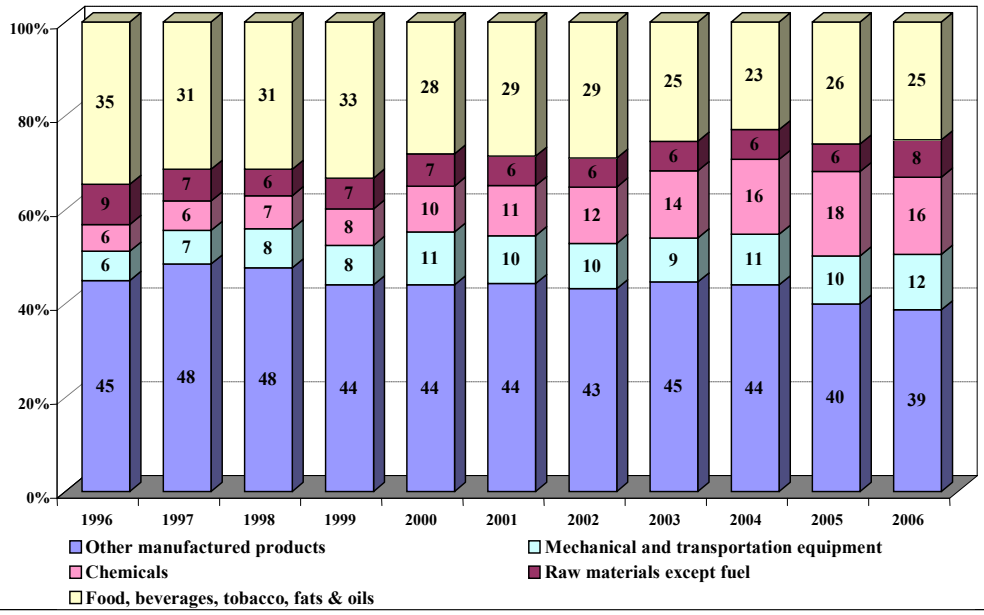
[1] The data used for the analysis of the Greek export structure by product and area include 279 products, as defined by the four-digit SITC.

[2] The product categories presented here correspond to the one-digit SITC codes in parentheses, as follows:

- Foodstuff products: food and beverages (1), tobacco (2) and fats and oils (4).

2006 (Figure 1). On the other hand, exports of "chemicals" and "machinery" almost tripled and doubled their shares, respectively (it should be mentioned that the euro area countries as a whole developed increased specialization in exports of chemicals over the period examined). [3]

Figure 1. Commodity composition of Greek exports
(percentage share in total exports value)



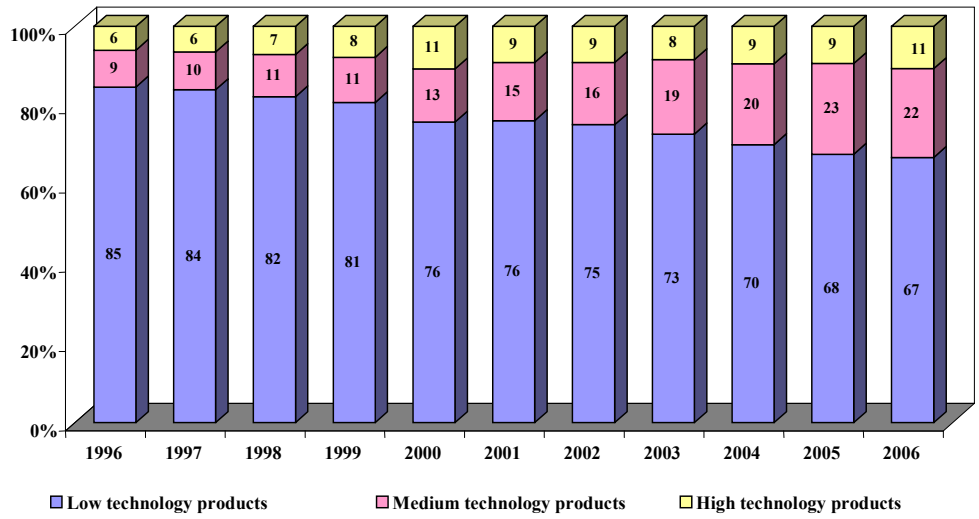
The changes in the composition of Greek exports by technological intensity are shown in Figure 2. Exported goods are grouped into three categories: "low", "medium" and "high" technology. During the period of interest, the share of low-technology products in total exports fell from 85% in 1996 to 67% in 2006, while that of medium-technology exports more than doubled. The share of high-technology products in exports also increased, although to a lesser extent. However, the gradual substitution of low technology-products by medium- and high-technology ones is slow and limited, placing Greek exports in an unfavourable position relative to the rest of the euro area countries (low-technology products represent two thirds of Greek exports and less than one third of EU countries). The technological content of exported products must be given serious consideration if Greece is to benefit from the growth prospects

- Raw materials excluding fuel (2).
- Chemicals: chemical and pharmaceuticals (5).
- Machinery: mechanical and transportation equipment (7).
- Other manufactured products: manufactured products classified by raw material (6) and other manufactured products (8).

[3] Di Mauro and Forster (2008).

of foreign demand, since the markets for high-technology goods are the most dynamic. In addition, Greek exports, as well as the exports of other EU countries (like Portugal) that specialize in low technology products, face strong competition from countries with low labour costs, such as China.

Figure 2. Composition of Greek exports by technological intensity
(percentage change in total exports value)

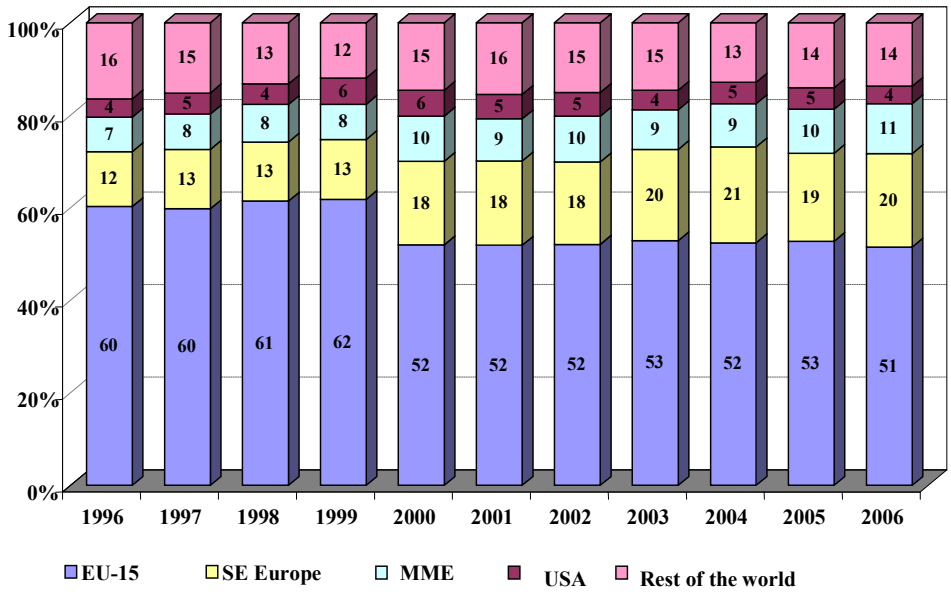


The large EU-15 market remained the major destination for Greek products, despite the fact that its share in Greek exports decreased from 60% in 1996 to 51% in 2006 (Figure 3). However, the process of this geographical redistribution was rather significant in terms of size and consequences. The redirection of Greek exports to alternative destinations, mainly to the SE Europe and the MME countries started in the early 1990s and accelerated during the period under consideration. Specifically, the shares of exports towards these markets rose from 12% and 7% respectively in 1996 to 20% and 11% in 2006. These two regions together absorb almost one third of Greek exports; at the same time, Greek products have a substantial market share in these regions.

Several factors were the key drivers of these developments. First, the increasing competition from third countries encountered by Greek exports in EU-15 markets forced them to find alternative destinations. Second, the already considerable presence of Greek firms and

Figure 3. Geographical distribution of Greek exports

(percentage share in total exports value)



financial institutions in SE Europe and MME countries provided them with knowledge of the local market environment. Third, proximity allowed easy access. Finally, these countries were growing fast. By contrast, the shares of Greek exports towards the USA and the rest of the world did not change significantly.

2.2 Trade exposure of the Greek economy

Over the past three decades, the trade exposure of many European countries expanded under the influence of several factors, such as the gradual international trade liberalization, the smaller distance between markets and lower transportation costs, consumer demand for wider product variety and the increased significance of vertical differentiation. The establishment of initially the EEC (1961) and later the EU (1992) set among its objectives the strengthening of free trade and the development of an expanded common market, to the benefit of all the participating countries. In particular, smaller countries would benefit from the restructuring of production and the resulting increase in foreign trade.

The positive correlation between growth rates and international trade exposure is supported by a number of empirical studies (Balassa, 1985, Edwards, 1992, Dollar, 1992 and

Proudman *et al*., 1997). In addition, Sachs and Warner (1995) exploring the effect of trade liberalization on economic development, after World war II, in two groups of countries: "open" and "closed", found that increased exposure of less developed economies to international trade supports higher growth rates than in more developed countries. These higher growth rates can be attributed to technology transfer or concentration of capital. However, the openness of the Greek economy to international trade during the 1996–2006 period seems to have remained relatively low, mainly due to low export performance.[4]

Table 1. Export Performance

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Austria	24,77	28,36	29,56	30,56	33,82	35,16	35,66	34,88	38,06	39,31	41,48
Belgium	58,39	61,66	61,94	61,96	69,29	68,99	66,99	65,99	68,50	70,95	71,80
Denmark	27,62	28,46	27,73	28,66	31,34	31,50	31,85	30,37	30,41	32,05	33,03
Finland	31,71	33,42	33,29	32,15	37,58	34,34	32,99	31,95	32,29	33,53	36,94
France	18,35	20,42	20,90	20,87	22,72	22,31	21,46	20,31	20,62	20,71	21,53
Germany	21,43	23,61	24,75	25,29	28,90	30,11	30,45	30,77	33,24	35,46	39,15
Greece	9,89	9,40	9,09	9,17	10,46	9,91	8,74	8,82	8,57	9,01	10,56
Ireland	66,44	67,91	69,93	70,85	76,64	74,53	69,32	56,61	54,56	50,99	46,95
Italy	20,04	20,18	20,20	19,64	21,90	21,89	20,79	19,84	20,46	20,93	22,40
Luxemburg	37,72	41,30	43,06	38,41	41,07	41,75	40,03	37,31	41,03	39,29	39,18
Netherlands	47,19	49,95	48,98	48,82	55,59	52,87	49,90	48,91	52,14	54,90	58,73
Portugal	22,66	22,84	22,63	21,66	23,13	22,40	21,54	21,72	21,75	21,82	23,52
Spain	16,50	18,68	18,64	18,24	19,90	19,26	18,47	17,85	17,68	17,36	17,90
Sweden	31,22	33,66	34,21	33,55	36,22	35,10	33,60	33,10	34,68	35,96	37,82
United Kingdom	21,39	20,71	18,66	17,89	19,25	18,51	17,34	16,52	15,90	16,89	18,43
EU-15	23,33	24,75	24,79	24,71	27,53	27,24	26,42	25,63	26,50	27,48	29,29
USA	7,98	8,33	7,83	7,56	8,03	7,26	6,70	6,64	7,04	7,35	7,87
Japan	8,64	9,61	9,68	9,20	9,85	9,36	10,07	10,59	11,70	12,48	14,12

Export performance (EP) = X/Y, where X & Y are goods exports and GDP respectively, USD, current prices.
Source: OECD, National Accounts, online.

As indicated in Table 1, Greek export performance, as measured by exports as a percentage of GDP, is the lowest among the EU-15 countries and approximately one third of the EU average (1996: 9.9%, 2006: 10.6%). The slight improvement observed since 2002 can be explained by the favourable effect of EMU participation. The overall openness[5] of the Greek economy increased substantially (from 33.6% in 1900 to 37.9% in 2006). However, it remained significantly lower than the EU-15 average (which increased from 45.3% in 1996 to

[4] Papazoglou (2009) reaches the conclusion that, unlike Portugal, Greece has not adequately exploited the opportunities presented by entry in to the EU market and has low market penetration in third markets.
[5] This index is calculated as the sum of exports and imports as % of GDP (Appendix: Table 13).

59% in 2006). Finally, the index of international trade exposure[6] is close to the EU-15 level and exceeds those of other European countries such as Spain due mainly to imports.

3. Market shares of Greek exports and constant market share analysis methodology

3.1 Market shares of Greek exports

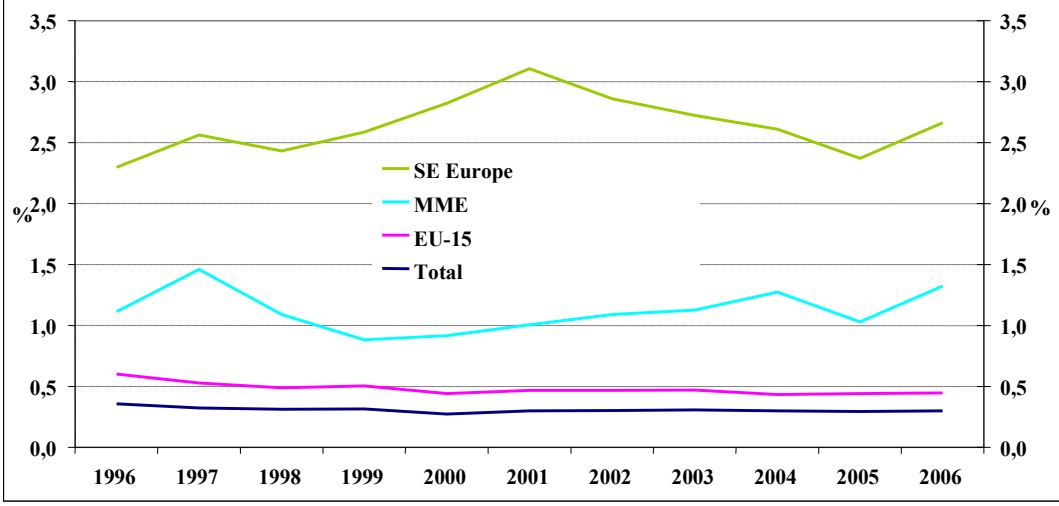
Further evaluation of the export performance of the Greek economy requires a study of Greek export shares in foreign markets. Export market share analysis allows the isolation of the effects of foreign demand and reflects changes mainly in export competitiveness. The export market share of total Greek exports in all destinations is defined in this study as the ratio of the value of Greek exports over the value of total world imports.[7]

Export market shares may differ depending on the definition of world imports. That is, world imports may be either weighted by the participation of each destination area in total exports of the country of interest, or taken as an unweighted sum. Market shares calculated using exports and imports in value terms are also different from shares based on volumes, partly reflecting movements in exchange rates. However, they are used more often because detailed data on international trade volumes are not easily available and are of limited reliability due to the presence of measurement errors. As a result, the conclusions of export market shares analysis may vary sometimes depending on the use of value or volume data,[8] but are similar in most cases.

The analysis of Greek export market shares, in Figure 4 and Table 2, shows that the share of Greek exported goods in the world market declined slightly, overall, from 0.32% in 1996 to 0.30% in 2006. It should be mentioned, that, according to the IMF,[9] during the same period (1996-2006), the export market shares of OECD and EU countries also fell (by 13.4% and 12.8% respectively) due mainly to competition from China.

[6] Trade Exposure = Export performance + (1 – Export performance) * Import penetration. The index is shown in Table 14 of the Appendix.
[7] The export market share of product i in market j, is defined, as the ratio of the value of exports of product i in this market j over total imports of product i in market j.
[8] ECB (2005).
[9] IMF (2008).

Figure 4. Greek export market shares by geographical area
(current prices, percentage in total value of imports in each area)



Greek exports achieved considerable market share in the markets of South-Eastern Europe. This was approximately eight times higher than the world total and increased from 2.3% in 1996 to 2.7% in 2006. The next highest Greek export market shares are observed in the MME region and rose from 1.1% in 1996 to 1.3% in 2006. Greek export market share in the EU-15 market declined and remained at a level below 0.5% in 2006.

Greek export market shares by product category and destination area are shown in Table 2. The market share of "chemicals" increased considerably from 0.20% in 1996 to 0.31% in 2006,[10] in all major markets of EU-15, SE Europe and MME. In addition, the market share of "machinery" showed improvement in the same markets. By contrast, with the exception of some destinations, the market shares of "foodstuff products" "raw materials" and "other manufacturing products" declined. It must be noted, that market shares of exports from several developed countries declined in markets for manufacturing products such as textiles and clothing.

[10] Michel (2005) showed that, during the 1991-2001 period, developed countries clearly specialized in exports of electronic equipment and, to a smaller degree, in exports of chemicals, while a decline in market shares is observed for food, textiles, mechanical and transportation equipment.

Table 2. Greek export market shares by product category and destination area
(current prices, percentage of total imports (value) of each area)[1]

	All products total		Food		Raw materials except fuel		Chemicals		Mechanical and transportation equipment		Other manufactured products	
	1996-2000	2001-2006	1996-2000	2001-2006	1996-2000	2001-2006	1996-2000	2001-2006	1996-2000	2001-2006	1996-2000	2001-2006
Total	0,32	0,30	1,03	0,94	1,44	1,30	**0,20**	**0,31**	**0,05**	**0,07**	0,40	0,37
EU-15	0,51	0,46	1,58	1,33	1,52	1,41	**0,20**	**0,40**	**0,08**	**0,11**	0,64	0,50
SE Europe	**2,54**	**2,72**	5,34	5,21	14,91	12,52	**1,80**	**1,94**	**0,77**	**0,97**	**2,59**	**3,31**
MME	**1,09**	**1,14**	**1,14**	**1,30**	5,17	4,39	**1,12**	**1,22**	**0,27**	**0,49**	1,81	1,45
USA	0,11	0,10	0,57	0,50	**0,39**	**0,44**	0,04	0,04	0,01	0,01	0,15	0,13
Rest of the world	0,11	0,10	**0,41**	**0,43**	0,54	0,51	0,10	0,10	0,02	0,02	0,12	0,11

1 The cases where export market shares increase are in bold characters.

Export market shares of "chemicals" and "machinery" in the EU-15 market rose between the two sample sub periods (1996-2000 and 2001-2006), while market shares of all other product categories declined in the same period. Improved Greek export shares in the South-Eastern European markets were due to exports of "chemicals" and "other manufacturing products". Finally, in the MME markets, exports of "chemicals", "machinery" and "foodstuff products" were the major contributors to increased market shares. Greek export market shares by technological intensity and destination area are presented in Table 3, which indicates in separate sections that market shares of medium-technology products and, to a lesser extent, of high-technology products increased in all world markets as well as in the major markets (EU-15, SE Europe and MME), between the two sub periods under review. At the same time, the market share of low-technology

Table 3. Greek export market shares by technological intensity and destination area

(current prices, percentage of total imports value of each area)[1]

	Total		Tecnological intensity					
			Low		Medium		High	
	1996-2000	2001-2006	1996-2000	2001-2006	1996-2000	2001-2006	1996-2000	2001-2006
All areas total	0,32	0,30	0,51	0,48	**0,15**	**0,23**	**0,05**	**0,07**
EU-15	0,51	0,46	0,80	0,67	**0,17**	**0,31**	**0,07**	**0,12**
SE Europe	**2,54**	**2,72**	3,21	1,65	**1,42**	**3,69**	**0,71**	**0,89**
MME	**1,09**	**1,14**	1,61	1,49	**0,78**	**0,89**	**0,26**	**0,54**
USA	0,11	0,10	0,20	0,18	0,03	0,03	0,01	0,01
Rest of the world	0,11	0,10	0,19	0,18	**0,07**	**0,08**	0,02	0,02

1 The cases where export market shares increase are in bold characters.

products fell in all destinations. Note that, among the southern euro area countries (France, Greece, Italy, Portugal and Spain), all but the last one improved the technological intensity of their exports considerably during the 1994-2005 period. This development was more pronounced in Greece and Portugal and consistent with the expectations concerning the convergence process after their entry in the EU and, later, in the EMU.

3.2 Constant Market Shares Analysis

3.2.1 Theoretical consideration

Constant Market Share Analysis (CMSA) is a method for examining export performance, by focusing on the role of a country's export structure (its composition by product and geographic distribution) and competitiveness. Specifically, if the country under review specialized in products and markets where the demand is growing fast, then its export market shares would be expected to rise.

The CMSA model, in its simple form, suggests that the export market shares of a given country are a function of the country's competitiveness as follows:

$$S_{ij} = q_{ij} / Q_{ij} = f_{ij}(c_{ij}) \,, \qquad (1)$$

Where: S is the country's export market share, q and Q are the country's and world exports, respectively, c is the competitiveness index, i is the exported product category, and j is the destination market.

Differentiating equation (1) with respect to time, implies:

$$q'_{ij} = \sum_i \sum_j S_{ij} Q'_{ij} + \sum_i \sum_j Q_{ij} S'_{ij}$$

$$= \sum_i \sum_j S_{ij} Q'_{ij} + \sum_i \sum_j Q_{ij} f'_{ij}(c_{ij}) \,, \qquad (2)$$

Which, after rearrangement takes the following form:

$$q'_{ij} = SQ' + (\sum_i S_i Q'_i - SQ') + (\sum_i \sum_j S_{ij} Q'_{ij} - \sum_i S_i Q'_i) + \sum_i \sum_j Q_{ij} S'_{ij} \,, \qquad (3)$$

Equation (3) indicates that a country's exports change can be decomposed into several terms:

- The **world growth effect** (first term on right-hand side), which will be positive if the growth rate of the country's exports is higher than the growth rate of world exports.
- The **commodity and market effects** (second and third term in parentheses respectively). A positive effect results if specialization takes place in particular commodities or markets, that are growing strongly. In this case, the analysis of commodity and market effects is static, assuming that export market shares are constant.
- The **competitiveness effect** (last term). This term is a residual one and expresses the difference between the actual change in export market shares and the two effects described above. The calculation of competitiveness in this case allows for changes in market shares.

3.2.2 Problems of definition and application

Application of the CMSA is associated with a series of problems:[11]

- *Measurement of trade flows:* Market shares calculated on the basis of volumes are the most appropriate. However, market shares based on values are widely used due to lack of reliable data on volumes.

[11] Βλ. Richardson (1971).

- *Interpretation of commodity composition and geographic market structure:* The change in the product composition of exports is related mainly to demand conditions, like consumer preferences and competition from third countries, in the destination country. The change in the geographic structure from the demand side reflects mainly consumer preferences and traditional trade relations between the two countries (exporter and destination country). From the supply side, geographic structure is related to productivity, as well as to the monetary and fiscal policy of the exporting country.
- *Definition of competitiveness:* The change in exports due to competitiveness is the residual after subtracting the three first terms of equation (3). This residual is "total competitiveness" and accounts for relative price including the effect of exchange rate movements as well as other non-price factors that determine competitiveness, such as product quality, services related to the export activity, timing etc.
- *Other problems related to the application of the CMSA methodology::* the commodity and market effects are asymmetric. The results obtained depend on whether the commodity effect or the market effect is calculated first. In addition, if time in equation (3) is discrete and not continuous, it would not be safe to assume that commodity composition and geographic structure remain the same for a very long period of time.

3.2.3 CMSA results for the 1996-2006 period.

3.2.3.1 Introductory remarks

The four terms of equation (3) were calculated for the period 1996-2006 and the sub-period 2001-2006, that is after Greece joined EMU using export market shares based on values. Calculations are based on average annual changes during the period under review, thus minimizing the problem of discrete time. They were also performed for changes between the first and the last year of the period, with similar results. The CMSA method was applied in two ways depending on whether the commodity composition effect or the geographic structure effect was calculated first. The final result is the simple average of the two results. In this way, the issue of calculation order was controlled for. In addition to applying the decomposition to total Greek exports, it was also applied to:

- Exports to five specific areas: EU-15, USA, South Eastern Europe (SE Europe), Mediterranean and Middle East (MME) and rest of the world.
- Exports grouped by product according to the one digit categories of the SITC.
- Exports grouped by technological intensity: low, medium and high technology.

3.2.3.2 Results

The results of the CMSA in Tables 4 and 5 indicate that the increase in Greek exports during the 1996-2006 period is smaller than the potential, given the growth of world trade. This can be attributed mainly to the product composition of Greek exports – namely the specialization in products facing rather unfavourable demand conditions - and to the negative effect of competitiveness. By contrast, the geographical structure of Greek exports had a positive effect on export growth. These results are similar to those of a related study (Michel, 2005), which concludes that during the 1997-2001 period, competitiveness and product composition had a negative effect on Greek exports[12].

In addition, according to a previous study[13] of Greek exports, the effect of commodity composition on Greek export performance is the same for the period 1968-1972. The effects of world trade and competitiveness are different, however. During the 1968-1972 period, the growth of Greek exports was faster than that of world trade, while the effect of competitiveness was substantial and positive. It must be noted that high competitiveness in this period reflects the considerable subsidies to most Greek exporting firms. During the 2001-2006 five year period, export performance as a whole, improved with respect to that of the longer 1996-2006 period. The market effect remained positive and high, while the commodity composition effect remained negative, though at a lower level. Finally, the competitiveness effect changed from negative to a marginal positive.

[12] Specifically, Michel (2005) applied CMS analysis for the EU-15 countries for the periods 1991-1997 and 1997-2001. During the first period all countries market shares fell, mainly because of the geographic structure of their export markets, which was not successful for most countries. In addition, for most countries the product composition of exports had a slightly negative effect, while the effects of competitiveness were mixed. The decline in the market share continued in the second period at a slower pace. In this period, competitiveness was the main reason for the decline in export market share in most EU-15 countries, while the effect of geographic structure and product composition was smaller. Results for Greece for the 1991-1997 period indicate that all three factors had a strong negative effect, while in the second period there was a significant negative effect was for competitiveness and product composition only.

[13] Athanasoglou (1993).

Table 4. Greek export performance based on Constant Market Share Analysis

		Average annual percentage change of exports	*Attributed to:*			
			Growth of world trade	Commodity composition	Geographic distribution	Competitivness
All areas total	**1996-2006**	**6,7 (=100)**	**120,9**	**-18,4**	**2,1**	**-4,6**
	2001-2006	**15,8 (=100)**	**91,2**	**-0,9**	**7,9**	**1,8**
	1968-1972*	**21,5 (=100)**	**85,0**	**-21,0**	**10,0**	**26,0**
EU-15	**1996-2006**	**5,7 (=100)**	**155,3**	**-26,5**	**-4,9**	**-23,9**
	2001-2006	**17,4 (=100)**	**101,6**	**5,0**	**-1,7**	**-4,9**
	1968-1972*	**21,4 (=100)**	**70,0**	**-23,0**	**35,0**	**18,0**
SE Europe[1]	**1996-2006**	**13,1 (=100)**	**96,0**	**2,9**	**-4,5**	**5,6**
	2001-2006	**18,1 (=100)**	**108,1**	**-5,2**	**-11,6**	**8,5**
	1968-1972*	**16,0 (=100)**	**63,0**	**-24,0**	**39,0**	**22,0**
MME	**1996-2006**	**10,7 (=100)**	**85,1**	**10,0**	**-35,3**	**40,2**
	2001-2006	**17,3 (=100)**	**64,2**	**6,7**	**-7,5**	**36,6**
USA	**1996-2006**	**6,1 (=100)**	**120,1**	**2,2**	**0,0**	**-22,3**
	2001-2006	**8,0 (=100)**	**78,0**	**36,8**	**0,0**	**-14,8**
	1968-1972*	**20,2 (=100)**	**116,0**	**-66,0**	**0,0**	**50,0**
Rest of the world[2]	**1996-2006**	**5,0 (=100)**	**140,9**	**-44,2**	**14,4**	**-11,5**
	2001-2006	**11,4 (=100)**	**108,3**	**-19,7**	**24,0**	**-12,6**
	1968-1972*	**38,0 (=100)**	**115,0**	**-9,0**	**-78,0**	**72,0**

1. Eastern Europe for the 1968-1972 period.
2. The group of countries in the "rest of the world" in the 1968-1972 period is different than that of the other two sub-periods.
*Source: P. Athanasoglou (1993).

The results of the CMSA by area indicate that, for exports to the EU15 all the effects deteriorated relative to those obtained for total exports, while the improvement observed for total exports during the 2001-2006 period was evident also in the performance of exports to EU-15 market. Over the 1996-2006 period, only the market effect was negative for exports to the SE Europe, while over the 2001-2006 period the commodity composition effect was also negative. Negative effects on export growth were also present in the market effect for exports to the MME markets, competitiveness for exports to the USA and competitiveness and export composition for exports to the rest of the world. It must be noted that the positive market effect on the growth of total exports, in general, was not maintained in individual sub-markets, while

the commodity composition of exports and competitiveness had positive effects on exports to some markets, except that of the EU-15.

Table 5. Greek export performance based on Constant Market Share Analysis *

	Growth of world trade		Commodity composition		Geographic distribution		Competitiveness	
	1996-2006	2001-2006	1996-2006	2001-2006	1996-2006	2001-2006	1996-2006	2001-2006
Total greek exports	+	+	-	-	+	+	-	+
according to								
1. Geographical area								
EU-15	+	+	-	+	-	-	-	-
USA	+	+	+	+			-	-
SE Europe	+	+	+	-	-	-	+	+
MME	+	+	+	+	-	-	+	+
Rest of the world	+	+	-	-	+	+	-	-
2. Product category (SITC)								
Food	+	+	+	+	+	+	+	+
Beverages & Tobacco	-	+	+	-	-	+	+	-
Raw mterial Except fuel	+	+	-	-	+	-	-	+
Fats and oils	-	+	+	+	+	+	+	-
Chamicals	+	+	+	+	+	+	+	+
Manufactured products classified by raw material	+	+	-	-	+	+	+	+
Mechanical and transportation equipment	+	+	+	+	-	-	+	+
Other manufactured products	+	+	+	+	+	+	-	-
3. Classification by technological intensity								
Low technology products	+	+	-	-	+	+	-	-
Medium technology products	+	+	+	+	+	+	+	+
High technology products	+	+	+	+	-	-	+	+
Total euro area exports [1]	+		+		+		-	

* Positive (negative) sign indicates positive (negative) effect.

1.Euro area data cover the 1996-2007 period.

The results of the analysis by technological intensity are presented in Table 5 and show that commodity composition and competitiveness had a negative effect on the exports of low technology products, while the geographic structure had a negative effect on exports of high technology products. By contrast, all effects on exports of medium technology products were positive.

Concluding, world trade growth and the geographical structure of destination markets had positive effects on Greek export performance during the 1996-2006 period, while the effects of export composition and competitiveness are negative. The effects of the last two factors showed substantial improvement during the 2001-2006 five year period; the effect of product composition remained negative, but was much smaller while the effect of competitiveness turned positive, albeit low. The next two sections focus on the study of commodity composition and competitiveness and their effects on Greek export performance.

4. The role of commodity composition of exports: variety and quality

4.1 Introductory remarks

"New Trade Theory" suggests that foreign income and price competitiveness only partially explain export performance, implying that factors such as variety, quality and the technological content of exported goods are also important. Krugman (1989) argues that the high income elasticity of exports in developed economies is associated with a high level of product variety. In addition, Grossman and Helpman (1991) focused on the role of innovation and the development of new varieties (horizontal differentiation) and the role of improved quality (vertical differentiation) in international trade. Dixit and Norman (1980) presented a similar analysis. Consequently, the "New Trade Theory" replaces the traditional hypothesis of perfect competition and constant returns to scale by the alternative of monopolistic competition and increasing returns in output markets. Within this framework, increased product variety and improved quality of exported goods may cause an upward shift in the export demand curve. The welfare effects from trade, identified by the "New Trade Theory" can be attributed to: 1) lower costs due to economies of scale; 2) increased consumer welfare since consumers can buy different varieties of the same product at a relatively lower price; and 3) lower structural costs due to liberalization and expansion of international trade.

Several recent empirical studies (Anderton, 1999, Funke and Ruhwedel, 2001, Hummels and Klenow, 2002, and Schott, 2004) support the positive effect of improved product variety and quality on export performance. Specifically, Anderton (1999) using investment and technology as proxy for variety and quality, found a significant influence on UK's trade. Funke and Ruhwedel (2001) showed that an increase in the product variety of exports of ten Eastern

Asian countries contributed to a considerable rise in their exports. In the case of Greece, Athanasoglou and Bardaka (2010) suggested that there is a positive relationship between product differentiation and export performance, since the variable used as a proxy for nonprice competitiveness is also an indirect index of product variety and quality.[14]

4.2 Product Variety

Several *direct* indices have been used in economic literature in order to measure product variety[15] (Kandogan, 2003), such as:

- the number of product categories exported;
- the Funke and Ruhwedel index (2001);
- the extensive margin index developed by Hummels and Klenow (2002); and
- the intra-industry trade index developed by Grubel and Lloyd (1975).

Although the first index is easy to calculate, it weights equally small and large product categories and ignores differentiation within the same category.

The Funke and Ruhwedel (2001) index, developed by Feenstra (Feenstra, 1994), results from estimating production or utility functions. (Kardogan, 2003). This index is given by:

$$FR_t^A = ln\left(\frac{\sum_{p\in Pt} X_{pt}^A}{\sum_{p\in Pt-1} X_{pt-1}^A}\right) - ln\left(\frac{\sum_{p\in P} X_{pt}^A}{\sum_{p\in P} X_{pt-1}^A}\right), \quad (4)$$

$$P_t = \{p|\ X_{pt}^A > 0\},\ P_{t-1} = \{p|\ X_{pt-1}^A > 0\}\ \text{και}\ P = P_{t-1} \cap P_t$$

where: X_{pt}^A is the volume of exports of product *p* from country A at time t. The first term on the right hand side shows the change in the total volume of exports between two consecutive time periods and the second term shows the change in the volume between the two time periods. Their difference represents the increase in the volume of exports of new products. This index takes into account the significance of each product category exported by country A. However, its calculation requires very detailed data in order to distinguish an increase in the volume of exports of products common in both periods from an increase in variety.

[14] In Athanasoglou and Bardaka (2010) the capital stock is used as a proxy for non price competitiveness. In addition, Muscatelli et al. (1995) reached similar conclusions.

[15] In the literature *indirect* indices, such as investment, profitability, expenditure for research and development and patents, have been often used to measure the product variety of exports (Funke and Ruhwedel, 2001).

The extensive margin index shows the share of world exports in the markets where the country under review exports. A low extensive margin indicates limited product variety. For country A, the index is given by:

$$HK^{A} = \frac{\sum_{i \neq A} \sum_{s \in X_{Ais}} X_{is}^{W}}{X^{W}} , \qquad (5)$$

where: X_{is}^{w} is world exports of product s to country i, X_{Ais} country A exports of product s to country i (with $X_{Ais} > 0$), while X^{W} is total world exports. The HK^{A} index takes into account the significance of all product categories, although the weights used are the shares in total world exports and not in country A's exports. In addition, it may overestimate product differentiation, as long as the increase in trade is totally attributed to product variety.

Exported product variety is also approximated by the intra-industry trade index (IIT) proposed by Grubel and Lloyd (1975). The (IIT) index reflects exports and imports of products that belong to the same sector from and to a country. According to OECD (2002), a considerable expansion of intra-industry trade was observed during the 1980's in the majority of its member countries (especially in economies with a high degree of openness) in sectors with relatively high technological content (chemicals, machinery and electronic equipment).

At this point it must be noted that there is a difference between vertical and horizontal intra-industry trade. The former refers to exports and imports of products in the same sector but at a different stage of production, while the latter refers to exports and imports of products in the same sector and at the same stage of production. This study focuses on horizontal intra-industry trade of products which:

- are close substitutes in their final use (consumption), but incorporate different inputs (use, intensity);
- use the same inputs, but have different final use;
- use the same inputs and have the same final use.

In economic analysis, a sector includes firms that produce similar products. Trade statistics use a different approach which according to Grubel and Lloyd (1975), "is based on ad hoc similarities of inputs and final use". For this reason, in external trade statistics a sector covers products that use different inputs. For example, code 712 of the SITC (office

machinery) includes both computers and pencil sharpeners. However, although a part of intra-industry trade may be spurious, a significant part of it is genuine (Gray, 1979).[16]

The intra-industry trade (ITT) index of sector i at time t is expressed by:

$$IIT_{it} = 1 - \frac{|x_{it} - m_{it}|}{x_{it} + m_{it}}, \quad 0 \le IIT_{it} \le 1, \qquad (6)$$

where: x_{it} and m_{it} are exports from and imports into the country under review in sector i.

Table 6. Intra industry trade indices [1]

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Austria	72,3	74,8	74,2	74,9	75,8	76,4	76,8	75,7	76,1	75,0	75,4	76,4
Belgium	73,9	75,8	78,8	79,2	78,5	79,3	80,8	80,8	79,8	79,8	80,9	81,3
Denmark	62,5	63,3	65,0	66,8	66,4	66,2	66,8	67,2	65,6	65,4	67,4	67,1
Finland	47,2	47,9	47,7	45,6	45,4	47,4	46,5	46,6	47,7	50,9	50,8	51,6
France	76,5	75,8	77,5	77,9	76,6	76,3	76,0	75,5	74,3	73,8	73,8	74,0
Germany	68,3	67,7	69,6	70,3	70,9	71,2	71,0	70,4	70,5	71,4	72,1	72,1
Greece	33,0	35,4	34,2	34,4	35,7	36,4	36,0	34,9	35,6	37,6	38,2	37,4
Ireland	59,4	59,8	57,4	54,1	54,1	56,2	52,1	48,9	47,3	46,1	45,3	42,5
Italy	56,9	56,6	58,3	59,7	60,2	60,9	59,8	60,1	58,9	58,4	58,0	58,3
Netherlands	73,3	73,9	75,1	75,2	75,3	74,0	73,9	76,4	75,6	74,8	74,7	76,8
Portugal	48,6	48,8	51,2	50,8	51,7	52,8	54,7	56,6	56,4	56,8	58,7	59,6
Spain	64,9	64,8	66,2	68,0	66,2	68,5	68,6	68,9	68,6	68,6	67,6	67,0
Sweden	59,6	60,2	63,3	62,4	62,1	63,9	63,4	64,7	64,9	65,6	66,0	78,1
United Kingdom	78,6	78,4	77,7	77,8	78,3	76,5	75,2	75,7	75,8	75,9	73,0	74,0
EU-15	**62,5**	**63,1**	**64,0**	**64,1**	**64,1**	**64,7**	**64,4**	**64,5**	**64,1**	**64,3**	**64,4**	**65,4**

1. Grubel-Lloyd Index (1975).
Source: OECD ITCS (International Trade by Commodity Statistics).

The intra-industry trade index of Greece, as shown in Table 6, is the lowest in the EU-15 countries and below the European average[17]. This indicates that Greece produces and exports a limited variety of products. It should also be noticed that the intra-industry trade index in Greece (as well as in Portugal and Sweden) increased more than the European average during the period 1996-2007

[16] Aquino (1978) showed that the intra-industry trade index is biased downwards when trade of a particular product is not in equilibrium.
[17] A relatively low intra-industry trade index has been calculated for Greece during the 1990's by Fontagne and Freudenberg (2002).

4.3 Product Quality

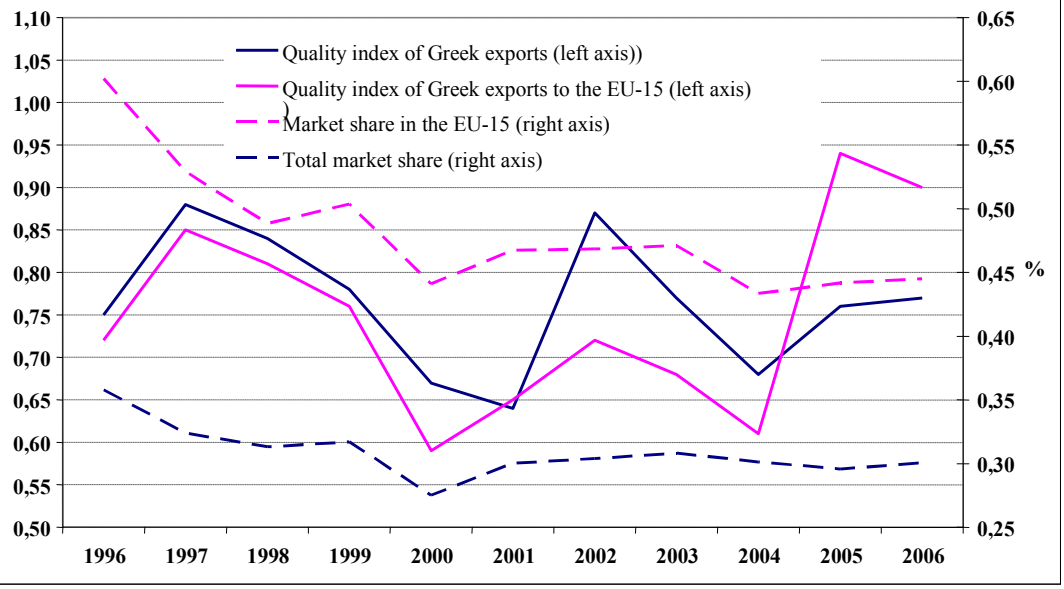
Structural changes in production and the replacement of traditional, labour intensive products by new products, intensive in specialized labour and high technology is expected to lead to a considerable improvement of export performance. While available inputs and prices are traditionally the main factors determining the structure of production and external trade of a country, in the case of new products, quality also plays a major role in determining competitiveness and establishing a substantial market share, especially in international markets. In addition, other relevant factors include the reputation of the firm or the product and other processes, such as marketing and delivery time.

In this paper, relative price is used as a proxy for the quality of a product. A quality index for total exports is given by:

$$Q_t = \frac{\sum_{i=1}^{n} P_{i,t}^{g}}{\sum_{i=1}^{n} \sum_{j=1}^{k} w_{j,t} P_{i,t}^{f}}, \qquad (7)$$

where: Q_t = quality index at time t, $P_{i,t}^{g}$ = Greek average export price, $P_{i,t}^{f}$ = average export price of competitors of Greek exports, i=1, …, η, the number of products and j=1, …, k, the number of competitors (n= 279 and k= 15).

Figure 5. Quality of Greek exports and market shares



The quality index of total exports as shown in Figure 5 has deteriorated in the last several years, while the quality of exports to the EU-15 had been deteriorating up to 2004 and started to improve in the 2005-2006 period. According to IMF estimates, [18] the quality of Greek exports is lower than that of the exports of Portugal and Spain.

In order to address the statistical significance of the difference between Greek exports and her competitor's exports, *Wilcoxon*'s non parametric statistic[19] was used. This test showed that the difference in question was statistically significant at a 5% level during the 1996-2006 period, except for the three- year period 2000-2002. In addition, the same statistic was used to test the *hypothesis* that Greek exports to the EU-15 are of the same quality as those to the rest of the world, which was refuted for the whole period under review, except for the year 2000.

5. Competitiveness

5.1 Balassa index of comparative advantage.

The "Revealed Comparative Advantage" (RCA) index developed by Balassa (1965) is widely used to determine the comparative advantage in exports and the competitive position of a country. The index is given by:

$$B_{ij} = \frac{x_{ij} / x_{wj}}{x_i / x_w}, \qquad (8)$$

$$with \;\; X_{wj} = \sum_{i=1}^{n} X_{ij} \; and \; X_i = \sum_{j=1}^{k} X_{ij}$$

where: X_{ij} = country's i exports of commodity j, X_{wj} = world exports of commodity j , X_i = total exports of country i, X_w = total world exports, $i=1,...,\eta$ the number of countries και $j=1, \ldots, k$ the number of commodities.

[18] See footnote 10.

[19] Wilcoxon's non parametric statistical test is used when two sets of observations are related or represent repeated measurements of a particular sample, in place of the Student t statistic and when the population does not follow the normal distribution. It is based on the calculation of the differences between corresponding observations and the ranking of the absolute values of the differences. The hypothesis to be tested is whether the distribution of the differences is symmetric around zero (0) or not. The statistic is given by: W= $\sum_{j=1}^{n} S_j r_j$, where r_j are the observed series with their sign (signed ranks) and S_j takes the value of either +1 or -1.

A country i has a revealed comparative advantage in commodity j, according to (8), if $(x_{ij} / x_{wj}) > (x_i / x_w)$, that is if the commodity j' s export market share is higher than the country's total export market share.

The Index B_{ij} reflects the international specialization of a country, since it evaluates its export market share in a particular commodity or sector in relation to a benchmark, such as the total export market share of this country. Theoretically, the B_{ij} index takes values between 0 and +∞. However, actually, the upper limit is x_w / x_i , which approaches ∞ when $x_i \to 0$. Therefore, country i has a comparative advantage if $1 \le B_{ij} < x_w / x_i$ and a comparative disadvantage if $0 < B_{ij} \le 1$ and the B_{ij} index follows an asymmetric distribution with 0 as the lower limit, a variable upper limit and a variable average. Specifically, the numerator of (8) is not weighted by the share of each commodity in total country exports, while the denominator is a weighted average of export market shares of all products. Consequently, if a country achieves high export shares in a few products with a small export share in world markets (the case of small economies), the result would be an average index $B_{ij}>1$. In addition, since the values of this index may change over time, a country's degree of specialization as measured by this index may change as well.

An index with symmetric distribution used instead of the B_{ij} index is the Laursen (1998) index given by:

$$BL_{ij} = \frac{B_{ij} - 1}{B_{ij} + 1} \ , \qquad (9)$$

This index takes values between -1 and 1 and its average value is $\overline{BLij} = 0$, which has no effect on the ranking by size of BL_{ij}. Finally, country i has a comparative advantage in commodity j if $0 \le BL_{ij} \le 1$ and a comparative disadvantage if $-1 \le BL_{ij} < 0$.

5.1.2 Descriptive statistics for the B_{ij} index of Greek exports

Table 7 presents the descriptive statistics of B_{ij} indices of Greek exported products by area of destination.[20] The overall index average is greater than one (>1) and relatively high for all individual destination areas, while the index average increased between periods 1996-2000 and 2001-2006 in all areas of destination excluding SE Europe and the USA. However, an examination of the standard deviation and the frequency of the maximum and minimum values

[20] For the five best products according to the Bij index in each area of destination, see Table 16 of the Appendix.

showed intense asymmetry. Therefore, an examination of the median was preferred. The median of the B_{ij} index increased between the periods under review for all destination areas except the USA, where it remained stable at less than one (<1). This indicates a comparative disadvantage of Greek exports, contrary to examination of the average that shows the existence of a comparative advantage.

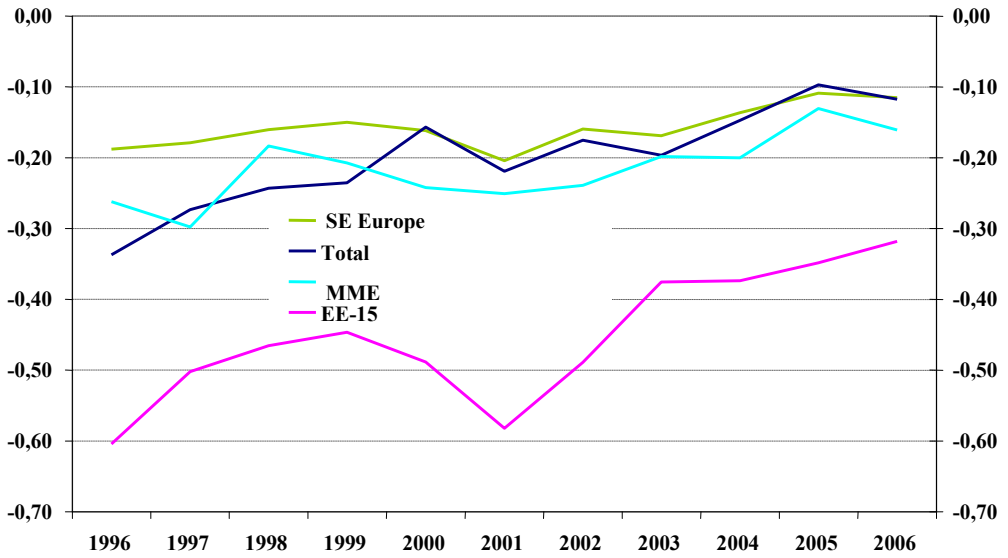
Table 7. Descriptive statistics for the B_{ij} Index*

	Average		Median		Standard deviation		Minimum		Maximum	
	1996-2000	2001-2006	1996-2000	2001-2006	1996-2000	2001-2006	1996-2000	2001-2006	1996-2000	2001-2006
Total	2,48	2,69	0,61	0,74	7,15	7,25	0,00 *(7)*	0,00 *(4)*	92,39 *(1)*	87,83 *(1)*
EU-15	2,32	2,73	0,34	0,43	6,83	9,42	0,00 *(42)*	0,00 *(48)*	77,56 *(1)*	155,02 *(1)*
SE Europe	1,70	1,56	0,62	0,67	3,97	2,90	0,00 *(23)*	0,00 *(26)*	52,59 *(1)*	40,30 *(1)*
MME	2,81	2,88	0,70	0,74	11,33	14,01	0,00 *(52)*	0,00 *(58)*	170,64 *(1)*	297,54 *(1)*
USA	6,61	5,88	0,05	0,05	58,14	39,06	0,00 *(456)*	0,00 *(500)*	1.271,74 *(1)*	872,09 *(1)*
Rest of the world	3,70	3,90	0,36	0,47	20,70	17,16	0,00 *(87)*	0,00 *(66)*	407,26 *(1)*	227,54 *(1)*

* Number of occurences of min and max values in parentheses

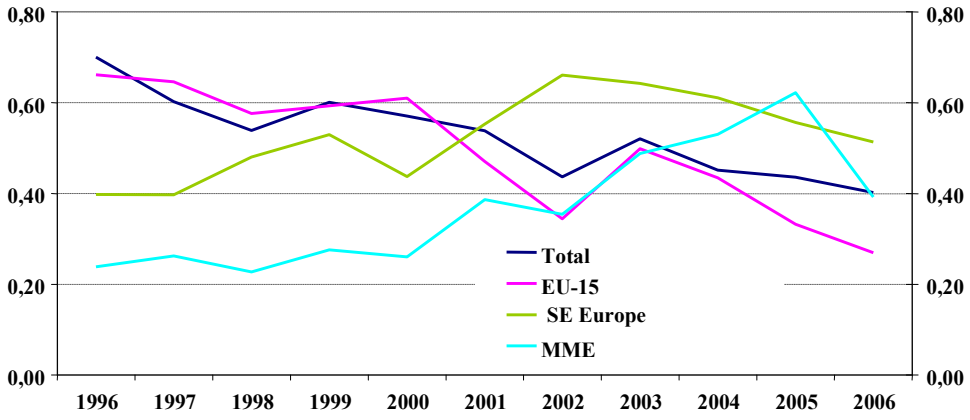
The median of the BL_{ij} index (Figure 6) took negative values (comparative disadvantage) and improved during the period 1996-2006 for all areas, especially the EU-15. The average level of the B_{ij} index for the five "best" commodities (those with the highest B_{ij} index value) and for the five "worst" commodities (those with the lowest B_{ij} index value) is presented in Table 8. During the period 1996-2000, the five "best" Greek exports represent a considerable proportion of the total value of exports, especially exports to the rest of the world (25%), the EU-15 and the USA (18%) and overall exports (16%). During the 2001-2006 period, these percentages declined significantly in all areas of destination except for the MME countries. The percentage share of the five "worst" commodities in total export value in both periods under examination is close to zero. The commodities appearing more frequently among the five "best" are articles of apparel, fur skins, tobacco, apparel made of fur, cotton seeds, olive oil, figs and citrus fruits (see Appendix).

Figure 6. Median of the BL_{ij} index



The correlation coefficient between the B_{ij} index and the structure of Greek exports by commodity for the different areas of destination is presented in Figure 7. Overall, this coefficient declined during the 1996-2006 period, in particular, a decline was observed in the EU-15, while the coefficient increased in SE Europe and the MME. This indicates that, with the exception of these two markets, the specialization of Greek exports is not closely related to the country's comparative advantage.

Figure 7. Correlation coefficient of the B_{ij} index and the structure of Greek exports[1]



[1] Share of each exported commodity in total Greek exports.

This development is supported by the decline in export market shares during the 1996-2006 period (section 3.1), as well as by the decline in the share of the "best" exports in the total export value (Table 8).

Table 8. Index B_{ij} of the five "best" and five "worst" exports and their share in total Greek exports value *

	1996-2000			2001-2006		
	Average	**Five "best**	**Five "worst"**	**Average**	**Five "best**	**Five "worst"**
Total	2,48	46,4	0,02	2,69	48,80	0,04
		(15,7%)	*(0,1%)*		*(9,6%)*	*(0,5%)*
EU-15	2,32	43,8	0,00	2,73	45,80	0,00
		(17,8%)	(0,0%)		(13,7%)	(0,02%)
Se Europe	1,70	23,08	0,01	1,56	15,70	0,01
		(12,4%)	*(0,01%)*		*(10,8%)*	*(0,01%)*
MME	2,81	62,4	0,00	2,88	70,70	0,01
		(5,6%)	*(0,4%)*		*(6,4%)*	*(0,04%)*
USA	6,61	252,6	0,00	5,88	196,50	0,00
		(17,6%)	*(0,0%)*		*(8,3%)*	*(0,0%)*
Rest of the world	3,70	118,4	0,00	3,90	100,90	0,00
		(24,7%)	*(0,0%)*		*(19,4%)*	*(0,0%)*

* Percentage share in total value of Greek exports towards each geographical area in parentheses.

5.2 The specialization pattern of Greek exports: static and dynamic analysis.

The preceding analysis is not sufficient to fully capture the specialization pattern and the competitive advantage of a country's exports. The following analysis of the total distribution of the B_{ij} index is necessary in order to:

- obtain a complete picture of the specialization pattern of Greek exports;
- estimate the degree of specialization; and
- examine the dynamics of the specialization pattern.

5.2.1 Specialization pattern of exports

The study of the specialization pattern of Greek exports iis based on an analysis of the frequency distribution of the BL_{ij} index. Specifically, the "Kernel"[21] frequency distribution was used for all products in the periods 1996-2006 and 2001-2006.

The results of this method are consistent with those obtained so far, namely that the specialization pattern of Greek exports is asymmetric and concentrated in the negative range of the BL_{ij} index (Figure 8). The distribution of the index for the EU-15 is the most asymmetric and the distribution for SE Europe the less asymmetric one, while the distribution for the MME is almost symmetric. This specialization pattern improved in the period 2001-2006, mainly due to the improvement in the areas of SE Europe and the MME (Figure 8). Finally, it is similar to that of Portugal, but different than that of Spain, which reflects a more symmetric distribution (Figure 9).

[21] The Kernel frequency distribution is a non-parametric method of estimating the probability density function of a random variable. It is a useful tool, as it allows to draw conclusions for a certain population on the basis of a sample of observations from a certain population. This study uses the Epanechikov Kernel function with "optimum" band width.

Figure 8. Frequency (%) distribution of the degree of specialization of Greek exports
(Kernel curve - % on vertical axis)

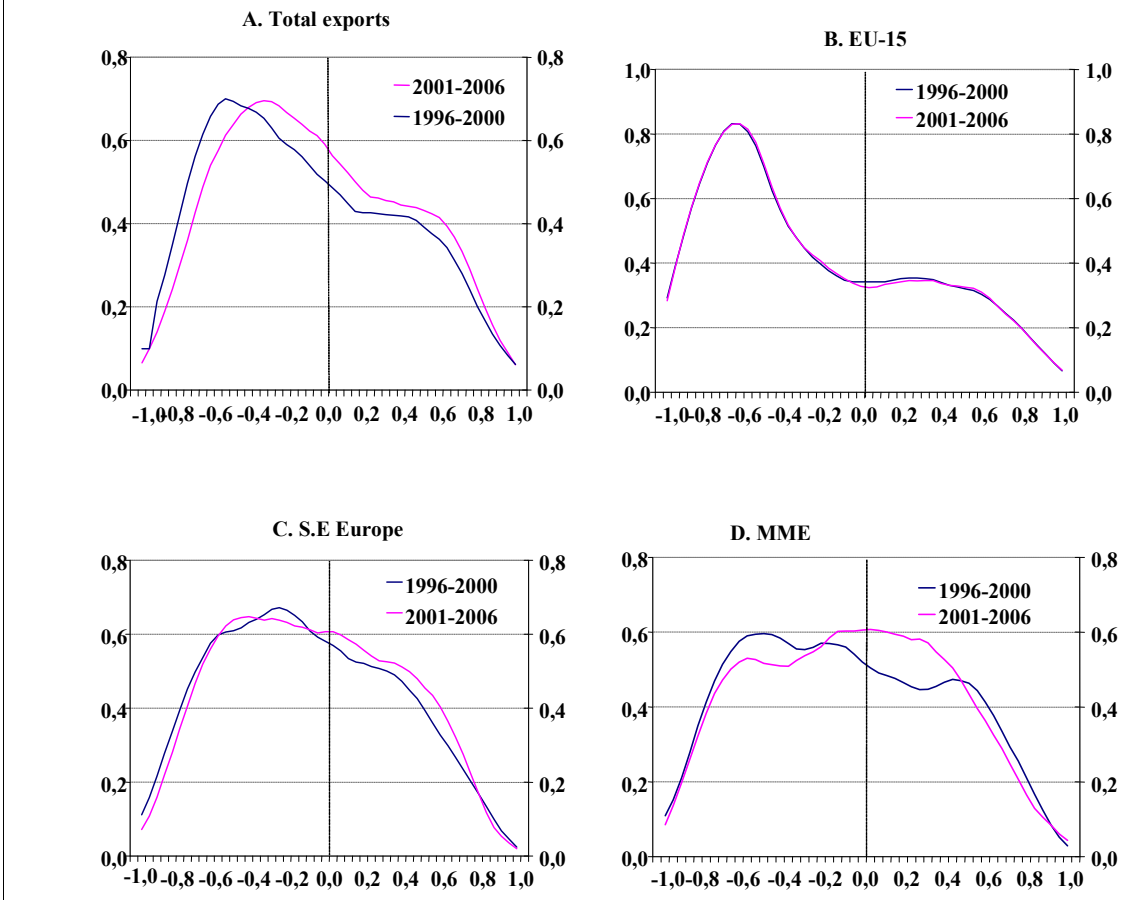
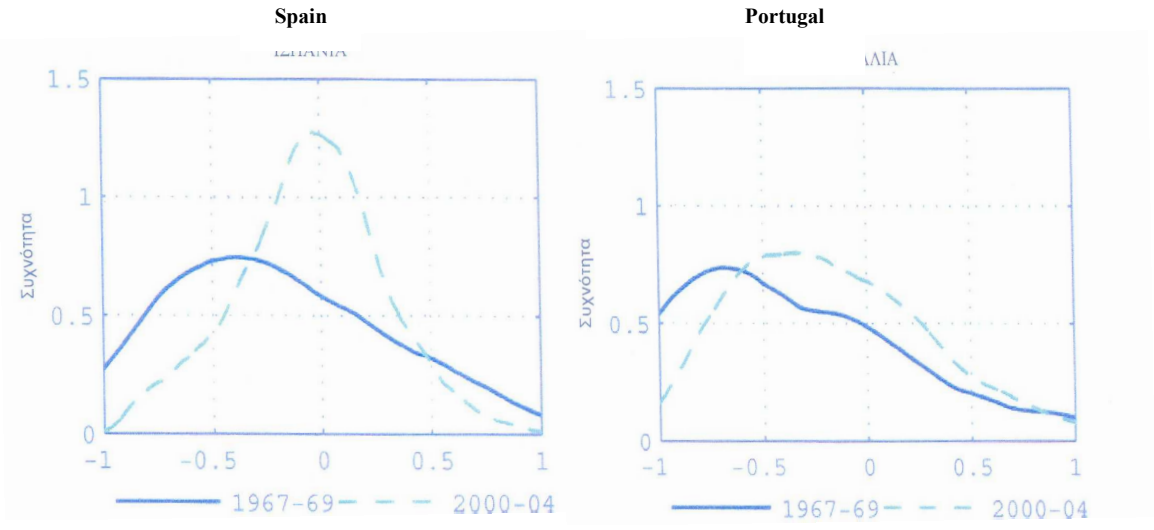


Figure 9. Frequency (%) distribution of the degree of specialization of exports of Spain and Portugal
(Kernel curve % on vertical axis)



Source: Amador et al. (2007).

5.2.2 Estimation of the degree of specialization

The estimation of the degree of specialization of Greek exports is based on the Lorenz curve, which allows the comparison of the structure of Greek exports with that of world trade. Specifically, the *Lorenz curve* is the graphic representation of the cumulative distribution of the nominator (horizontal axis) and the denominator (vertical axis) of equation 8. The 45^o line is the "full equality'' line and represents the degree of specialization of world trade. The degree of specialization of Greek exports is measured by the maximum distance between the Lorenz curve and the 45^o line. Lorenz curves for the periods 1996-2006 and 2001-2006, constructed using the sample average of the two periods, are shown in Figure 10.

The Lorenz curve of total exports during the 1996-2006 period indicates a relatively high degree of specialization. Exports towards EU-15 show the highest degree of specialization. Exports towards South-Eastern Europe are characterized by less extensive specialization, which declines during the 2001-2006 period and was responsible for the drop in the overall degree of specialization. Finally, a comparison of Figures 10 and 11 indicates that Greek exports are more specialized than exports of Portugal and Spain.

5.2.3 The dynamic development of the specialization pattern of Greek exports.

In order to estimate the change in the total distribution of the BL_{ij} index over time, a simple dynamic discrete-time *Markov model* is used to examine the stability (or transition) of the specialization pattern.

Let $F_t(BL_{ij})$ be the distribution of the BL_{ij} index and A_t the probability vector that represents the initial distribution of the BL_{ij} index in $\Delta=1,..., k$ discrete-time sub-intervals of the range [-1,+1] of the BL_{ij} index values. The probability of transition of an index in the sub-interval j in time $t+\eta$, given that the value was in sub-interval i in time t, is called the *transition probability* of one step $\{\eta\}$ and is given by $p_{ij}(t)$, where:

$$p_{ij}(t) = P(X_{t+n}=j / X_t=i) , \qquad (10)$$

Figure 10. Degree of specialization of Greek exports (Lorenz curve)

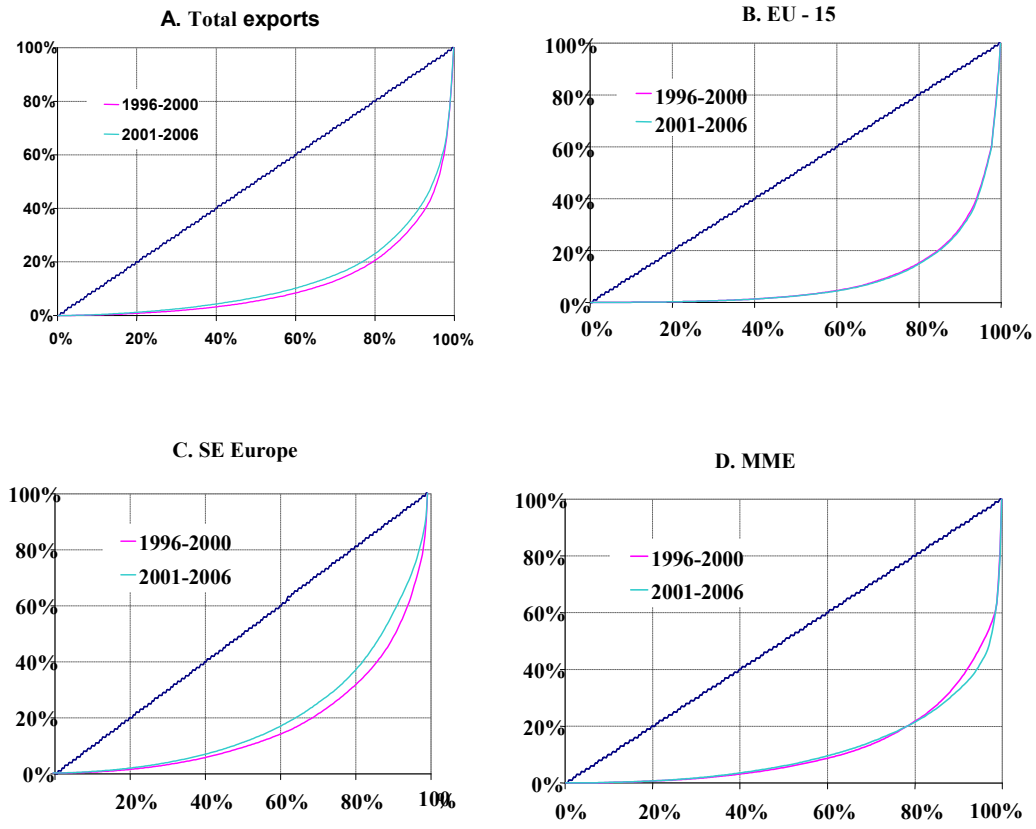
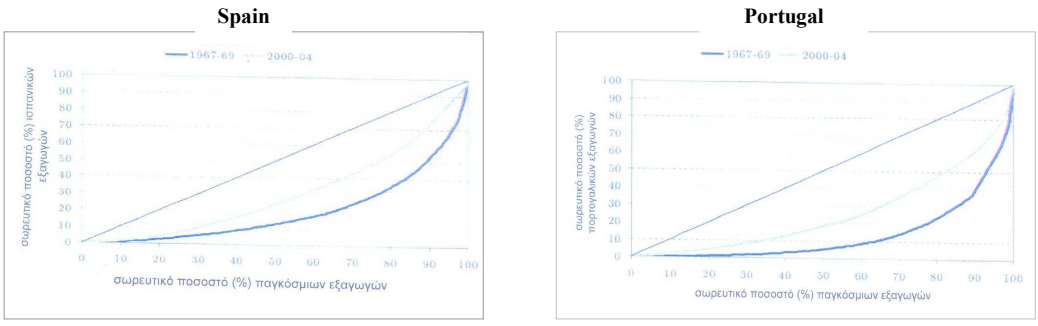


Figure 11. Degree of specialization of the exports of Spain and Portugal (Lorenz curve)



Source: Amador et al. (2007).

Assuming that $p_{ij}(t) = p_{ij}$, (the transition probabilities do not depend on time), then the transition probabilities are stable or homogeneous and X_t is called stable distribution. For k sub-intervals, the transition matrix P of dimensions kxk, for k=2, is given by (11) :

$$\begin{vmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{vmatrix} , \qquad (11)$$

Note that P is stochastic since:

$$p_{ij} \geq 0 \ \ \forall \ i, j \text{ and } \sum_{j=1}^{k} p_{ij} = 1 , \ \ \forall \ \ i=1,2,..., \qquad (12)$$

meaning that the transition probabilities sum to 1.

The Markov process is fully described by P and the initial distribution $A_t = \{A_{i,t}\}$, where $A_o = P(X_o=i)$ is the probability that the transition starts at time i, $i=0, 1,...$ Therefore, for the set of all subspaces the evolution of the probabilities of the Markov process in one step $\{\eta=1\}$ is given by the stochastic equation:

$$A_{t+1} = A_o P , \qquad (13)$$

After {η=s} periods (13) is written as:

$$A_{t+s} = A_o P_s , \qquad (14)$$

It can be also proven that $\lim_{S \to \infty} P_s = \mathbf{1} X_t$

Let v_{ij} be the number of indices in subspace i at time t and in subspace j at time $t+n$. Then, the probability p_{ij} that an index is in subspace j at time $t+n$, given that it was in subspace i at time t is written as:

$$p_{ij} = \frac{v_{ij}}{\sum_{j} v_{ij}} , \qquad (15)$$

Therefore, the probability p_{ij} equals the number of indices that transitioned from subspace i to subspace j as a percentage of the total number of indices. Anderson and Goodman (1957) showed that (15) is a consistent but biased maximum likelihood estimator. However the bias approaches zero as the sample size increases.

Finally, the transition matrix *P* describes the intensity of the change of the BL_{ij} index distribution over time. The existence of high values of transition probabilities on the diagonal of the matrix indicates stability, while high values *off - diagonal* indicate considerable change.

Table 9. Markov transition matrix of BLij indices of Greek exports

1996 \ 2006	Intervals of BLij indices values			
	[(1) - (0,50)]	[(0,50) - (0)]	[(0) - (-0,50)]	[(-0,50) - (-1)]
[(1) - (0,50)]	71%	20%	9%	0%
[(0,50) - (0)]	25%	46%	27%	2%
[(0) - (-0,50)]	6%	31%	48%	15%
[(-0,50) - (-1)]	2%	11%	43%	44%
Initial distribution	16%	20%	22%	42%
Final Distribution	33%	30%	29%	9%
Limit of the distribution	33%	30%	29%	9%

The highest transition probabilities, as Table 9 indicates are on the diagonal. The stability of specialization is very high (71%) in the 1st (best) quadrant of the BL_{ij} index values. The 2nd best quadrant is characterized by lower stability, improved by 25% and deteriorated by 29%. As for the 3rd quadrant, almost 50% of the indices have not changed, 37% have improved and 15% have deteriorated. Finally, 87% of the indices of the 4th (worst) quadrant remain in the negative value subspaces, while the rest (13%) transitioned to the two best quadrants. A comparison of the limit of the distribution with the initial distribution shows that the dynamic convergence process of the initial distribution lasted approximately a decade and the limit distribution has considerably improved compared to the initial. It should be noted, that the results on the stability of specialization of Greek exports are comparable to those of Italy in the 1990's for the 1st quadrant, while for the other quadrants, the stability of specialization of Greek exports is clearly lower (De Benedictis and Tamberi, 2001).

5.3 Export price and cost competitiveness of Greek exports.

Price as well as cost (unit labour cost) competitiveness of Greek exports declined considerably during the previous five decades and after 1980 in particular (Figure 12). Cost

competitiveness decreased by 75 percentage points between 1980 and 2007, while export price competitiveness recorded a slight decline (approximately 9 percentage points). During the period 1980-2007 average cost competitiveness was approximately 34 percentage points higher than price competitiveness. During the period 2001-2007, average price competitiveness reached its long-run (1962-2007) average, while cost competitiveness was some 37 percentage points higher than its long-run average.

5.3.1 Export price competitiveness as a determinant of export market shares.

The analysis so far has pointed to the decline in Greek export market shares to most destinations and especially to the EU-15 as well as the negative contribution of competitiveness.[22] This section attempts to estimate the determinants of export market shares and their relation to price competitiveness. For this purpose, a panel of data is used on export market shares for 279 exported commodities and their prices, as well as the competitor' s (main competitors of Greek exports) prices for the same commodities for the period 1996-2006. The equation to be estimated is given by:

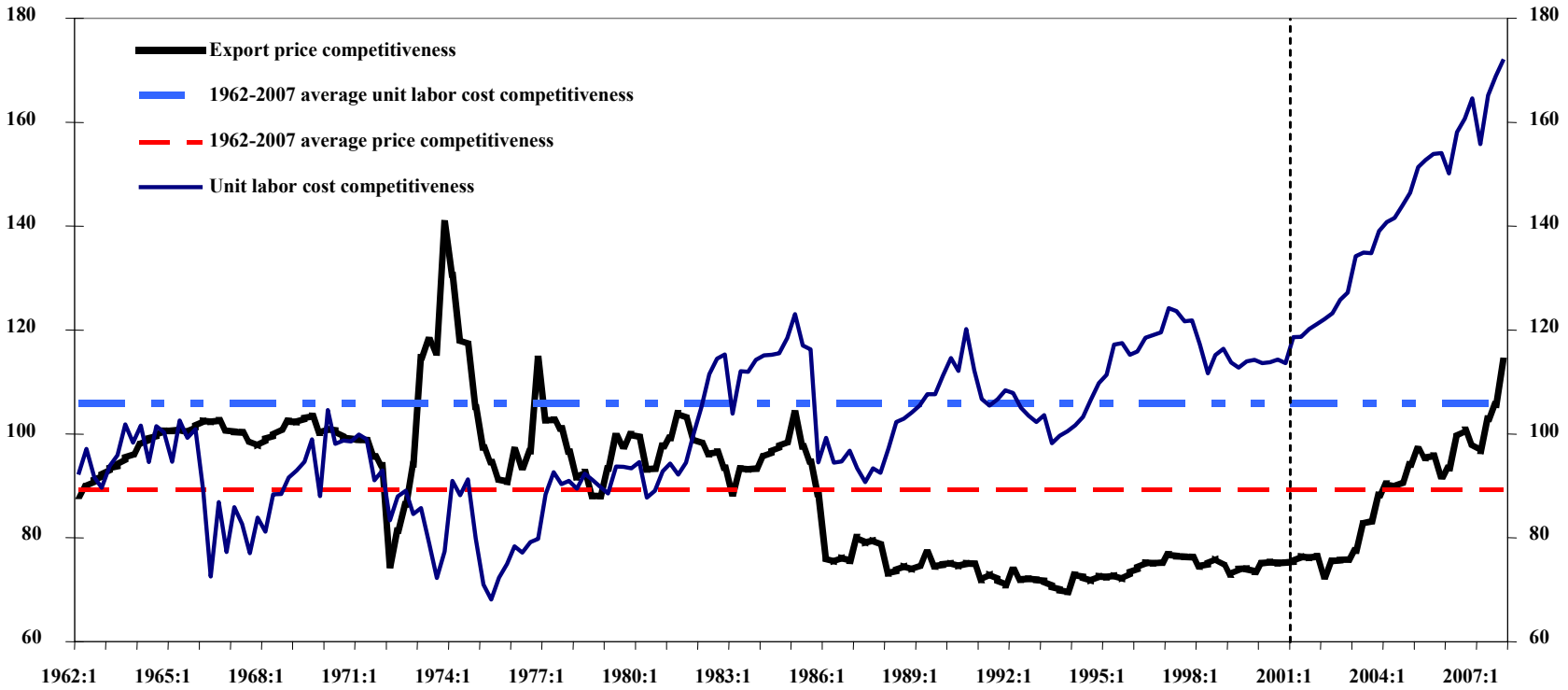
$$S_{i,t} = f\,(P_{x,t}^{\,g},\, P_{x,t}^{\,c},\, t)\,, \qquad (16)$$

where $S_{i,t}$: Greek export market shares in constant prices, $P_{x,t}^{\,g}$: average prices of Greek exports (in euro), $P_{x,t}^{\,c}$: average competitor's prices[23] (in euro), $i= 1,\ldots,N$: commodities and $t=1,\ldots,T$ years: a time trend. Price competitiveness is affected not only by changes of Greek export prices but price changes of the same commodities in competitor countries.

[22] According to the ECB (2006), competitiveness declined considerably during the period 1995-2005 in Belgium, Spain and Italy (besides Greece), while it improved in Germany, France, Austria and Finland.
[23] 15 major competitors.

Figure 12. Price and cost competitiveness of Greek manufactured products

(1970=100, quarterly data, seasonally adjusted)



Data for 25 OECE member competitor countries were used with weights varying each year.

Source: Athanasoglou and Bardaka (2010).

The following three methods were used to estimate equation (16):

- the Generalized Method of Moments (GMM), as proposed by Blundell and Bond (1998). The need to estimate a dynamic equation is supported by the nature of the relations examined. In addition, the estimation of (16) with a lagged value of export market shares offers a partial solution for the missing variable problem.
- the Random Coefficient Model (RCM), that considers commodities as heterogeneous and allows the examination of each commodity separately[24], and
- the Panel-Corrected Standard Errors (PCSE), that assumes that errors are by definition heteroscadastic and at the same time correlated between panels.[25]

Table 10. Determinants of export market shares

	Estimation methods							
	GMM		**RCM**		**PCSE[1]**			
N=279, T=11	**Total**	**EE**	**Total**	**EE**	**Total**	**EE**	**Total**	**EE**
Constant	-1,39	-1,37	-1,58	-1,91	-1,74	-2,04	-1,2	-1,84
	(-40,09)	(-14,31)	(-19,00)	(-14,38)	(-40,57)	(-34,79)	(-19,40)	(-24,72)
$lnS_{i,t-1}$	0,16	0,20						
	(-8,30)	(-7,71)						
$ln(P_{x,t}^{g}/P_{x,t}^{c})$	-0,57	-0,39	-0,63	-0,49	-0,47	-0,46		
	(-15,83)	(-6,71)	(-13,52)	(-13,52)	(-13,94)	(-16,05)		
$lnP_{x,t}^{g}$							-0,60	-0,50
							(-18,74)	(-15,50)
lnP_{x}^{c}							0,29	0,41
							(8,06)	(11,89)
Wald (x^2)	337	116	183	41	194	258	385	262
R^2					0,33	0,21	0,36	0,19

1.First differences errors are not autocorrelated.

The results of the estimation are presented in Table 10 for all exports and exports destined for the EU-15. Estimation results including the trend are not presented, since the associated coefficient was not found to be statistically significant.

All three methods show that the elasticity of competitors prices is statistically significant and lies between [-0.47, -0.63], while Greek export prices elasticity is twice as much as competitors prices. This indicates that the price competitiveness of Greek exports is determined mainly by the pricing policies and the cost of Greek exporting firms and less by the behaviour

[24] This method treats the coefficients of the heterogeneous commodities as stochastic processes (Swamy, 1970).
[25] The coefficients of equation (16) were estimated with the Prais-Winsten method, assuming autocorrelation in the residuals of the panels.

of their competitors. The results of estimating equation (16) by the GMM method showed a rather long time lag before the adjustment of the short-run export market shares to the corresponding long-run ones. Consequently, the long-run price elasticity is low (0.68).

In addition, the random coefficients method allowed the estimation of price competitiveness elasticity for each commodity. This was found to be greater than 1 in approximately 70 cases, mainly in the categories of chemicals, machinery and other manufactured products, which means that these exporters successfully deal with competition in foreign markets. The five products (in the categories of machinery and other manufactured products) with the highest price competitiveness elasticity are shown in Table 11. The elasticity of price competitiveness for exports destined for the EU-15 area is statistically significant and slightly lower than for total exports and ranges from -0.39 to -0.49.

Table 11. The five products with the highest price competitiveness elasticity *

Total			EU-15		
SITC code	**Product description**	**Elasticity**	**SITC code**	**Product description**	**Elasticity**
7449	Mechanical parts	-2,90	7426	Centrifugal pumps	-3,01
6825	Copper plates, sheet & strip	-2,72	8425	Skirts for women	-3,00
6572	Fabrics	-2,62	6417	Paper, paperproducts coated with plastic	-2,53
6827	Copper tubes, pipes &tubes or pipe fittings	-2,54	6743	Metal flat-rolled products	-2,43
7426	Centrifugal pumps	-2,32	7436	Filtering & purifying machinery for liquid or gas	-2,09

* Price competitiveness elasticity is greater than 1 in the case of 58 products.
and of 70 products in the EU-15 in particular.

This result confirms the previous results that Greek exports are less competitive in EU markets. However, the elasticity of price competitiveness for 58 products is higher than one. As indicated in Table 11, the five commodities with the highest elasticity exported to the EU-15 area are in the categories of machinery and other manufactured products.

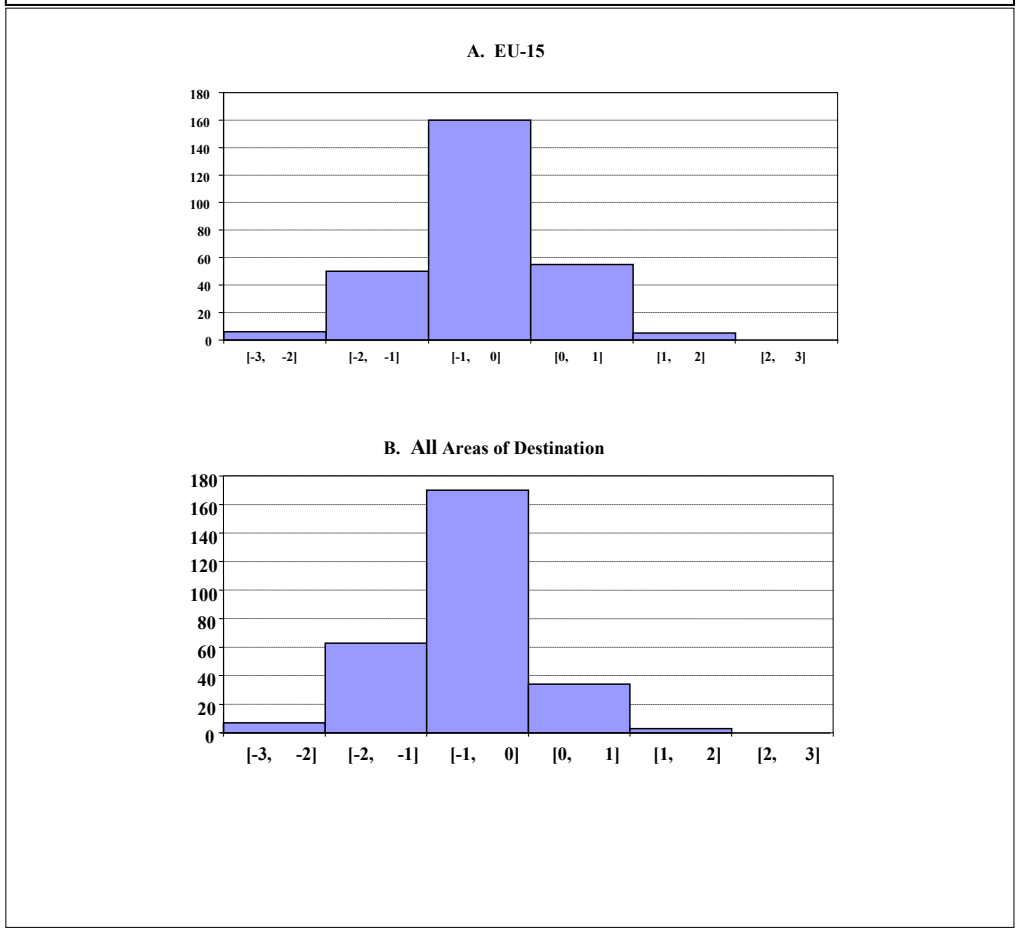
The frequency of the elasticities of price competitiveness for all geographical areas and the EU-15 separately are presented in Figure 16. The frequency distributions are similar in both cases, with the highest frequency ranging within the interval [-1, 0]. The second highest frequency, for all destination areas is observed in the [-2, -1] followed by the intervals [0, 1], [-

3, -2] and [1, 2]. The second highest frequency for EU-15 elasticities is in the interval [0, 1] followed by the interval [-2, -1], while the frequencies in the intervals [-3, -2] and [1, 2] are very small.

5.4 Non-price competitiveness

Low short-run and long-run price competitive elasticities estimated so far indicate the existence of other factors affecting export performance, such as variety and quality, technological content and innovation, foreign direct investment and foreign demand structure and the structure of the domestic economy.

Figure 13. Distribution of competitiveness elasticities by commodity



Athanasoglou and Bardaka (2009) study the role of non-price factors on Greek export performance using time series to estimate Greek exports as a function of explanatory

variables such as foreign income (approximated by GDP or, alternatively, industrial production), price competitiveness (export prices - unit values - or unit labor cost in manufacturing) and non-price competitiveness (capital stock in manufacturing).

Table 12. Price and non-price competitiveness elasticities of Greek manufactured goods exports

	Elasticities when foreign demand is:			
	GDP [1]		Industrial Production [1]	
	Short-run	Long-run	Short-run	Long-run
Price competitiveness				
- Relative export prices	-1,139 (-5,399)	-	-1,089 (-5,367)	-
- Relative unit labor cost	-	-1,169 (-3,697)	-	0,934 (-4,223)
Non-price competitiveness	2,766 (6,096)	1,265 (2,517)	2,513 (5,636)	1,466 (6,254)

1. GDP and Industrial production of destination countries are alterantive variables used in the model.
t- statistics in parentheses
Source: Athanasoglou and Bardaka (2010).

The estimation results, presented in Table 12, indicate that both short-run and long-run price competitiveness elasticity is close to one, while the elasticity of non-price competitiveness is greater than one. Consequently, although Greek exporters are not particularly competitive in foreign markets, they could achieve better performance if they improve non-price competitiveness.

8. Conclusions

This study attempts to evaluate Greek export performance during the period 1996-2001, first by studying the exposure of the Greek economy to international trade and the structure of exports. Second, the method of Constant Market Shares is used in order to measure Greek export market shares and the factors underlying their changes. Third, the role of commodity composition of exports, their competitive position in international markets and an analysis (both static and dynamic) of the specialization pattern of Greek exports are presented. Finally, the effect of price competitiveness on export market shares is examined.

Given the degree of competition in international markets and despite the decline in export market shares in Greece and other developed economies, Greek export performance was satisfactory. A considerable change in export structure, especially their destinations was observed during this period, which had a favourable effect on Greek market shares. The redirection of Greek exports towards the markets of South-Eastern Europe and the Mediterranean and Middle East was reinforced by the high growth of these economies, their geographical proximity to Greece and the presence of Greek companies and financial institutions. However, trade performance was negatively influenced by commodity composition (in terms of variety and quality) and competitiveness, during the period 1996-2006, due to the underlying structure of production. Although the technological intensity of Greek exports has improved substantially during the period under review, it has not improved sufficiently. Greek exports are still, concentrated in low and medium technology sectors, and therefore unable to exploit the trends of foreign demand.

The intra- industry trade index for Greece is below the EU-15 average, which means that Greek exports are characterized by low degree of differentiation. In addition, the quality of Greek exports declined compared to the quality of its competitors, even though the quality of exports towards EU-15 improved substantially during the last two years.

The degree of specialization of Greek exports remained relatively high. However, it declined during the period 1996-2006, as a result of the declining specialization of exports towards South-Eastern Europe. In addition, the specialization pattern of Greek exports reflects a concentration to the negative values of the revealed preferences index. The improvement in this index observed during the 2001-2006 period is due to exports directed to South-Eastern Europe and the Mediterranean and Middle East. The results also show the stability of the Greek export specialization pattern between 1996 and 2006 in the positive (best) intervals of the index. This indicates a rather encouraging dynamic development for Greek exports.

The long-run elasticity of price competitiveness of Greek exports, according to the panel data analysis, was relatively low, which means that the improvement in export performance through changing export prices requires a rather strong effort. In addition, the adjustment time of the short-run market shares to the long-run ones is long. On the other side, it seems that Greek exporting firms have some competitive power in several commodity categories (such as mechanical equipment, manufactured metallurgy products, paper and glass) and could achieve better performance by focusing on non-price factors. Therefore, policies that support innovation, variety and quality and create a suitable environment through investment in

research and development are necessary, especially in sectors where Greece already has a comparative advantage and substantial competitive power.

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Appendix

Table 13. Trade Openess

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Austria	53,26	59,51	61,48	63,38	69,73	72,02	70,69	70,45	76,36	79,12	82,75
Belgium	112,94	119,53	120,14	120,18	136,48	135,21	130,17	128,46	134,12	140,00	142,31
Denmark	51,94	54,38	54,19	54,34	59,50	59,28	60,06	57,00	58,12	61,83	65,63
Finland	54,38	57,26	56,79	54,97	63,90	58,56	56,60	56,09	57,84	62,15	68,40
France	35,69	38,85	40,12	40,59	45,62	44,46	42,37	40,47	41,54	42,66	44,53
Germany	39,97	43,92	45,97	47,30	54,77	55,46	54,53	55,44	59,51	63,79	71,18
Greece	33,61	32,88	33,56	34,55	40,35	38,25	36,64	36,29	35,12	34,77	37,93
Ireland	113,95	115,38	119,77	119,17	126,98	122,64	110,84	89,39	87,54	84,58	79,78
Italy	35,77	36,96	37,38	37,37	42,91	42,45	40,48	38,96	40,28	41,82	45,49
Luxembourg	85,96	94,46	98,64	90,04	94,65	96,76	90,56	85,13	92,07	89,89	87,94
Netherlands	88,93	94,32	93,08	93,22	105,49	99,72	93,08	91,31	97,07	101,87	109,65
Portugal	52,60	54,15	55,05	54,58	58,30	56,04	52,78	51,55	53,03	53,97	57,13
Spain	35,62	39,75	40,71	41,48	46,13	44,15	41,95	40,82	41,69	42,20	44,25
Sweden	55,43	59,61	61,24	60,45	66,00	63,47	60,61	59,84	62,52	66,12	70,03
United Kingdom	44,53	42,91	39,80	38,91	41,87	41,04	39,12	37,31	36,87	39,27	42,64
EU15	45,28	47,92	48,41	48,84	55,08	54,00	51,89	50,58	52,51	54,95	58,97
United States	18,39	19,05	18,52	18,91	20,77	18,85	18,11	18,41	19,93	21,14	22,22
Japan	15,52	16,87	16,24	15,64	17,23	17,03	17,79	18,74	20,61	22,91	26,37

Openess (OP) =(X+M)/Y, where X, M and Y are exports, imports and GDP respectively, in USD and current prices

Source: OECD, National accounts

Table 14. Exposure to international trade

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Austria	21	22	22	23	24	24	23	23	24	24	25
Belgium	24,19	23,68	23,63	23,63	21,77	21,81	22,35	22,68	21,97	21,16	20,86
Denmark	18,48	19,31	19,65	19,17	20,28	20,08	20,27	19,57	20,12	21,03	22,25
Finland	17,34	17,89	17,71	17,40	18,89	18,04	17,79	18,14	18,88	20,34	21,36
France	14,49	15,17	15,68	16,00	17,89	17,46	16,73	16,29	16,76	17,40	18,00
Germany	15,21	16,28	16,80	17,25	19,25	18,90	18,19	18,50	19,18	20,04	21,38
Greece	18,88	18,74	19,37	19,93	22,51	21,66	21,46	21,20	20,66	20,17	21,06
Ireland	20,33	19,83	19,45	18,89	16,72	17,40	18,33	19,24	19,65	20,44	20,75
Italy	13,35	14,07	14,34	14,72	16,78	16,49	15,98	15,64	16,07	16,74	18,02
Luxembourg	27,56	28,31	28,56	28,47	28,47	28,71	27,82	27,50	27,77	27,99	27,46
Netherlands	23,78	24,02	24,14	24,26	24,05	24,02	23,69	23,66	23,70	23,56	23,38
Portugal	21,81	22,50	23,07	23,40	24,36	23,69	22,56	21,82	22,57	23,00	23,59
Spain	15,72	16,92	17,54	18,28	19,96	19,22	18,42	18,13	18,76	19,27	20,13
Sweden	18,21	18,99	19,50	19,48	20,66	20,09	19,53	19,44	19,86	20,86	21,60
United Kingdom	18,09	17,55	16,97	16,91	17,86	17,84	17,41	16,81	16,94	17,80	18,85
EU15	17,29	17,96	18,22	18,52	20,24	19,84	19,19	18,94	19,48	20,20	21,20
United States	9,44	9,68	9,65	10,18	11,27	10,38	10,24	10,52	11,39	12,08	12,50
Japan	6,49	6,82	6,21	6,10	6,93	7,17	7,21	7,57	8,21	9,44	10,86

Exposure to international trade (EIT)=EP+(1-EP)*MP, where EP and MP: export performance and import penetration respectively

Source: OECD, National accounts

Table 15. The best five exports according to the B_{ij} index

		Total Exports		EU-15		SE Europe		M & Middle East		USA		Rest of the world	
SITC Code	**Product descriptiion**	**1996-2000**	**2001-2006**	**1996-2000**	**2001-2006**	**1996-2000**	**2001-2006**	**1996-2000**	**2001-2006**	**1996-2000**	**2001-2006**	**1996-2000**	**2001-2006**
8447	Dresses, shirts	1	1	5	5	5	5	2		2			
6133	Furskins assembled	2	2					3	1	5	5	2	2
4214	Olive oil	3		1	2								
1211	Tobacco	4	3	3	1					3	2	4	4
8483	Apparel of furskins	5	4	4	3			5	5			5	5
2223	Cotton seeds		5	2	4	3	3		4		4		
483	Pasta					1							
571	Citrus fruits					2	4						
1222	Cigarettes					4							
567	Vegetables							1					
6131	Furskins not assembled							4					
576	Figs									1			
589	Fruits and nuts prepared									4	3	3	3
579	Fruits											1	1
8442	Suits, dresses												
1213	Tobacco refuse								2				
5423	Medicaments								3				
223	Yogurt, buttermilk										1		