

**European Macro-economic Policy and Technological Development: the  
case of Greece**

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## **Abstract**

Recent studies on economic and technological transformation in less developed countries emphasise that improvement of their performance in terms of competitiveness and successful integration into the world economy requires both economic stabilisation at the macroeconomic level and technological development.

Greece is a typical case, which during the last twenty years has had to deal with specific imperatives: European integration, technological catch-up and macro-economic stability. These processes are envisaged under the pressure of the opening of the economy, which in principle could facilitate dissemination of new technologies on the one hand but constrain the development of national capabilities on the other.

In this paper we present the specificities of the Greek productive system that have shaped its integration into the EC and attempt to link the process of European integration with its technological development. Special reference is made to the macroeconomic policy of the EU and its impact on technological transformation.

## **1. Introduction**

In this paper we study the impact of macro-economic policies introduced by the European Union on technical change in Greece.

Until 1973 the Greek economy experienced a spectacular rate of growth and high performance based on the development of an important range of heavy industrial activities as well as on the flourishing of a spectrum of traditional industries (textile, food and beverage). After the first oil shock and with the gradual opening of the economy to international pressures, the Greek economy entered a phase of economic recession that was reflected in a wide range of economic indicators.

Circumstances seem to change again after 1995, a period which has all the characteristics of macro-economic recovery in terms of growth rates, investment, inflation and public debt.

**Table 1.1: GDP, GFCF (% change at market prices 1995), Deficit, Inflation**

	GDP		GFCF		Net Lending/ GDP	Inflation
	GR	EU	GR	EU		
61-72	8.63	4.6	10.1	5.7	0.58	2.34
73-83	2.30	2.3	-0.24	0.08	-3.64	18.5
84-94	1.36	2.4	-0.51	2.5	-11.66	16.86
95-01	3.34	2.3	8.26	4.0	-3.76	5.23

**Table 1.2: Average % change of labour productivity**

	61-72	73-83	84-94	95-01
GR	9.3	1.5	0.6	2.5
EU	4.4	2.2	1.9	1.5

Sources: *Main National Accounts Aggregates of the Greek Economy (1960-2001)* of the Ministry of National Economy, *European Economy* (EC) and *Economic Outlook* (OECD).

European Integration coincided with a period of global restructuring and strong tendencies towards integration of national economic systems into the world market.

The major milestones of Greece's European integration were the following:

**1961:** Affiliation Agreement with the EC: the pre-accession period.

**1981:** Accession of Greece to the EC.

**1992:** Single Market Act and opening of markets for goods and services.

**2001:** Member of the European Monetary Union (EMU).

In Greece the main dimensions of European macro-economic policies that were of crucial importance were trade liberalisation, monetary convergence and regional policy. The first dimension had a major impact because of the high level of protectionism that characterised the Greek economy before the European integration. The second dimension refers to the requirements for fiscal discipline and restriction of state intervention in economic activity. The third dimension played the role of counteracting restrictive policies as EC transfers supported a modernisation of the Greek economy and the scientific and technological system (the improvement of technological infrastructures and research and innovative activities).

Greece delayed restructuring efforts even in the directions that had been chosen from a political point of view. This was also probably a result of the fact that the decision for European integration had been essentially a political one, and its economic terms and conditions were taken into account later on as necessary requirements from the European Community's side.

Greece delayed its adjustment to the new situation of trade liberalisation but, like almost all West European governments, Greek governments after 1993 treated preparation for Economic and Monetary Union as a national priority, and economic policies were geared towards meeting the criteria set by the Maastricht Treaty in 1992 for a sustainable nominal monetary convergence.

In the following sections we will refer to the impact of the different dimensions of EU policy on technological development in Greece.

In the first section we present the specificities of the Greek industrial system with regard to the protectionist regime and the public intervention.

In the second section we focus on the S&T system in Greece and its evolution as well as on the impact of the European regional and RTD policy. Emphasis is given on efforts that might improve the catching-up process and the country's absorption capability.

In the third section we attempt to investigate the role of the European Regional Policy aiming to support structural adjustment in specific Member States (Greece being one of them).

The last section summarises the main points with regard to technological change and the competitive position of Greece.

## **2. The relaxation of the protectionist regime and trade liberalisation**

For a long time industrial policy in Greece was focused on the level of protectionism, incentives and subsidies, taking the form of a deal between political power and private interests for the distribution of economic benefits expected from public intervention. High protectionism and state intervention offered conditions for high profits for Greek firms by the exploitation of monopolistic positions, but also created a misleading picture of the situation in Greek industry and oriented corporate behaviour towards practices that resulted in de-industrialisation (turning to commercial activities, limp investment behaviour, etc).

The Affiliation of Greece to the European Community in 1961 pointed towards the elimination of tariff protection against imports from EC member states. The level of protection was not the same for all goods. Some categories benefited from low levels of protectionism, either because of a policy priority to facilitate technology transfer through imports of goods that were important for investment in a country that could not produce technologically sophisticated goods (machinery equipment), or simply because there was no domestic production of such goods. Other categories benefited from very high levels of tariff protection, sometimes reaching more than 100% (and up to 200%) of their value. These categories included mainly traditional sectors and products that were domestically produced. This policy preserved the traditional structures of the Greek productive system.

The Affiliation Agreement required a gradual dismantling of tariff protection until 1974 for products that were not produced in Greece<sup>1</sup> and until 1984 for products for which domestic production existed. This was of great importance for technological development in Greece, as technologically more sophisticated activities that were not developed in Greece were exposed to international competitive pressures from the early 1970s. The absence of protection for infant industries explains to some extent the limp investment behaviour in technologically more advanced activities.

However there was a delay of the adjustment to this new status and even in 1985 the amount of taxes and duties on the taxed value of goods remained important. In 1985 taxes and duties on the taxed value of specific imported products were as follows:

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<sup>1</sup> It should be mentioned that the protection included, in addition to tariffs, other kinds of protection such as taxes that accounted for a big proportion of the taxed value.

**Table 2.1: Taxes and duties in 1985**

Food	9.6
Beverages	119.8
Cigarettes	6.5
Textiles	32.4
Footwear	30.2
Clothing	39.9
Wood and cork manufactures	24.5
Furniture	28.9
Paper	19.4
Plastics	31.9
Chemicals	22.3
Petroleum products	40.7
Non-metallic minerals	31.4
Metallic products	24.8
Machinery	13.4
Electrical goods	43.3
Transport equipment	66.3
Miscellaneous industrial articles	32.5

*Source: Giannitsis, 1988, p79*

Although the percentage of taxes and duties decreased for a number of categories from 1983 to 1995 (see annex, Table A.1) it remained important because for some cases taxes represented almost the total charge on the imported value (eg, the charge for beverages and tobacco from import duties was only 1% and the remaining part was from taxes).

The openness of the economy increased over the period 1978-1999 as the percentage of exports and imports to GDP rose from 29% to 33%. Additionally a shift occurred in the geographical distribution of trade, as trade with EC countries increased from 61% in 1980 to 73% in 1997 (Table A.9).

In the context of industrial policy a number of policy tools have been used in addition to tariff protection to support growth of production and income. Different tools distinct from the duties, such as advance payments on imports, quotas, indirect taxation or administrative forms of intervention, discriminatory treatment of Greek firms in public procurement, privileges for FDI, all constituted the complex of protection for firms producing in Greece. State aids and public intervention (subsidies, bank loans, nationalisations, pricing policy, tax exemptions, returns of interest payments, etc), especially to specific manufacturing sectors such as shipbuilding and the fertiliser industry, remained relatively high until the end of the 80s. State intervention was supported and facilitated by financial/banking institutions that were largely controlled by the state, and this delayed any restructuring until the cost became

too high and could no longer be absorbed by public banks, and until international pressures became very strong (Table A.2) (Caloghirou *et al*, 2000). In fact, until the late 80s there were no real strategies designed to accomplish the adjustment of the Greek productive system to the new situation, but instead efforts were made to preserve the status quo and attenuate external constraints and pressures.

A change in policy from favouring state intervention towards a more open market approach occurred at the end of 80s and in the early 90s, first because there were no more degrees of freedom with regard to the EC requirements and second because the benefits from the EC regional policy persuaded economic actors to speed up Greece's integration into the EC (*ibid.*). Since 1990 there has been a gradual decline in total State aids in the EU. State aid as a percentage of GDP for the period 1990-1999 given as annual averages over three-year periods shows a slight decrease, following the general trend to relaxation of public intervention (Table 2.2).

**Table 2.2: State aid as a percentage of GDP, annual averages, 1990-1999**

	90-92	91-93	92-94	93-95	94-96	95-97	96-98	97-99
Greece	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.7
Spain	1.4	1.3	1.3	1.4	1.4	1.4	1.2	1.1
Ireland	0.7	0.8	0.8	0.8	0.7	0.6	0.5	0.6
Portugal	0.9	0.7	0.9	1.0	1.2	1.4	1.4	1.3
EU15	1.2	1.2	1.2	1.2	1.1	1.1	1.0	0.9

Source: *Key Indicators 2001*, General Statistics, EUROPA website.

In Greece 74% of State aids during the period 1992-94 were directed to manufacturing. This percentage decreased to 67.6% in the period 1994-96 (DG Economic and Financial Affairs, 1999). In absolute terms at 1995 prices and exchange rates (million euros), state aid to manufacturing was 1274 million euros for the period 1990-92, 734 for the period 1992-94, and 663 for 1994-96 (*ibid.*).

During the period of relaxation of the protectionist regime we observe a deterioration in a number of performance indices.

Particular attention should be given to trade performance for the different categories of goods. Greece fell behind (especially in the period 1989-93) in terms of export/import ratios in categories for which the relative specialisation ratio was relatively high, and in terms of international competitiveness in categories for which the competitiveness index was higher than the average for all goods. For example in the category of animal and vegetable oils and fats the relative specialisation ratio decreased by 36%, in food and live animals 28%, and in

beverages and tobacco 59% (Table A.3). The Balassa index deteriorated for most of the categories (Figure 2.1). However, it should be mentioned that the share of exports of high-tech products in total exports has shown an improvement over recent years, although it stands somewhat behind other countries of the EU (Table A.5) and its competitiveness is very low by comparison with other countries of Southern Europe and Ireland (Table A.6).

**[Insert Figure 2.1 here]**

The move from protective to competitive conditions affected profitability of industrial firms, which was squeezed during the period 1982-1988. A reversal of the downward trend was achieved through restrictive income policies mainly after 1989 (Figure 2.2). The weak technological capabilities of most industrial firms imposed severe limits on their possibilities of facing competitive pressures by improving productivity rather than depressing labour cost (Giannitsis and Mavri, 1993).

**[Insert Figure 2.2 here]**

The unification of the European Market and the European Monetary Integration made obsolete many of the state practices that involved public intervention in industrial development. At the same time they revealed the strategic role of knowledge and technological and organisational characteristics at the micro level. As the relaxation of public intervention intensified, there was more pressure for the private actors (national and international) to improve their competitive position in terms of technological and organisational capabilities.

### **3. Technological characteristics of the Greek industrial system and Greek S&T system<sup>2</sup>**

The discussion of industrial development in Greece is to a great extent related to the inadequacies of the Greek industrial system concerning technological issues. The Greek industrial system specialises in low or medium technological areas, where it confronts competition from countries whose competitiveness lies in low labour costs, whereas it stands well behind as far as high technology activities are concerned.

A basic element of Greek industrial evolution has been relying on technology transfer. Technology transfer was considered one of the main tools for improving the competitiveness of Greek firms, although it had some characteristics that were not always beneficial for the

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<sup>2</sup> Some of the material of this section is taken from Kastelli (2000).

recipient country. In such a context absorptive capability, defined as the capability to absorb the transferred technology, to diffuse it within the productive system, and to transform it into new technological solutions, becomes an important determinant of the country's potential to reduce technological gaps with more advanced countries. It is then crucial for an intermediate country to accumulate skills, create an R&D system with adequate immaterial and material infrastructure and improve its knowledge stock as prerequisites for catching-up. However, the low export intensity of recipient firms, the weak performance of Greek manufacturing, the level of import penetration and the deterioration of the competitive position of Greece raise serious questions about the extent to which Greek firms succeeded in exploiting technology transfer in order to upgrade their technological and organisational capabilities (Giannitsis, 1991). This is discussed in the following section after we present the main dimensions of the process of technology transfer in Greece.

### **3.1 Technology transfer**

Technology transfer has taken place via imports of capital equipment, foreign direct investment and licensing.

The Greek Government, in order to attract foreign investors, enacted the law 2687 in 1953. Its objective was to offer constitutional protection to foreign investors and to establish exchange, tariff and tax privileges for them. This legislative framework has been progressively supplemented with specific agreements between the Greek State and foreign investors when important investment initiatives were involved. Public policy was very open towards FDI until 1974. Changes have been introduced since 1974 in an effort to rationalise foreign investment. Some criteria for the performance of the foreign investors have been established.

The characteristics of FDI in Greece pointed to an important restructuring of the Greek industrial system (Giannitsis and Vaitzos, 1987, pp64-65):

1. FDI resulted in the creation of large units in Greek industry and in totally new activities for the Greek productive system (petrochemicals, electrical materials, pharmaceuticals, etc). An important part of the FDI concentrated on intermediate sectors and on the production of capital goods.
2. Most FDI aimed at penetration of the Greek market. Only in the first period of their establishment in Greece did they export, probably because the internal market could not

absorb all their production. This, in combination with foreign companies which aimed at the exploitation of raw materials (vertical direct investments), resulted in an increase of industrial exports.

3. There was however an important part of FDI oriented to the final phases of the production process, thus making a low contribution to the industrial value-added.

According to Vaitsos and Giannitsis (1987), FDI has played a very important role in the formation of the industrial structure, in the establishment of entirely new industrial activities (as above), in shaping the characteristics of Greek industry (size, turnover) and in the restructuring of Greek exports, from almost exclusively agricultural goods to a combination of agricultural and manufacturing products. However it is worth mentioning that the most important reasons for foreign investments were the exploitation of the Greek market and of Greek natural resources, and to take advantage of the specific privileges.

However the picture changed following the oil crisis. The foreign capital inflows decreased after 1975 and turned to sectors of consumer goods or traditional sectors (food and beverages, textiles). In Figure 3.1 we observe that inflows of entrepreneurial capital remained at very low levels as percentages of GNP until 1991 and increased considerably after 1992. One would expect this increase to be explained either by an increase of foreign direct investment and mergers and acquisitions or of investment in the stock market or of loans. It is expected that the reduction of exchange rate risk and the general stabilisation of the monetary variables played an important role in the increase of entrepreneurial capital inflows<sup>3</sup>.

**[Insert Figure 3.1 here]**

A survey carried out by Thompson Financial on mergers and acquisitions (OECD, 2001) shows a stable interest of foreign investors in the Greek productive system, with only exceptions being the years 1992 and 1996 where we observe a slight increase of the deal value as a percentage of the total inward cross-border mergers and acquisitions in OECD countries (0.57% and 0.25% respectively) (Table 3.1). Probably these years might be explained by the opening of the capital market and modernisation of the Stock Market. However, the value of deals realised during the period 1990-99 was one of the lowest among OECD countries, confirming the weak interest of foreign investors. Most of the mergers and

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<sup>3</sup> There is a break in the collection of data for FDI after 1993 because of a change in the Balance of Payments system. In order to follow the trend for a long period we used long-term entrepreneurial capital inflows without real estate investment.

acquisitions in the 90s took place in the sectors of food and beverages, chemicals and paper materials.

**Table 3.1: Inward cross border M&As in Greece, deal value as a % of OECD total**

	% deal value GR / deal value OECD total
1990	0.08
1991	0.09
1992	0.57
1993	0.07
1994	0.01
1995	0.03
1996	0.25
1997	0.04
1998	0.004
1999	0.03

*Source:* “New Patterns of Industrial Globalisation. Cross-Border Mergers and Acquisitions and Strategic Alliances”, OECD 2001.

Loans are the other component that could explain the increase in foreign capital inflows but no data are available for studying their evolution. We can only suspect that this is the main reason for the increase in the long-term entrepreneurial capital inflows, as there was a period during which interest rates were lower in foreign banks than in Greek banks.

Regarding licensing, although the Greek government considered it as a tool for upgrading Greek firms’ performance and competitiveness, it failed to turn into a mechanism of knowledge flows and development of in-house technological capabilities. The licensing agreements most of the time imposed important export restrictions and thus did not function as a tool for improving industrial competitiveness (Giannitsis and Mavri, 1993). In addition, an important part of the royalty payments concerned payments of subsidiaries to the mother company that chose licensing as a way of penetrating the Greek market.

The protectionist regime in Greece played an important role in FDI and licensing. Investing in Greece gave the opportunity to foreign firms to penetrate a protected market. Regarding licensing, the high level of protectionism ensured to domestic producers a monopolistic rent that was reflected in prices. Foreign providers of technology were taking a part of this monopolistic rent as they were negotiating for higher royalties as a percentage of the price of the product. European integration and the relaxation of protectionism made exports a more attractive (in economic terms) way of penetration by foreign producers into the Greek market as the price of the products on which the royalties were calculated diminished. That is

probably one of the reasons why royalties as a percentage of Greek industrial exports and of invisible payments diminished until 1992 (Figure 3.2).

**[Insert Figure 3.2 here]**

After 1992 there is again an increase of both ratios, probably relating to the increase of the share of gross investment in the gross productive value (Figure 3.3).

**[Insert Figure 3.3 here]**

### **3.2 The S&T system in Greece**

Until the mid-80s, relatively little attention was paid to endogenous technological development, and the institutional set-up relating to research and technological activities was rudimentary. At the end of the 80s and in line with European S&T policy some important changes occurred.

1. There is a general consensus that issues regarding technological development and modernisation of industrial structures should be approached in a systematic way. In this context many changes and new elements were introduced into the institutional set-up.
2. Application of austerity policies and macro-economic stabilisation was expected to constrain the ability of the state to intervene and actively promote technological development. In addition competition policy reduced the possibilities for traditional direct intervention that might distort competition (eg, support of infant industries). However, European initiatives for the improvement of European competitiveness through Framework Programmes and support to less favoured regions through Structural Funds formed a new mode of public intervention for the development of the S&T system in Greece.
3. The objectives of the Science and Technology Policy derive essentially from European Technology Policy. During the last fifteen years the main orientation of the Greek S&T policy has been shaped according to European priorities. In this respect emphasis has been put on the linkages of productive and research activities, on facilitation of knowledge flows, on networking and cooperation, on the development of research infrastructure, adoption and assimilation of new technologies (ICTs, biotechnologies, etc), and on the development of human resources.

However as already pointed out intermediate countries need to build a sustainable potential of skills, knowledge stock, infrastructure and R&D capability in order to exploit knowledge flows and transform technology that has been imported from abroad. Thus what is interesting to present is the level of the scientific and technological system and its characteristics, not only in a technology supply perspective but also in a catching-up perspective. In the latter perspective the R&D efforts, the education efforts, the scientific and research personnel are indicative of the capability of the country to better exploit knowledge and technology created by foreign actors.

### *R&D efforts*

As observed in Figure 3.4, gross domestic expenditure on R&D (GERD) as a percentage of GDP is one of the lowest among EU countries.

**[Insert Figure 3.4 here]**

The business sector failed to make systematic efforts in R&D and innovation activities, while the linkages of the productive and scientific system proved to be very weak. Taking into account the increased exposure of Greek industry to foreign competition, especially from the early 80s, this problem hastened the deterioration of the Greek position in international trade (increased import penetration and low export market shares). The evolution of business expenditure on R&D (BERD) as a percentage of GDP, as it appears in Figure 3.5, shows the weak level of Greek firms' expenditure on R&D compared with other EU countries.

**[Insert Figure 3.5 here]**

The breakdown of R&D expenditures by source of financing and performing sector, as appears in Tables A.16 and A.17, reveals that by the mid-90s, firms financed half of EU R&D and performed more than two-thirds. However, in Greece the breakdown shows the relatively small contribution of the business sector (public and private firms) in funding R&D. At the same time we observe the significant contribution of government in R&D funding as well as of sources from abroad, which mainly consist of EU Framework Programmes, Structural Funds and other foreign sources (from 1995 Structural Funds are considered as public funding). According to the figures the performance of the Greek business sector in R&D was well below the European respective average. The Government (PRIs) and the Higher Education sector performed the rest, which is high compared with other European countries.

[Insert Figures 3.6 and 3.7 here]

The sectoral distribution of BERD shows an important concentration in five sectors, namely food and beverages, chemicals (including pharmaceuticals), machinery and equipment, radio/television and communication equipment, computer-related activities and business services. More specifically as we observe in the following table the above five sectors add up to 60% of BERD.

**Table 3.2: Sectoral distribution of BERD**

	<b>1995</b>	<b>1996</b>	<b>1997</b>
Computer and related activities	23.26	26.13	26.12
Food and beverages	5.41	5.9	5.17
Chemicals (including pharmaceuticals)	8.46	7.26	7.63
Machinery and equipment	5.01	4.78	5.25
Radio/television and communication equipment)	15.95	15.23	17.21
	58.09	59.3	61.38

Source: GSRT 2001, "Research in Greece".

#### *R&D expenditure and innovative activity*

However, low R&D expenditure is not an indicator that alone could evaluate innovative efforts in Greece. As empirical evidence from OECD countries indicates, only 30-50% of all innovation costs relate to R&D expenditure (OECD, 1998). The rest is expenditure on product design, market analysis, outsourcing and expenditure on patents and licences. The breakdown of innovation expenditures, according to CIS I data, shows however that in Greece, the major sum spent by Greek firms is on R&D and very low amounts are spent on patents, licences and market analyses (*ibid*, p58).

As is being increasingly recognised, innovation relies on interactive processes and knowledge flows. A major problem in the Greek S&T system is the limited linkages between economic actors and the weak infrastructure for diffusion of information and knowledge. Interaction among firms as well as between firms and the scientific community are weak (Deniozos, 1996). This can be observed in the structure of GERD inflows and outflows (Table A.18), according to which private firms in 1997 financed only 3.6% and 0.4% respectively of the Universities' and Public Research Institutes' (PRIs) expenditure on R&D.

In Greece there have been three surveys of innovative activity (conducted in the context of the Community Innovation Surveys) that cover the periods 89-91, 94-96, 97-98. Although there are methodological issues that do not allow reliable comparisons between the first

period and the other two, we do observe an improvement between the periods 94-96 and 97-98 as the number of innovative firms relative to the total number of manufacturing firms increases from 16.9% to 18.4% (GSRT, 2001). During the 90s we also observe an increase in the patent applications to the EPO per million inhabitants, from 3.3 to 8.1 (Eurostat, *Key indicators*, 2001).

However the innovative performance of Greece remains the worst except for Portugal among EU countries (the share of firms that have introduced a product innovation in the period 1994-96 is only 26.5% in Greek manufacturing firms). Interaction between firms and other organisations in innovative efforts is partly represented by the share of innovative firms that have co-operated. This share reaches 17% of innovative firms in 94-96 and 20.6% in 97-98, and to an extent is related to the conditions of funded programmes (mainly EU Framework Programmes requiring co-operation). In 94-96 42% of innovative firms were funded, and additionally funded firms demonstrate a higher intensity of innovative efforts.

One issue that is partly indicative of the extent of interaction between S&T actors is the synergies and links developed between firms and between firms and universities located in the incubator of a science park that may prove to be critical for innovative activity. According to a survey undertaken in March 2000 (Bakouros *et al*, 2002), involving 24 firms located in three Greek science parks, there is no strong formal interaction between companies located in these parks. Additionally, research synergies between on-park companies are completely absent and only commercial transactions and social interaction are taking place. Informal links are also developed between firms and the local university. Although informal interaction and socialisation are not without importance for knowledge and information flows, no research-based synergy in terms of joint research or shared equipment has been established in the science parks that have been studied.

Some recent studies<sup>4</sup> point to some interesting trends suggesting that there is a proportion of Greek firms which in the light of EU membership and European Monetary Union have made important steps towards modernization in terms of competitive strategy, organizational structure and management processes. These firms initiated change irrespective of size. The findings of these studies show that some firms have managed to succeed by drawing on their own initiatives and compete in the context of European integration. Especially regarding innovation, some firms appearing as “hidden champions” have relied on better satisfying

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<sup>4</sup> Three recent research studies give some interesting information about the Greek firms: Makridakis *et al*, 1998; Voudouris *et al*, 2000; and Spanos *et al*, 2001.

their customers' needs and on close co-operation with their suppliers. These findings may justify a degree of optimism for the future of Greek firms and their technological development in the context of European integration.

#### *Human resources*

The development of human resources, through investment in education and training and efforts to upgrade research personnel, is an indicator for evaluating learning and knowledge transfer capability. To implement foreign knowledge and technology requires that skills are built up in the domestic economy.

In Greece there is some improvement in that respect. In the following table we observe that, although below the level of other European countries, researchers increased over the period 1991-1997 as a percentage of the labour force. European Framework Programmes played an important role in that respect as many scientists were hired either in companies or in Universities and Public Research Centres for the needs of research projects financed by the EC.

**Table 3.3: Researchers in Europe (man-years/000 labour force)**

	<b>1991</b>	<b>1993</b>	<b>1995</b>	<b>1997</b>
EU15		9.3	9.4	9.5
France	12	12.5	12.6	12.3
Germany	13.2	12.3	11.6	11.6
Denmark	8.8	9.5	10.8	11.9
Greece	2.7	3.5	4.1	4.7
Ireland	6.1	5.6	6.6	7.8
Spain	4.7	4.9	5.0	5.3
The Netherlands	9.5	10.5	10.7	10.9
Portugal	2.4*	2.9	3.2	3.6
Sweden	11.9	13.1	14.5	15.4
Finland	11.6	12.2	13.3	16.4

\*: 1990.

Source: GSRT 2001, "Research in Greece".

Secondly, public expenditure on education as a percentage of GDP increased from 2.7 to 3.5 (Table 3.4), showing the growing importance attributed to learning from Greek public actors. However these indicators still remain below the levels encountered in other European countries.

**Table 3.4: Public expenditure on education as percentage of GDP**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
DK	..	..	..	7.7	8.1	7.9	8.2	8.0	..	..
D	..	..	..	4.7	4.8	4.7	4.7	4.7	..	..
EL	..	2.7	3	2.9	3.1	3.4	3.5	3.7	3.5	3.5
E	4.8	4.9	4.7	4.7	4.7	4.5	4.5	4.5	4.5	4.4
F	5.6	5.9	5.9	6.0	5.9	6.0	5.9	5.9	5.8	5.7
IRL	5.6	5.9	5.9	5.5	5.3	5.2	4.9	4.6	4.5	
I	5.4	5.4	5.0	4.9	4.9	4.6	4.6	4.5	4.6	4.5
NL	5.4	5.2	5.1	5.0	5.0	4.8	4.9	4.8	4.9	4.9
P	..	..	..	5.4	5.5	5.6	5.6	5.7	..	..
FIN	7.3	6.9	6.7	6.9	7.0	6.5	6.2	6.2	6.0	..
S	..	7.6	7.5	7.5	7.6	7.9	8	7.7	8.4	8.3
UK	5.2	5.2	5.2	5.0	4.8	4.7	4.6	4.6	4.9	..
EU15	..	5.5	5.3	5.2	5.2	5.1	5.0	5.0	5.1	..

Source: EUROSTAT 2002, *General Statistics, Structural Indicators*, EUROPA, <http://europa.eu.int/comm/eurostat/Public/datashop/print-product/EN?catalogue=Eurostat&product=1-ir010-EN&mode=download>

#### **4. The role of the EU transfers**

European Union policy has been in favour of balanced regional growth. European integration has revealed the importance not only of nominal but also of real convergence, the latter expressing the approximation of the levels of economic welfare, the social cohesion and the improvement of the competitive base of member states.

Policy priorities aimed at effecting economic and technological convergence of the different European regions and improving their S&T bases in order to increase their competitiveness. In this respect considerable transfers have been made from more to less developed regions through two types of mechanisms: the EU Structural Funds and the EU Framework Programmes. The latter constitute a tool of RTD policy whereas the former are considered as a tool of broader macro-economic policy.

The application of austerity policies in the preceding 10-15 year period seriously constrained the ability of the state to intervene and actively promote technological development. In addition competition policy has reduced the possibilities for traditional direct intervention that might distort competition (eg, support of infant industries). Thus, the proportion of R&D activities that have been publicly funded fell from 74.4% of the total funding in 1986 to 57% in 1991 and 55% in 1997 (Table A.19). At the same time the funding of R&D activities from European financial resources has risen considerably (*ibid*). The evolution of government financing of R&D as a percentage of GDP (the r indicator) appears in Table 4.1, showing a slight increase after 1992. However it should be taken into account that most of the public

funds were directed to projects co-financed by EU funds, the Greek Government and private actors, and could not be considered as an independent growing interest in R&D activities.

**Table 4.1: Evolution of the r indicator (including Structural Funds for the years before 1995)**

	Greece	Portugal	Spain	Ireland	EU15
1986	0.20	0.27	0.34	0.43	
1988	0.20	0.29	0.43	0.38	
1989	0.26	0.31	0.52	0.38	
1991	0.24	0.40	0.54	0.44	
1993	0.30	0.50	0.49	0.33	0.90
1995	0.31	0.46	0.49	0.36	0.84
1997	0.33	0.53	0.48	0.31	0.77
1998	0.29	0.56	0.56	0.31	0.76
1999	0.29				

*Source: GSRT 2001, "Research in Greece".*

S&T policy in Greece has been influenced to a great extent by the priorities of European S&T policy. Especially after 1989 the policy orientation adopted most of the priorities set by the European Commission but also benefited from the important transfers in the context of EC regional policy and European S&T policy.

After 1983, there was an increasing participation of Greece in the European Commission's activities. This constituted a basic change for the Greek economy because of the drastic increase of the resources available for R&D funding. The participation of Greek organisations in the European Programmes was very important, with the Research Laboratories taking a more active role. Participations in EU Framework Programmes increased considerably after 1996 until 1998 (Table A.22) and 49% of all participations came about between 1996 and 1998 (Tsakanikas, 2002). A survey carried out during winter 1999 in Greece<sup>5</sup>, studied the R&D collaborations funded by European or National programmes. For EUREKA projects it was observed that in most of the cases Greek participants had not finally implemented the project, as they did not find the necessary funds from national sources. This can be considered as evidence that, even in cases for which the R&D project was positively evaluated, Greek firms were not willing to take the risk of implementation without funding. The same survey showed that "additionality", which is an objective of EU intervention, has been achieved to a considerable extent as 65% of the research activity undertaken in the context of the Framework Programmes would not have been performed in the absence of

<sup>5</sup> The survey was carried in the context of the STEP TO RJVs project funded by the EC TSER programme

funding (Tsakanikas, 2002). This becomes more crucial if we take into account that for almost half of the Greek firms of the sample this activity represents the only R&D effort undertaken.

In Greece EC transfers played a very important role in raising the amount of funding that aimed either directly at R&D activities or indirectly at upgrading infrastructures aiming to improve competitiveness. In the context of European regional policy, a large amount of receipts from the Structural Funds were directed at investment.

EU transfers (net receipts) reached the level of 5% of the GDP in the year 2000 (Table 4.2). Receipts from Structural Funds, that are mainly oriented to investment purposes, represent 14% of the Gross Fixed Capital Formation and 50% of the public GFCF.

**Table 4.2: Evolution of net receipts from EU and of the trade balance as % of GDP and GFCF**

	ECrecpts/GDP	SF/GFCF	SF/pubGFCF	TB/GDP	TB-fuels/GDP
1981	0.37	1.24	5.92	-7.44	-8.5
1982	1.31	1.66	6.93	-10.16	-8.2
1983	1.99	2.15	8.39	-10.46	-8.3
1984	1.82	2.88	8.57	-10.13	-7.8
1985	2.18	3.29	9.93	-11.32	-9.6
1986	2.72	5.22	19.69	-10.72	-9.2
1987	3.23	5.65	24.34	-10.47	-9.2
1988	2.83	5.84	27.09	-11.41	-9.7
1989	3.24	6.92	32.00	-12.56	-11.1
1990	3.61	7.10	37.36	-14.52	-12.2
1991	3.74	8.33	38.92	-14.11	-11.5
1992	4.35	11.66	48.87	-13.30	-12.4
1993	4.98	14.23	56.20	-13.42	-12.1
1994	4.64	14.37	57.25	-11.92	-12.3
1995	3.95	13.01	49.42	-12.19	-13.3
1996	4.70	15.16	58.85	-13.24	-13.1
1997	3.92	12.72	49.76	-13.81	-13.4
1998	3.84	12.96	53.54	-15.12	..
1999	4.84	15.15	57.67	-13.90	..
2000*	4.86	14.34	54.88	-14.91	..

ECrecpts: net receipts from EC; SF: receipts from Structural Funds; pubGFCF: public Gross Fixed Capital Formation; TB: trade balance; TB-fuels: trade balance without fuels.

Source: National Accounts, ESYE.

It is reasonable to suggest that in a period during which restrictive macro-economic policies have squeezed the possibility of spending on the improvement of infrastructures and the technological basis of the industrial system, European transfers play a role of counterbalance, which relates to taking a long-term perspective. European transfers have played the role of

attenuating restrictive policies and raised the level of public funding without the negative effects that might result from intervention with national funds. European funding has also raised the level of economic activity (a multiplier effect). However as trade performance still remains very problematic (the trade deficit is increasing as a percentage of GDP) it is still to be shown in the years to come whether the impact of the European support will really play a restructuring role in the industrial system or will exert pressure on the trade balance through the increase of domestic consumption. The key element in this question is the ability of the Greek industrial system to exploit European financial resources in improving its absorptive capability and building a dynamic process of catching up.

**[Insert Figure 3.8 here]**

## **5. Discussion**

In the context of the European integration, Greece moved from a protectionist regime of state intervention towards greater openness and economic liberalisation. European macroeconomic policies were pointing to this transition from the time of the Affiliation agreement, and more strongly from the Accession of Greece to the EC (in 1981). However, before 1992 there was a dissociation between the national macroeconomic policy and the needs for adjustment in the context of European policy requirements. National priorities delayed the adjustment to the new status, and it was only after 1992 that European integration and preparation for Economic and Monetary Union came to be treated as a national priority.

The transition to greater openness and economic liberalisation made obsolete many of the state practices in favour of industrial and technological development and required new strategies from the side of private actors. As the relaxation of public intervention intensified there was more pressure for private actors to improve their competitive position in terms of technological and organisational capabilities. Restrictive macroeconomic policies in the 90s, which were in line with monetary convergence, squeezed the possibility of public spending for improvement of the Greek scientific and technological system. However, as we showed in section 3, the scientific and technological system in Greece has experienced a slight improvement during the 90s, although it stands behind all EU countries (except Portugal) in terms of technological convergence. The Government played the most important role in the formation of this system, as the main financing source. Its role remains crucial even in the context of restrictive macro-economic policies. This is due to the support in the context of the

European RTD and regional policy. European Union policy supported economic and technological convergence through regional and technology policies.

European macroeconomic policy has influenced technological development and R&D activities in Greece in two ways. Firstly, it has put a pressure on budget cuts because of austerity policies. This was expected to constrain the ability of the state to intervene and actively promote technological development. Secondly, it has proved to be one of the pillars of subsidisation through regional policy. This made transition period of monetary convergence smoother.

In the case of Greece as for other intermediate countries that have mainly relied on imported technology and know-how, support from the EU alone is not sufficient for technological catch-up and convergence. It strongly relates to the country's absorptive capability, ie, its ability to exploit knowledge and technology flows in favour of its competitive position. All dimensions of what could be described as absorptive capability show an improvement over the last 15 years although any comparison with other European countries still leaves Greece in the bottom range. However the weak performance of Greek manufacturing and import penetration raises questions about the sustainability and the transformation of any improvement in terms of science and technology into real benefits for the competitive position of the Greek industrial system. There is still much to be done regarding national initiatives (private or public) in order to ensure that the impact of EC transfers will strengthen the productive base in the long run.

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