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Peripherality and Integration: Industrial Growth and Decline in the Greek Regions

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**PERIPHERALITY AND INTEGRATION:
INDUSTRIAL GROWTH AND DECLINE IN THE GREEK REGIONS***

Abstract: An empirical model has been deployed to account for regional industrial growth and performance in Greece's post EU-accession period. The results obtained suggest that the effect of European integration on manufacturing has been rather adverse across Greek regions. Regions that are more industrialised, whose structure was more similar to the European average and which have been more exposed to European competition are those that have been more adversely affected. In contrast, higher diversity, higher presence of capital-intensive sectors and higher tertiarisation of the regional economies were found to be beneficial to regional industrial growth and performance.

Key-Words: peripherality, integration, industry, Greek regions

JEL: R11, R12

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1. Introduction.

In the last two decades, a relatively large portion of literature has been analyzing the impact of economic integration on a number of economic indicators, such as growth and structure. Given the restrictions imposed on trade of agricultural products and the non-tradable character of most services, this discussion is more interesting when it focuses on industry.

A critical question is how less advanced industrial bases adjust to the pressures and opportunities generated by the process of economic integration. Are open markets associated with growing differences in performance among more and less advanced countries and regions? Is the new environment helping less advanced regions to converge towards the more advanced ones in terms of growth records and production structure?

In the European Union, the process of integration has been associated with a variety of outcomes in time and space. At the national level, the most frequently cited success story is that of Ireland. At the opposite end of the performance scale, one encounters Greece, the country with the greatest difficulties (at least in the early years after membership). At the regional level, an even greater mosaic is evident, with advanced regions having, more often, a better record than their less advanced counterparts.

Given that industrial activity is more exposed to the forces of integration than any other sector, the analysis of the adjustment of a weak or more vulnerable industrial base in the European periphery shows potential. Understanding the factors behind success and failure may have an added value for policy-making at a time when the European project is at a barometric low and European structural and cohesion policies are under scrutiny.

The aim of this paper is to address industrial performance in the Greek regions in the period following its accession to the EU. In the next section we summarize the most interesting aspects of the broad discussion in the literature concerning regional performance, industrial structure and integration. Section 3 reports key aspects and stylized facts of the industrial experience of Greece in the post accession period and critically discusses the regional dimension of this experience. In section 4, we combine theoretical considerations with stylized facts and empirical evidence in order to build an empirical model of industrial performance at the regional level and in section 5 we present the conclusions of our research.

2. Theory and evidence

Even though economists almost unanimously accept that free trade increases aggregate welfare (BEN-DAVID, 1993; SACHS and WERNER, 1995; EDWARDS, 1998), an ongoing theoretical and empirical debate takes place concerning the distribution of these overall welfare gains (KRIEGER-BODEN, 2000; FORSLID *et al.*, 2002, *inter alia*). In advanced economies, concerns have been expressed that the abolition of trade barriers and the free movement of capital will have negative implications for their industrial activity. In the less advanced and peripheral, economies, there is much skepticism regarding their ability to take advantage of the opportunities provided by economic integration. The main danger perceived is that the gap which separates these economies from their advanced counterparts may become wider, as the advanced ones are thought to be better adjusted (in terms of economic and institutional structures, human capital and technology) to the conditions and demands of the free-market economic environment (MELACHROINOS, 2002).

Current theoretical analysis is dominated by the neoclassical, new trade and new economic geography schools (see BRÜLHART, 1998 for an overview of the principal features of each school). Neoclassical trade theory seems to better explain the inter-industry trade, conducted mainly among countries with different productive structures, whereas new trade theories and new economic geography are more suited to account for the intra-industry trade, conducted mainly among countries with similar productive structures. Empirical research has not decided yet about the relative importance of the above theories in driving world trade (DAVIS and WEINSTEIN, 1999). As KRUGMAN (1994) indicates, this question may not have a precise answer, and if it does, we don't know it.

By and large, the intra-industry type of trade activity seem to fit more to the cases of the countries of the EU core since during the process of economic integration, factor endowments and costs become more similar as firms become multinational, jobs and people move, innovation disseminates and legal frameworks become European (AIGINGER, 2000). HEAD and MAYER (2003) tried to list the parameters that characterize the EU economic environment, supported that factor prices tend to be high in regions with good market access, mobile sectors tend to be disproportionately clustered in these regions due to high demand for their goods, and reductions in trade cost induce agglomeration of industries.

These parameters reveal that even small differences among regions, in an ongoing integration context, are of high importance and result in shifts in production organization and location. Under these conditions, it is possible that

countries or regions with industries associated with increasing returns to scale can do better than others since imperfect competition can result in adverse effects i.e. uneven distribution of the benefits of trade (MARTIN and OTTAVIANO, 2001) and the possibility of some countries or regions being net losers (VENABLES, 1996).

As KRUGMAN and LIVAS (1992) indicate, if the externalities generated by a market expansion (as they are the cases of the EU enlargements) are important, then higher productivity growth rates are observed in the regions spatially close to the new market center. Regions at a geographical disadvantage cannot benefit as much as others from international trade because they face higher transportation costs (LIMAO and VENABLES, 2001). Engaged in an integration process with distant and larger partners, peripheral regions will tend to develop unbalanced, inter-industry type trade relations, with an unfavorable impact on their industrial bases (PETRAKOS and CHRISTODOULAKIS, 1997). Keeping the principles of the above trade theories and the parameters that characterize the EU space in mind, it is natural to expect that the EU – having reached a critical level of economic integration – is going to experience an even more intense cumulative process of industrial concentration following the US pattern (AIGINGER and DAVIES, 2004).

Radical changes have already taken place in the competitive environment of European manufacturing and especially in the peripheral EU regions. The pressure to produce high-quality products at attractive prices, forces firms to focus not only on low production cost but also on quality and innovation. The external environment of the firms – proximity to clients and suppliers, level of infrastructure, availability of skilled labor force, *inter alia* – has become the decisive factor that affects their location decisions (FUJITA and KRUGMAN, 1995; VENABLES, 1996). The EU economic integration has generated competition among regions (MALMBERG *et al.*, 1996) as differences in the above factors contribute significantly to variations in regional competitiveness (BUDD, 1998), and the existence of low labor costs has lost much of its significance to competition (BEST, 1990). As low labor costs are typically a characteristic of less developed countries, the emerging new conditions removed a source of competitive advantage from such countries (PETRAKOS and PITELIS, 2001).

The geographic distribution of industrial activities is characterized by agglomeration economies that can enhance the imbalance between the core and the peripheral EU regions; a fear that has been already expressed by the EU itself (EUROPEAN COMMISSION, 1992). These integration dynamics may take the form of a cumulative process that will have an overall unfavorable impact on the

economic performance of the less developed countries and regions (AIGINGER and DAVIES, 2004). As a result, lagging countries and regions having the weakest economic base with the highest shares of sensitive (labor-intensive) sectors (CAMAGNI, 1992) and an unfavorable geographic index (PETRAKOS and ZIKOS, 1996), suffered during the process of economic integration since they failed to effectively redeploy their resources in order to mitigate the adverse effects of integration (AIGINGER, 1999).

Adaptability is essential to the resilience to shocks and Ireland is a proof of this (AIGINGER, 2000). Despite being a peripheral and cohesion country, Ireland records a 10% annual increase in manufacturing output, having by far the highest share in Gross National Product (32%) and the highest productivity growth among the EU members. This economic miracle is the outcome of a combination of low wages, the supply of skilled labor, a climate in favor of innovation and a policy focus to establish upstream linkages between domestic and foreign firms. On the other hand, Greece, also a peripheral and cohesion EU country, recorded only slight increases in manufacturing output, and had, in the year 2000, the smallest share in Gross National Product (only 12%) among the EU members. Despite its low wages, it has been unable to attract a significant amount of Foreign Direct Investment. Greece thus remained a country with low productivity, a high presence of non-skilled labor, an increasing trade deficit, and an industrial base unable to adjust successfully to the new economic conditions of integration. The above is in line with existing evidence that economic integration within the EU has led to changing patterns of production and specialization among EU countries and regions (AMITI, 1998) and that these changes have affected the economic performance of countries and regions and the level of cohesion (KRUGMAN, 1991; PENEDER, 2003).

A theoretical controversy exists regarding the relation of higher or lower specialization to growth, employment creation and competitiveness. WEINHOLD and RAUCH (1999) and BENITO and EZCURRA (2004) argue that an increase in the level of specialization leads to an increase in productivity through the exploitation of scale economies. The EU supports that this is only true for dynamic, high growth regions (EUROPEAN COMMISSION, 1999) whereas AIGINGER (2000) supports that the increase in specialization is negatively correlated with employment growth, at least in the short run. A somewhat different dimension was set to the discussion by PASINETTI (1981) who suggested that the degree by which the productive structures of less developed countries are getting more similar to the respective structures of advanced countries determines their potential to achieve higher rates of income growth.

LAU (1992) indirectly accepted the previous view, supporting that specialization in capital-intensive sectors enhances income growth. On the contrary, DALUM *et al.* (1998) supported that less developed countries or regions should differentiate their productive structures from those of the advanced ones in order to present trends of convergence.

Additionally to the above theoretical controversy, no comprehensive empirical investigation is available on the issue since existing empirical work varies widely, with respect to spatial and temporal scales, databases and statistical methods used (AIGINGER 2000; COMBES and OVERMAN, 2003). GLAESER *et al.* (1992) in their study of employment growth between 1956 and 1987 in 170 U.S. standard metropolitan areas (SMA), found that specialization slows employment growth. In a different study, HENDERSON *et al.* (1995), using more extensive geographical data coverage (224 SMA) but only eight traditional capital goods industries, found that industrial concentration had a positive effect on employment growth between 1970 and 1987. COMBES (2000) in his study of the impact of economic structure on local economic growth in France in the period 1983-1993, found that specialization had a negative effect on employment growth in both manufacturing and services sectors. The author suggested that this result may be seen in relation to business cycles, since specialization may enhance local employment growth during economic upturns but contribute to employment decline during downturns. In a somewhat different, but not unrelated research context, BALDWIN and BROWN (2004) found that specialization (as an inverse concept to diversity) has a positive effect on employment growth volatility (variance of annual regional employment growth rates). This result echoes earlier findings from the U.S. metropolitan areas (KORT, 1981) where diversification was found to be statistically significant in reducing regional economic instability.

Contradicting are also the empirical results that concern the opposite direction of the above relation i.e. the relation of growth to high or low specialization. IMBS and WACZIARG (2000), in their survey of 67 countries for the period 1969-1997, concluded that less developed countries in an economic integration context start to present low levels of specialization until they reach a mature level of development when they start to specialize more intensively. KELLEHER (2003), on the contrary, studying 117 countries for the period 1980-1997, found a negative relation between income growth and specialization level. MOLLE (1997) studying 96 EU regions for the period 1950-1990 found that regions with lower income, located in the EU periphery, are associated with higher levels of specialization. EZCURRA *et al.* (2004) surveying 197 EU regions for the period 1977-1999 found that small regions, located far from the EU core, recorded a fall

in the levels of their specialization, as they were exposed to international competition, and then, a respective rise, after a rather advanced level of economic performance. On the contrary, HALLET (2000) in a previous study surveying 119 EU regions for the period 1980-1995 did not find a clear pattern between level of income, geographical location and level of specialization. These contradicting results indicate that the relation between structural changes and economic performance has to be further investigated (BODE *et al.*, 2004).

3. Industrial performance and structure in Greece

The industrial GDP of Greece accounts for a minuscule fraction of the relative EU-15 figure. The industrial share of GDP has been declining in both Greece and EU-15 (Table 1). However, this share has been about eight to nine percentage points lower in Greece when compared to EU-15 average. Moreover, it seems that this gap has been quite persistent throughout the 1980-2004 period (Figure 1).

Table 1

Figure 1

Despite this gap, Greece has recently (2000-2004) managed to outperform EU-15 in industrial GDP growth (Table 1). However, industrial labor productivity remained below the 60% of the corresponding EU-15 average throughout the 1980-2004 period (Figure 2).

Figure 2

A two snap-shot comparison of the industry structure between Greece and EU-15 helps to identify both differences in structure and its evolution between 1985 and 2000 (Table 2).

Table 2

As an overall comparison reveals, Greek industrial structure in the mid-80s was dominated by labor-intensive sectors (the classification of sectors here follows JACKSON and PETRAKOS, 2001) as slightly more than 50% of Greek industrial GDP was concentrated in such sectors and about 42% in two sectors alone. Namely, these sectors are the Food-Beverages and Tobacco (DA) and the Textiles-Wearing Apparel (DB). The corresponding figures for the EU-15 were about 36% and 21% respectively. Over time, it appears that both in Greece and the EU-15, labor-intensive sectors lost their share in total industrial GDP. However, whereas in the EU-15 this change took place in favor of capital-intensive sectors (as intermediate-intensity receded slightly), in Greece it was primarily the intermediate-intensity (IINT) group that gained ground (about 5% increase) and less so the capital-intensive sectors (about 2.5% increase). Beyond this aggregate picture drawn, some interesting branch-specific stories emerge.

Food-Beverages and Tobacco industries have further advanced in Greece over the 1985-2000 period (about 6%) whereas at the same time they have slightly declined at the EU-15 average level (about 1.5%). Most dramatic is the case of the textile and clothing apparel sectors (DB). This manufacturing branch was ranked first in 1985 (accounting for 21.5% of Greece's industrial GDP), only to drop to the third place by the year 2000 with its share dropping to 10.2% and being outperformed by both Food-Beverages and Tobacco industries as well as an amalgamation of fuel and chemical products industries (DF+DG). The latter group increased its share in total industrial GDP from 12.4% in 1985 to 18.8% in 2000. These, as well as other manufacturing branch stories, such as electrical machinery and optical equipment (DL) that almost doubled its share, but also fabricated metal products (DJ) at the other extreme (with an 1/3 reduction in share), suggest that some restructuring has taken place in Greek manufacturing. Greek manufacturing firms are small when compared to their European counterparts, since in 2002 the average manufacturing-firm size in Greece was the smallest in the EU-15 (about 6 employees) (Table 3). To some extent this may be attributed to the limited and isolated national market suggesting that Greek firms find it difficult to exploit economies of scale at the plant level in most sectors

Table 3

Despite their small size, Greek firms could still potentially reap the benefits of scale economies that are external to firms but internal to a group of similar firms located in the same region (localization economies) or that transcend both firms and industries but remain internal to an area (agglomeration economies). Whereas the former source of external economies requires some sort of regional specialization the latter thrives through larger diversity of economic activities (HENDERSON, 1986).

Although it does not address the issue of external economies, Figure 3 helps to visualize both the regional distribution of GDP and its evolution over the 1981-2000 period. It also helps to discern the spatial pattern of their association.

Figure 3

More than 60% of industrial GDP is concentrated in two NUTS III regions, namely those of Attiki (that contains Athens (47.2%)) and Thessaloniki (14.6%). These are the largest urban areas in Greece and are followed by Larissa (3%), Achaia (2.88%), Magnesia (2.17%), Korinthia (1.29%) and Heraklion (1.24%). The spatial distribution of these shares seems to point to a positive relation between urbanization and industrialization. However, a misfit to this relation may be the region of Voiotia which despite being far less urbanized, is a major industrial hub

(6.60% share in national industrial GDP) adjacent to Attiki. However, the information summarized in Figure 3 also suggests that most regions hosting urban areas have experienced industrial decline (in terms of change in their relative share in the country's industrial GDP) over the period considered. A notable exception to this is Thessaloniki (the second largest city in Greece).

An overview of the shares of industrial GDP within each region and its evolution, over the period considered, is provided in Figure 4. Here it appears that all urban economies in Greece have experienced a transition away from manufacturing and towards the tertiary sector of the economy. It also becomes equally evident that in the case of both Athens and Thessaloniki (but note also Heraklion) this tendency has been accompanied by an increase in manufacturing share in some of their adjacent less urbanized regions.

Figure 4

4. A model of regional growth performance.

Motivated by the discussion in section 2 as well as the preliminary analysis of relevant data in the previous section, the aim of this part of the paper is to put together an empirical model of manufacturing performance at the regional level. To this end, two dependent variables have been used. The first is industrial GDP growth (INDGDPGR) and the second is labor productivity growth in the manufacturing sector (INDPROGR). Both variables are defined over the 1981-2000 time-interval, in real terms.

Base year industrial GDP (INDGDP81) and industrial labor-productivity (INDPROD81) have been used in the corresponding econometric growth formulations as control variables to capture the effects of the initial conditions on the consequent growth performance. A negative effect of initial conditions on subsequent growth may signify the advantages of backwardness (GERSCHENKRON, 1952) as far as less developed regions can gain from the more advanced ones through technological and other spillovers. In a process like this, less developed regions outperform the most developed ones in growth terms. In contrast, a positive sign may be perceived as indicating a diverging process that further builds on itself.

A Theil index (THEIL, 1967; THEIL, 1972) of regional diversity (as opposed to regional specialization) was also used. This was calculated as follows: Let

$empl_{ri}$ be the employment in region r and sector i and define $p_{ri} = \frac{empl_{ri}}{\sum_r \sum_i empl_{ri}}$

having the property that $\sum_r \sum_i p_{ri} = 1$. The Theil regional-diversity entropy-

measure is then $H_r = \sum_i \frac{p_{ri}}{p_r} \log \frac{p_r}{p_{ri}}$, where p_i is defined as $p_r = \sum_i p_{ri}$. This

measure takes the value of 0 when only one sector is present in region r and the value $\ln(n)$ where all n sectors employ the same number of persons in the region in question. Interest in applying such entropy measures for the analysis of industrial specialization of regional economies and geographical concentration of industries has only recently been renewed by AIGINGER and DAVIES (2004) and AIGINGER and PFAFFERMAYR (2004).

As far as agglomeration economies need economic variety in an area (diversification), the Theil index is used here to assess the effect of the latter on regional industrial growth. A higher degree of diversification implies a higher variety of skills available locally. Skill and diverse working experiences can, in turn, give way to higher entrepreneurial choice and opportunity, especially since there should be some degree of transfer of individuals between not only firms but also industries. The latter might work as a safeguard. Downturn movements, in some sectors, would not be as harmful to the local economy because human and other resources are diverted to existing and more secure alternatives. Moreover, higher degrees of diversification could ensure that emerging opportunities due to, say increasing demand, may not go unexploited locally, if even a small number of firms in the industry producing the product are in the area.

The average firm size of industrial firms in each region (AFS) was used to account for possible economies of scale effects that emanate from the firm-level. The rationale is that advantages of economies of scale may lead to an expansion of firms and to a higher growth of hosting regions.

An index of integration (PETRAKOS *et al.*, 2005a) with the EU economy for each of the 14 industrial sectors considered here was first calculated at the national level: $IOI_i = \frac{(EXP_{i,EU-15} + IMP_{i,EU-15})}{(EXP_{i,world} + IMP_{i,world})}$ where i denotes the industrial sector, EXP stands for exports and IMP for the imports. Subscripts $EU-15$ and $world$ refer to trade with the EU-15 and the world respectively. The higher the index the higher the 'integration' of this sector within the European economy. To regionalize the index, the sectoral index of integration (IOI_i) was multiplied by the corresponding employment location quotient and the result was summed over sectors for each regions i.e. $IOI_r = \sum_i IOI_i * LQ_{ir}$. Higher values of the regional index of integration indicate that the economic base of a region has been more exposed to European competition. This index has been calculated for the

base year combining data from the National Statistical Service of Greece and the Eurostat COMEXT database.

Within a framework of ongoing economic integration it is important to note the effect of a deviant (when compared to EU average) regional economic structure on its subsequent employment growth (see PASINETTI, 1981 and the discussion in section 2 of this research). The similarity or dissimilarity of regional structures in comparison to a representative EU regional economy was explored using an "Index of Dissimilarity" (IDIS). This is defined as $IDIS = (a_{i,t} - b_{i,t})^2$, where a and b are the economies under comparison, i is the industrial sector under consideration and t is the year of comparison (JACKSON and PETRAKOS, 2001). A higher value of this index signifies more dissimilar structures.

Most Greek regions have been traditionally specializing in labour-intensive sectors that were also becoming highly exposed to international competition from lower cost producers (Petraikos *et al.*, 2005b). In spite of this, regional restructuring in the post EU-accession has been quite slow in Greece and has been attributed to considerable sectoral persistence in regional specialization patterns within manufacturing for most of the period (*ibid.*). The experience of Western Europe shows that the most advanced industrial regions are often characterized by a strong presence of machinery and transportation branches. The tested hypothesis here is that regions with a higher share of capital-intensive sectors in their industrial base have, *ceteris paribus*, a better growth performance (RAUCH, 1993; ALONSO-VILLAR 2002). To account for some sort of early deviant regional specialisation patterns within Greece, the employment share of capital intensive sectors in regional industrial base was also included on the right hand side of the empirical model estimated.

The shares in the tertiary sector (TERTGDP) in the base year, as well as in regional productivity (TERTPROD) in the same sector have been used when accounting for regional variation in industrial GDP growth and industrial productivity growth respectively. A positive sign of TERTGDP would indicate that, *ceteris paribus*, a more advanced tertiary sector, due to commercial sector, public services or tourism, would have a positive local impact on industrial activity. This impact could be the outcome of significant forward and backward linkages between the two sectors of the economy. Theoretically, a negative sign is also possible, if a trade-off between the two sectors takes place and the development of services is based on intensive competition in the factor markets and massive transfer of resources from one sector to the other. The possible effect of linkages between the services and manufacturing sectors on improving the productivity of the latter at the regional level is explored by the inclusion of TERTPROD.

The last two variables considered refer to policy instruments. In particular, variable DL is defined as the percentage of investment subsidized by the state (Law 1262/82) and variable PCPUBINV is the per capita public investment by region over the period 1981-1998.

The results of the estimation are presented in Table 4. There are two dependent variables, industrial GDP growth (INDGDPGR) and industrial labor-productivity growth (INDPROGR) and two methods of estimation. The first estimation method provides for heteroskedasticity consistent standard errors (WHITE, 1980), whereas the second is that of weighted least squares (WLS) using regional population density as the weighting factor. The latter method is used here following a rationale developed in earlier studies assessing the effect of regional diversification on regional economic instability (see KORT, 1981 and references therein) where it was postulated that the relationship between diversification and economic instability varies with city size. In these studies economic instability is related to some notion of time variation of growth rates. In the present study growth rates are of interest and regions (NUTS III) instead of cities or metropolitan areas are the spatial units of analysis. Thereby, population density as an index of urbanization within each region was used instead.

The results obtained clearly suggest that regional diversification within manufacturing positively affects both industrial GDP and industrial productivity growth. This effect is statistically significant in both cases and robust to alternative econometric estimation methods. Thus, these results appear to vindicate theorizations according to which greater diversity may act as a safeguard against downturns in the demand for the regional production.

On the other hand, the results obtained for regional index of integration (IOI) indicate that regions that were, initially, more exposed to European competition suffered most from the process of integration. This is most probably attributed to their economic-base structures. That is, regional specialisation has been, on average, quite unfavourable for Greek regions. This result helps to better justify the result on diversification discussed above.

Table 4

A more detailed account of the regional industrial structure and its deviation from the EU-15 average regional profile (IDIS) suggests that the more deviant in industrial structure Greek regions perform better in terms of industrial GDP growth. Looking at the evidence from a different perspective, it could be argued that the Greek regions that had the closer to the EU productive base were those experiencing the greatest difficulties in the post-1981 period. The obvious interpretation of this finding is that these regions were not able to handle the

competition from their European counterparts producing more or less similar products. On the other hand, the regions that did not have strong similarities with the average EU region did better. This is an indication that the process of integration implied for the Greek regions is of inter-industry trade relations. This type of trade relations is, however, associated with very limited prospects for structural converge with the EU.

The picture drawn by these results gets more complete when the effects of the initial conditions in terms of base year industrial GDP and labor productivity are taken into consideration. These effects, negative and statistically significant, suggest that regions with higher industrial GDP in absolute terms were not those that subsequently had higher percentage industrial GDP growth, and regions that were more productive in industrial sectors were not those that experienced higher productivity growth. These results confirm the spatial shifts in manufacturing activity that were indicated in Figure 3 and the de-industrialisation process depicted in Figure 4 and are easy to reconcile with those obtained for the regional index of integration.

On the other hand, the positive sign of the relative size of the tertiary-sector (TERTGDP) variable suggests that the tertiary sector in the Greek regions has developed in a way that has been more complementary than competitive to industry. Although there have been reports of abandonment of traditional activities in favor of tourism, especially on the islands, this trend has probably affected agriculture more than industry. In addition, this finding provides evidence for the importance of the services sectors for the performance of industry. The positive effect of the productivity of the tertiary sector on subsequent manufacturing productivity in a region accords with the previous finding.

The share of capital intensive sectors (CINT) in the regional industrial base has a positive and significant effect on regional productivity growth. To put this result in a more pragmatic way, the absence of capital-intensive sectors from the local industry of most regions is one of the reasons for poor performance. The relatively insignificant presence of capital-intensive sectors in the Greek industry is a structural deficiency related to a number of less favorable initial conditions and geography and no easy cure seems to exist for it.

The positive and significant effect of average firm size (AFS) on regional productivity growth provides some evidence that size matters and economies of scale may be one of the contributors of industrial growth. As a result, the poor performance of regions with respect to industrial growth is partly attributed to the small size of industrial firms in Greece, compared to the other EU countries. This

is another structural weakness of the Greek economy and perhaps a unique situation in the EU. This small size is related to small national markets and a lack of access to international markets. In this case it can be attributed to the distance from the EU markets and the fact that the northern borders of the country were sealed for decades because of the "Iron Curtain".

The positive and significant sign of the investment incentives variable (DL) provides evidence in favor of the implemented industrial policies. The regions that received a higher level of support have managed to achieve higher rates of industrial growth (see the discussion on PAPADOULIS *et al.*, 2004). However, the same is not evident for the per capita public investment in the base year (PCPUBINV). The insignificant impact of public investment can be attributed on the fact that the allocation of public investment funding may not be the appropriate one. There is evidence for the existence of a political cycle in the regional distribution of funds under criteria that are not always transparent (see the discussion on PETRAKOS and PSYCHARIS, 2004). Moreover, there is evidence that interregional multipliers tend to channel significant shares of induced demand to metropolitan regions irrespective of the initial distribution of public funds (POLYZOS and PETRAKOS, 2005).

5. Conclusions

The empirical model considered in this research has provided some insight into the causes of poor industrial performance of the Greek regions in the period after membership to EU. The unusually small - by European standards - size of industrial firms, the lack of capital intensive sectors from the industrial base of most regions and the specialization in sectors that faced significant pressure in international markets (such as metals and textiles) are all factors that have contributed to this poor record. Some of these factors are embedded characteristics of the economy that are linked to the country's historical paths and geographical coordinates. The process of EU integration, while not having generated any structural weaknesses in the Greek industry has, nevertheless, amplified them. The increase of levels of competition from the more advanced EU regions has forced regions with 'similar' industrial structure to poor records and industrial decline.

Although increasing diversification could produce favorable results, the realities of the Greek regions indicate that only the metropolitan regions and perhaps a few large cities may benefit, as most regions have an industrial base with limited variety. As the models indicate, the other route is to base industrial growth in activities that are 'dissimilar' to those of the average EU regions. Although this is

feasible and to a certain extent does takes place, the question is to what extent this type of inter-industry specialization based on increasing structural differentiation can produce long-term convergence with the EU.

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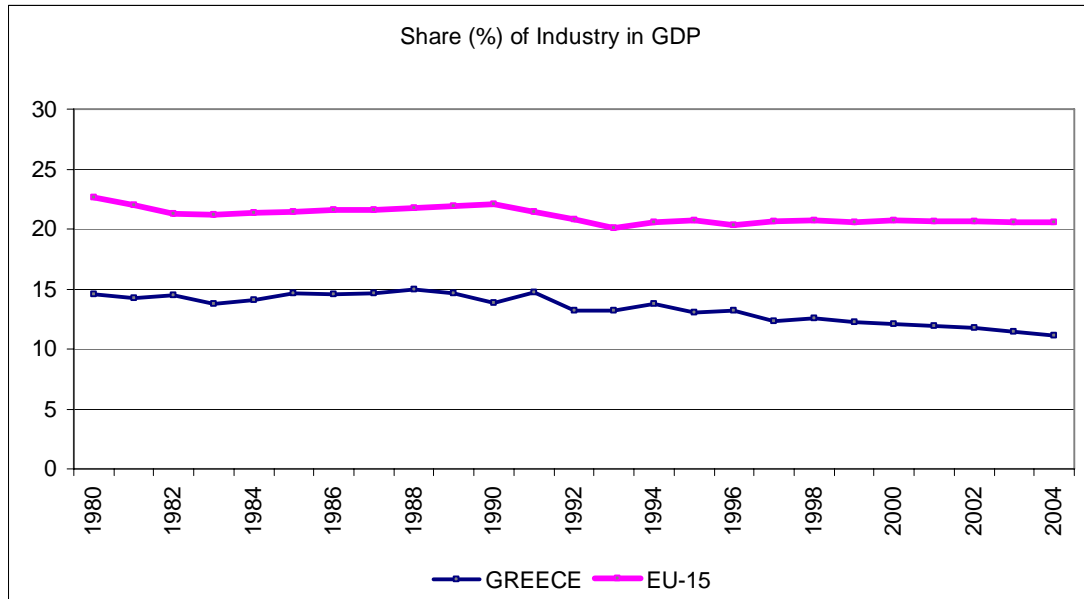
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Table 1: Industrial GDP real growth and share of industry in GDP (1980-2004)

Year	Industrial GDP (million €, 1995 prices)		Share of Industry in GDP (%)		Period	Industrial GDP growth (%)	
	Greece	EU-15	Greece	EU-15		Greece	EU-15
1980	9,962	4,282,866	14.59	22.65	1980-1984	-2.85	-0.97
1985	10,292	4,622,491	14.66	21.46	1985-1989	7.49	16.00
1990	10,544	5,405,652	13.83	22.06	1990-1994	5.67	0.52
1995	10,802	5,934,556	13.00	20.73	1995-1999	6.01	9.42
2000	11,632	6,798,819	12.08	20.73	2000-2004	6.77	4.93

Source: CAMBRIDGE ECONOMETRICS EUROPEAN REGIONAL Database (2005) / Authors' elaboration

Figure 1: Share of Industry in GDP (1980-2004)



Source: CAMBRIDGE ECONOMETRICS EUROPEAN REGIONAL Database (2005) / Authors' elaboration

Figure 2: Industrial productivity of Greece (EU-15 = 100)



Source: CAMBRIDGE ECONOMETRICS EUROPEAN REGIONAL Database (2005) / Authors' elaboration

Table 2: The evolution of the industrial structure of Greece and the EU-15, NACE 2-digit branches, (1985, 2000)

NACE Branches	Share in industrial GDP 1985		Share in industrial GDP 2000	
	Greece	EU-15	Greece	EU-15
DA	20.7%	14.6%	26.2%	13.1%
DB	21.5%	6.8%	10.2%	4.2%
DC	2.1%	1.3%	1.4%	0.9%
DD	2.1%	3.4%	2.0%	4.2%
DE	4.2%	8.7%	5.2%	9.2%
DF + DG	12.4%	13.7%	18.8%	10.9%
DH	3.3%	3.4%	4.7%	4.8%
DI	7.4%	4.8%	7.5%	4.5%
DJ	13.2%	13.0%	8.8%	13.1%
DK	1.8%	11.0%	2.3%	12.2%
DL	4.7%	9.1%	8.1%	11.2%
DM	5.8%	8.9%	4.4%	10.8%
DN	0.8%	1.3%	0.4%	0.9%
TOTAL	100.0%	100.0%	100.0%	100.0%
LINT	51.4%	36.1%	45.4%	32.5%
IINT	36.3%	34.9%	39.8%	33.5%
CINT	12.3%	29.0%	14.8%	34.2%
TOTAL	100.0%	100.0%	100.0%	100.0%
DA: Food, Beverages & Tobacco (LINT)		DI: Non-Metallic Mineral Products (IINT)		
DB: Textiles & Wearing Apparel (LINT)		DJ: Fabricated Metal Products (IINT)		
DC: Leather Products (LINT)		DK: Machinery (excl. Electrical) (CINT)		
DD: Wood Products (LINT)		DL: Electrical Machinery & Optical Equipment (CINT)		
DE: Paper, Publishing & Printing (LINT)		DM: Transport Equipment (CINT)		
DF: Fuel Products (IINT)		DN: Other Manufactured Products (LINT)		
DG: Chemical Products (IINT)		LINT: Labor-intensive industries		
DH: Rubber & Plastic Products (IINT)		IINT: Industries of intermediate intensiveness		
		CINT: Capital-intensive industries		

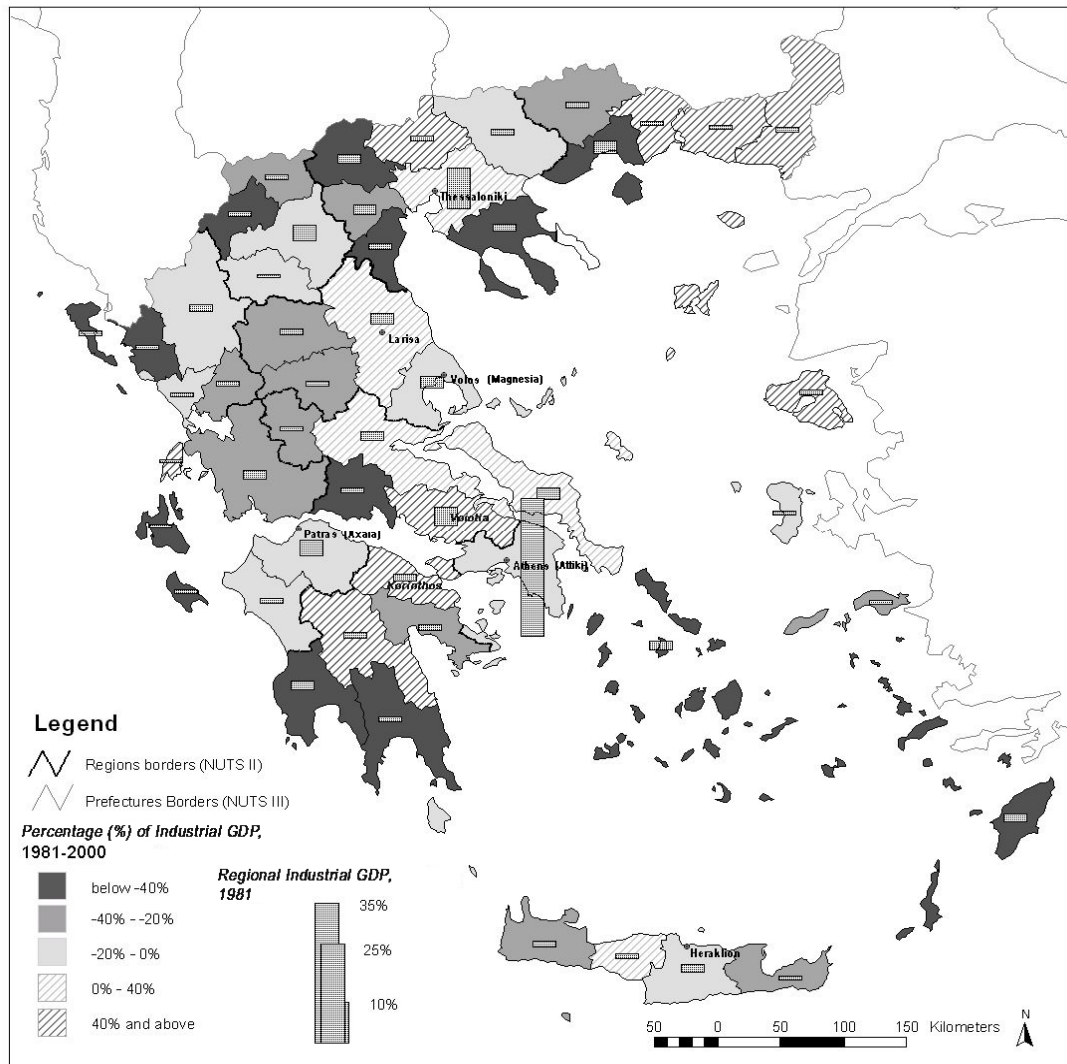
Source: CAMBRIDGE ECONOMETRICS EUROPEAN REGIONAL Database (2005) / Authors' elaboration

Table 3: The average size (employees per firm) of industrial firms (2002)

Country	
Belgium	17.87
Denmark	23.79
Germany	37.30
Greece	5.85
Spain	11.83
France	16.26
Ireland	49.01
Italy	8.70
Luxemburg	34.92
Netherlands	18.37
Austria	22.90
Portugal	11.57
Finland	16.73
Sweden	14.48
UK	23.56

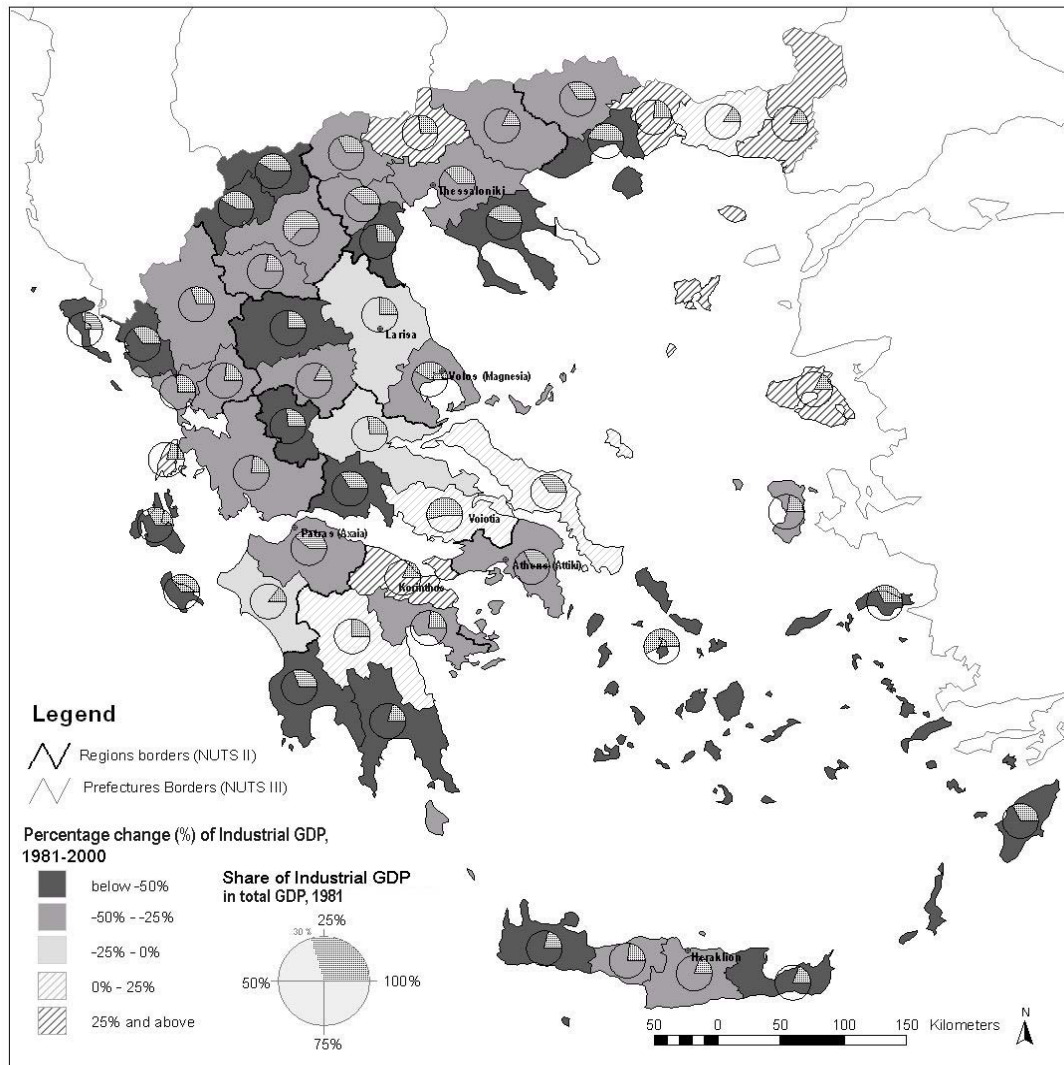
Source: EUROSTAT NEW CRONOS Database (2005) / Authors' elaboration

Figure 3: Regional distribution (1981) and evolution (1981-2000) of industrial GDP in Greece



Source: NATIONAL STATISTICAL SERVICE OF GREECE (2005) / Authors' elaboration

Figure 4: Regional share (1981) and evolution (1981-2000) of industrial GDP in Greece



Source: NATIONAL STATISTICAL SERVICE OF GREECE (2005) / Authors' elaboration

Table 4: Results of regression analysis (P values in parentheses)

Independent Variables	Dependent Variables			
	(1)	(2)	(3)	(4)
	INDGDPGR	INDPROGR	INDGDPGR	INDPROGR
(Constant)	-249.926 (0.000)	-168.426 (0.000)	-217.723 (0.000)	-135.346 (0.004)
INDGDP	-1.10 * 10 ⁻⁷ (0.080)		-7.12 * 10 ⁻⁸ (0.056)	
INDPROD		-0.001 (0.000)		-0.001 (0.004)
TERTGDP	4.08 * 10 ⁻⁸ (0.080)		2.55 * 10 ⁻⁸ (0.061)	
TERTPROD		0.003 (0.000)		0.002 (0.070)
IOI	-0.093 (0.181)	-0.059 (0.014)	-0.130 (0.047)	-0.075 (0.041)
THEIL	384.661 (0.002)	1397.94 (0.000)	399.70 (0.000)	154.74 (0.000)
CINT	0.831 (0.349)	1.263 (0.000)	1.574 (0.285)	1.064 (0.002)
AFS	0.039 (0.433)	0.052 (0.000)	0.027 (0.383)	0.039 (0.020)
IDIS	0.011 (0.122)	0.005 (0.086)	0.011 (0.070)	0.003 (0.274)
DL	2.546 (0.029)	1.160 (0.003)	2.510 (0.061)	1.792 (0.000)
PCPUBINV	0.862 (0.650)	1.123 (0.181)	-1.957 (0.494)	-1.112 (0.474)
Estimation Method	GLS	GLS	WLS	WLS
R ²	48.9%	76,0%	59.4%	93.5%
F	3.718 (0.002)	12.325 (0.000)	6.648 (0.000)	14.635 (0.000)
N	45	45	45	45

The analysis is carried on 45 out of 51 Greek NUTS III due to data limitations pertaining to the calculation of the Theil index.

Sources: NATIONAL STATISTICAL SERVICE OF GREECE (2005) and EUROSTAT NEW CRONOS Database / Authors' elaboration