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Structural Analysis of the Greek Economy

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Abstract

The paper focuses on the "structural characteristics" of the Greek economy: domestic sectoral productive linkages, specialization profile, level of industrial and technological development, relative income elasticities of demand, international trade profile. Our analysis in these characteristics indicates that the Greek economy is a rather "extraverted" economy, within the EU frame. This "extraversion," and not the labor costs, is the real cause of the Greek poor economic performance and low competitiveness. Input-output analysis confirms this suggestion.

JEL classification: D57, O10, O57

Keywords

Greek economy, relative income elasticities of demand, productive diversification, input-output analysis, "extraverted" economy

1. Introduction

The Greek economy has performed relatively poorly compared to other EU and euro area economies in recent decades. The data are clear. In 1993 (the first available comparative data) the Greek gross domestic product (GDP) per capita was 70.45 percent of the EU-27 and 60.02 percent of the euro area 17. In 2012 it decreased to 64.22 percent and 58.19 percent, respectively. Moreover, the Greek economy shows a prolonged relatively low competitiveness compared to other EU and euro area economies. This is clearly depicted in the chronic deficits of the current account balance. In 1995 (the first available comparative data) the current account deficit was 0.8 percent of GDP, while EU-27 and euro area 17 exhibited surpluses (0.41 percent and 0.52 percent, respectively). In 2007 the current account deficit of the Greek economy reached 17.63 percent of GDP. Despite the recession, and the following drastic reduction of the trade deficits, the Greek economy continued to accumulate net liabilities in the rest of the world, contrary to the EU-27 and euro area 17. More

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precisely, the Greek economy continued to create current account deficits (-5.32 percent of GDP in 2012), while the EU-27 and the euro area 17 generated surpluses (0.95 percent, and 1.82 percent of GDP in 2012, respectively) (AMECO). At the same time, the net international investment position of the country deteriorated rapidly: from -27.39 percent of GDP in 1998 (the first available comparative data), in contrast to 1.61 percent of the euro area 17, to -114.50 percent in 2012, in contrast to -13.32 percent of the euro area 17 (Eurostat). Indeed, the Greek economy is less robust and fully developed than its EU and euro area partners.

This paper looks at the structure of the Greek economy and finds that it has the characteristics of an "extraverted" economy. In particular, the Greek economy is an EU (and euro area) economy with relatively weak domestic sectoral productive linkages (especially in manufacturing industries and high-tech industrial sectors), strong specialization, relatively low level of industrial and technological development, and "unfavorable" relative income elasticities of demand. This is a "structural weakness," and it helps to explain the low competitiveness of the Greek economy and, perhaps, its vulnerability to balance of payment issues, and debt crisis.

The structure of the paper is as follows: the second section presents the theoretical framework of the paper, in which the characteristics of "extraverted" and "autocentric" economy are defined. In the third section the competitiveness of the Greek economy is examined in relation to the posed theoretical framework. A further inquiry into the question of the "structural characteristics" of the Greek economy is based on input-output analysis, in section four. Finally, the last section summarizes our concluding remarks.

2. International Competitiveness, "Extraverted" and "Autocentric" Economy

According to Fagerberg (1988: 355), "it is rather rare to see the concept of international competitiveness of a country defined. However, few would probably disagree with the view that it refers to the ability of a country to realise central economic policy goals, especially growth in income and employment, without running into balance-of-payments difficulties."

The international trade profile of a national economy – that is its international competitiveness – is not a matter of "price" or "cost competitiveness." There is empirical evidence suggesting that it is mainly dependent on "non-price," *i.e.* "structural" factors, such as technological opportunities, technical infrastructure, and production capacities. The "structural factors" constitute the productive structure and the related "externalities" which determine the so-called "structural competitiveness" of a national economy (see Ilzkovitz *et al.* Internet: 2; Nurbel 2007: 65).

Furthermore, Kaldor's postwar findings indicate "that those countries that had experienced the greatest decline in their price competitiveness (*i.e.* highest increase in unit labor costs) also had the greatest increase in their market share" (Felipe and Kumar 2011: 3-4). This is known as *"Kaldor's paradox."*

2.1. Relative income elasticities of demand, terms of trade, and trade deficits

The "relative income elasticities" of demand of a national economy (*i.e.* income elasticities of demand for an economy's exports against those for its imports) (Krugman 1989) reflect the "non-price factors" (mainly differences in technological capabilities) (Fagerberg 1996: 42).[1] Fagerberg

[1]The relation of income elasticities of exported goods with technology can be seen in terms of the "product cycle scenario." According to this scenario which is developed in the context of "North-South trade," the new products in the North have very high income elasticity. Due to lack of technological knowledge the South produces older products with lower income elasticity. By the time the South acquires the knowledge, the North has already introduced another new product, and so on (Sarkar 2001: 323).

(1996: 42) supports that these factors explain the growth of an economy's exports, as the "paradoxical findings of Kaldor" indicate.

Kaldor wrote in this connection:

> …in a growing world economy the growth of exports is mainly to be explained by the income elasticity of foreign countries for a country's products; but it is a matter of the innovative ability and adaptive capacity of its manufacturers whether this income elasticity will tend to be relatively large or small. (cited in Fagerberg 1996: 42)

Based on an econometric analysis of several countries, Krugman (1989) also points out an "empirical regularity": the income elasticities of demand of a country's exports and imports are systematically related with its growth rates. In the same context, Thirlwall (1979), using evidence from developed economies, infers that a rising income elasticity of imports – against income elasticity of exports – reduces the positive effects of export growth on long-run income growth. This is a consequence of the so-called Engel's law: as the income increases, the pressure of demand on the imported goods is much higher than the exported goods, so that, *ceteris paribus*, the prices of imported goods increase faster than the exported leading to trade deficits *via* the deterioration of the terms of trade (see Singer 1950; Love 1980; Ocampo 1986; Hunt 1989:132-133).

2.2. Relative income elasticities of demand, productive diversification, domestic linkages, and international trade profile

According to the Krugman model (Krugman 1989), the high income elasticity of demand that characterizes the exports of the developed countries reflects the greater diversification of the domestic production, toward the production of the countries with low exports' income elasticity of demand.

Greater diversification of the productive structure of a national economy means a more complete, articulated, and interdependent economic structure. Peres (2006: 68), studying industrial policies in Latin America and the Caribbean, supports that the diversification of the productive structure of a national economy results in greater domestic sectoral productive linkages. The latter strengthen "the positive impact of economic growth on overall productivity." In a similar direction, Rios-Morales and O'Donovan (2006: 50, 55-56, 64) studying aspects of the Irish experience "that may be applicable in Latin America," maintain that domestic sectoral productive linkages are related to the spillover effects, "in terms of technology transfer and absorption."

Accordingly, the higher the income elasticity of export demand the more diversified is the production structure of a national economy, greater are the domestic sectoral productive linkages, and, consequently, "more virtuous" is its international trade profile[2] (see Cimoli *et al.* 2006: 92).

The industries which depend primarily on their inter-industry transactions are in manufacturing (see Hirschman 1958: 109-110). Cimoli *et al.* (2006: 88), searching the structural barriers that prevent the growth of Latin America economies, infer that the development of manufacturing industry would generate productive linkages, spillover effects, capital accumulation, and technological externalities. Manufacturing industry is the "driver of innovation and technological change," given that it represents the main bulk of business expenditure on R&D, as Pilat *et al.* (2006: 26) conclude based on their study of several OECD countries for the period 1995-2003. Thus, the growth of manufacturing industry has an accumulative result in the development process due to the high degree of interdependence of industries. On the contrary, the more the

[2]According to the European Commission (2009: 75), "strong interconnection" ("interrelationships") between industries "are central for the analysis of competitiveness."

national economy depends on primary activities or final demand activities as services, the lower is the interdependence among the various productive sectors (Fotopoulos 1985: 178).

Services are more independent of other sectors compared to the manufacturing sector. Pilat and Wölfl (2005: 3, 36), using firm-level cross-country data of some OECD countries since the beginning of the 2000s, come to the conclusion that most of the service inputs are derived from the service sector itself. Moreover, they support that the role of services "as providers of intermediate inputs to other industries is not yet as strong as that of the manufacturing sector." Karagiannis and Tzouvelekas (2010) strengthen the above mentioned argument. Using the 1995 input-output tables for 14 EU countries, they conclude that services exhibit low interdependence with the other sectors of the economy.

Therefore, *there is a structural interrelation between the degree of diversification of the productive structure of a national economy, the strength of its domestic sectoral productive linkages, the level of its industrial and technological development (and the resultant externalities), and its international trade profile, as it is depicted by the relative income elasticities of demand*.

It must be noted that although the size of a national economy matters in the degree of diversification, this is not always the case. Within the EU, productive diversification "is naturally easier for large countries." However, some of the EU countries "despite their relatively small size … exhibit a … balanced sectoral structure … Austria, Belgium and Sweden show a relatively low degree of specialisation, similar to that of large countries such as Germany and the UK" (European Commission 2009: 9, 60).

2.3. Economic development and domestic linkages: "Extraverted" and "autocentric" economy

The more advanced an economy is, the more complete and articulated is its economic structure (Leontief 1986: 169-170), *i.e.* the greater is the diversification of its productive structure. On the contrary, the most typical characteristic of economic underdevelopment is the relative absence of interdependencies and strong linkages (Hirschman 1958: 109).

Similarly, Mouzelis (1978: 37-38) points out that the crucial question for the economic development is "the type of articulation that connects the dynamic high-productivity sectors of the economy … with those that are technologically backward." A developed economy is characterized by *"organic complementarity"* between big capitalist manufacturing industry and the other productive sectors.

According to Amin (1976: 237-238),

> …the advanced economy is an integrated whole, a feature of which is a very dense flow of internal exchanges, the flow of external exchanges of the atoms that make up this whole being, by and large, marginal as compared with that of internal exchanges. In contrast to this, the underdeveloped economy is made up of atoms that are relatively juxtaposed and not integrated, the density of the flow of external exchanges of these atoms being much greater, and that of the flow of internal exchanges very much less. … In a structured autocentric economy, any progress that begins at any point is spread throughout the entire organism by many convergent mechanisms. Contemporary analysis has stressed the "leading" effects of an increase in primary demand. … If the economy is extraverted all these effects are limited, being largely transferred abroad.

Amin argues that an "autocentric" economy has strong domestic productive linkages and weak external productive linkages, while an "extraverted" economy is quite the opposite. In this way Amin's "autocentric" economy tends to be an "autarkic" economy.

Such an approach, however, contradicts the economic reality. "Though intra-industry trade is strongly present in developed countries, all countries depend, in one way or another, on external intermediate inputs" (European Commission 2009: 9).

Consequently, relatively strong domestic sectoral productive linkages could coexist with more or less dependence on external intermediate inputs (production leakages).

Given the above, partly taking Amin's argumentation into consideration, and also taking into account the *structural interrelation* described previously, we understand that compared with an "autocentric" economy an "extraverted" economy is characterized by:

- relatively weak domestic sectoral productive linkages, and simultaneously by:
- strong specialization,
- relatively low level of industrial and technological development,
- "unfavorable" relative income elasticities of demand, and accordingly
- relatively low international competitiveness.[3]

The "structural characteristics" of the above definition cannot be defined absolutely, but only comparatively; *e.g.* there is not a "single number" indicating the weakness of domestic sectoral productive linkages or the degree of specialization. Consequently, the above definition of the "extraverted" and "autocentric" economy could indicate only a classification of national economies, and not an absolute "autocentric" or "extraverted" position.

3. The Question of Competitiveness of the Greek Economy

The Greek debt crisis and Greece's recourse to the financial support mechanism in the conjuncture of global economic crisis pose the question of the "structural characteristics" of the Greek economy.

The official ("mainstream") position, as it is expressed by the Bank of Greece, supports that the high deficits of the current account balance, the growth of the external debt, and the deterioration of Greece's negative net international investment position is a result of the "losses in competitiveness" of the Greek economy. These are mainly related to the rigid labor market that leads to wage increase and losses in price competitiveness. The latter "are one of the primary factors underlying both the persistently low 'structural' competitiveness and the limited ability of domestic output to adequately and flexibly meet the composition of and changes in external and domestic demand" (Bank of Greece 2010: 28).

Considering that a country's low international competitiveness is referred to balance of payment difficulties (see above), Figure 1 depicts the competitiveness problem of the Greek economy, as it is expressed by the current account balance and mainly by the balance of goods and services (as a percentage of GDP), for the period 1960-2012.

As can be seen from Figure 1, within the EU and euro area the competitiveness of the Greek economy has been deteriorating, something that the official position has avoided to point out. More precisely, Figure 1 shows that the increasing deficits in the Greek current account balance began mainly from 1994 and onwards. A similar trend is followed in general by the balance of goods and services, although the latter is continuously negative for the whole period 1960-2012.[4] On 1.1.1993 the common European market was established. Moreover, although Greece adopted

[3]From this point of view, the international competitiveness of a national economy is mainly dependent on "non-price," *i.e.* "structural," factors. In other words, "extraversion" – in accordance with "Kaldor's paradox" – explains that the low international competitiveness of a national economy is not due to low "cost" but to low "structural" competitiveness.

[4]The deficit reduction in the current account balance since 2008 is due to the drastic reduction of the trade deficits owing mainly to the recession (Bank of Greece 2012: 91-94) that followed the global economic crisis and the austerity policies imposed after Greece's recourse to the financial support mechanism.

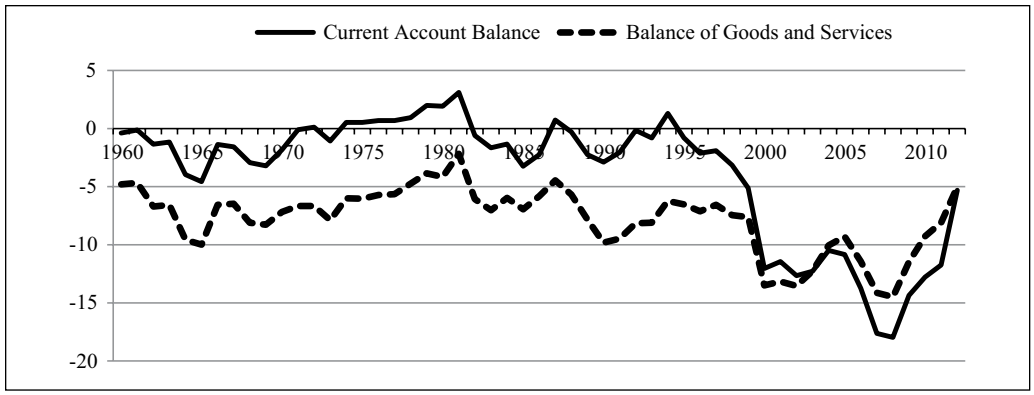

Figure 1. Current account balance and balance of goods and services (% GDP) of the Greek economy (1960-2012).
Source: AMECO.

the euro from 1.1.2001, in the 1990s the drachma was revaluated in real terms[5] (Milios 2002). Consequently, the Greek economy lacked the means of trade policy and exchange rate policy for the confrontation of foreign competition.[6]

Nevertheless, it should be noted that although the competitiveness of the Greek economy has been deteriorating within the EU and euro area, the competitiveness problem is present in the whole examined period, as the continuously negative balance of goods and services indicates.

Moreover, the argument that the competitiveness of the Greek economy is worsened because of the rising requirements of the wage earners is not accurate (see also INE 2009). Figure 2 and 3 depict the decrease of real unit labor costs and of adjusted wage share to GDP, respectively, in the Greek economy during the last 50 years.

It must be noted that this decreasing tendency of the real unit labor costs and wage share was continuous, with the exception of slight temporary inversions mainly in the first period after the dictatorship (1974-1981) and during the first period of the social democratic (PASOK) government (1981-1985).

As can be seen from Table 1, the Greek economy is an economy of low wages within the EU-15 frame. During the period 2000-2010, the Greek average annual wages (in 2010 USD PPPs and 2010 constant prices) remained the lowest in the EU-15, with the exception of Portugal.[7]

[5]The policy of "hard drachma" aimed to bring the Greek currency into the euro (Milios 2002). As a result, even before entering the euro area, Greece lost the flexibility that a variable exchange rate provides to address trade deficits.

[6]The rising deficits in the current account balance until 2008 were reflected in the augmentation of the gross external debt. Thus, the Greek economy exhibits a serious deterioration of its gross external debt before the recent crisis. As a percentage of GDP the gross external debt reached 156.26 percent in 2008 (Bank of Greece 2013: 38, Table 19). The above indicates that the huge Greek external debt is related to the competitiveness problem of the Greek economy. However, the investigation of the Greek debt crisis is beyond the aim of the present paper.

[7]Noteworthy is the rather medium level of German wages. According to the research of Andersson *et al.* (2008) into wage growth dispersion across the 12 euro area countries, during 1993-2006, Germany was the only country with a significantly lower relative wage than productivity level. On the other hand, during the same period, Ireland was the country which exceeds the euro area 12 average wage level (in nominal terms), reflecting, as Anderson *et al.* (2008) support, the strength of productivity. However, it is interesting to note that, while German nominal compensation per employee was in line with the euro area 12 average

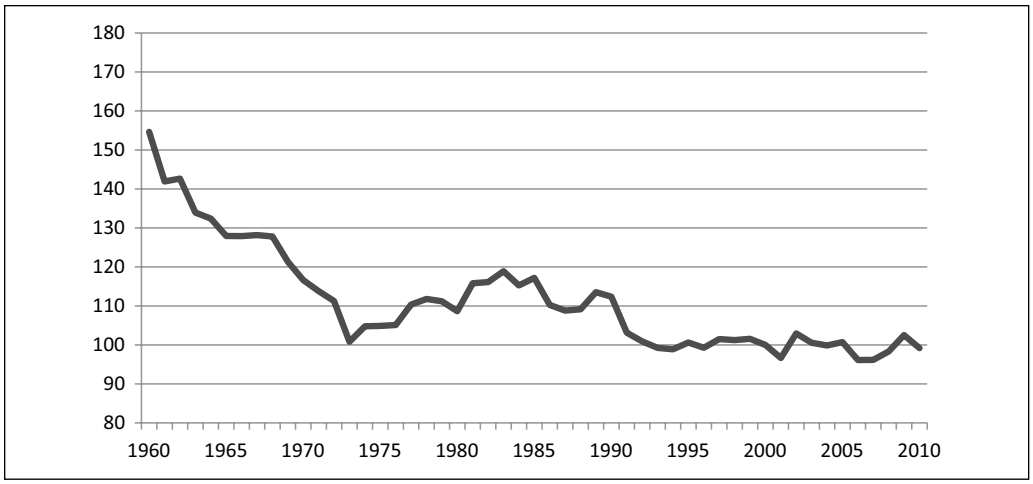

Figure 2. Real unit labor costs of the Greek economy (1960-2010).
Source: AMECO.

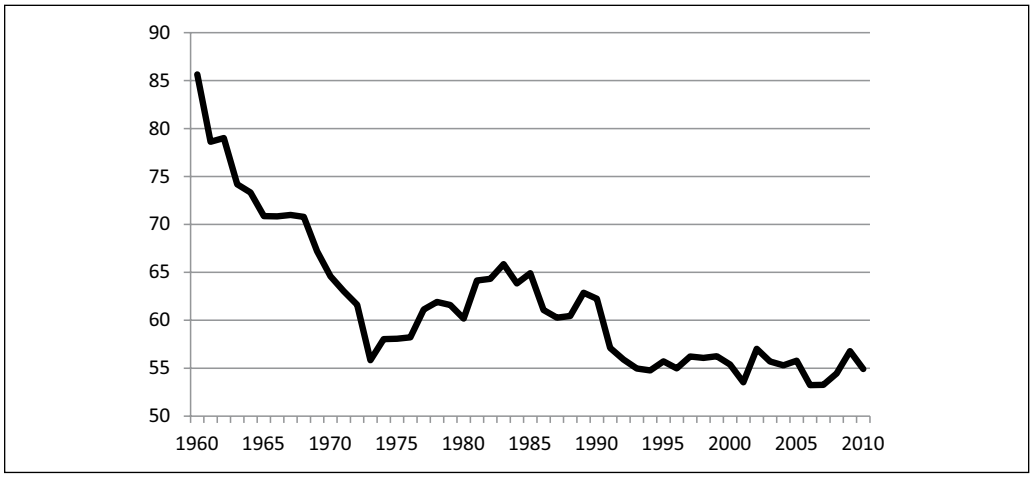

Figure 3. Adjusted wage share to GDP (%) of the Greek economy (1960-2010).
Source: AMECO.

This means that the "mainstream" view – that Greece's "cost competitiveness" has deteriorated (and, more generally, that low costs bring prosperity) – is utterly false.

Besides, as noted, the international competitiveness of a national economy is not a matter of "cost" but of "structural" competitiveness, which is mainly dependent on "non-price" ("structural") factors. We will investigate Greek low "structural competitiveness" in the analysis that follows.

(2006 data), the level of nominal hourly compensation in Germany, across most sectors, was substantially above the euro area 12 average (2004 data). According to Anderson *et al.* (2008), this reflects the fact that German workers have the lowest working time across the euro area 12.

Table 1. Average annual wages in 2010 USD PPPs and 2010 constant prices, EU-15 (selected years 2000-2010).

	2000	2005	2010
Luxemburg	47607	50248	52110
Ireland	38765	43597	48757
Netherlands	41541	42763	45671
UK	40541	43474	44008
Denmark	37010	40689	43190
Belgium	41585	42494	43023
Austria	37927	39510	42005
Germany	37695	38089	38325
France	34194	36556	38124
Sweden	31828	34242	36826
Finland	29140	32988	35707
Spain	31720	31411	33656
Italy	31920	32362	32657
Greece	24261	27962	27484
Portugal	21307	21561	23173

Source: OECD Stat Extracts.

3.1. Relative income elasticities of demand and Greek trade deficits

In the case of Greece, the inability of domestic supply to meet domestic and foreign demand reflects the different income elasticities of demand between the domestically produced and exported goods on the one hand and the imported goods on the other. The imported goods are mainly characterized by higher income elasticity of demand against domestically produced and exported goods. According to the previous analysis this leads to trade deficits *via* the deterioration of the terms of trade.[8]

More precisely, according to the Bank of Greece (2009b: 121) data, "increased export receipts in 2008 are mainly attributable to exports of agricultural … products" that are products of relatively low income elasticity of demand, "while the higher import bill is mainly accounted for by imports of machinery and means of transport excluding ships," that are products of relatively high income elasticity of demand (see also Bank of Greece 2009a: 97, 99; Athanasoglou 2010: 175; Gibson 2010: 344). Fotopoulos (2010: 59) noted that machinery and means of transport that always constituted the biggest part of the exports of advanced capitalist countries constitute only a small portion of Greek exports. In 2008, the share of manufacturing exports in the total exports of Greece was 54 percent, while that of manufacturing exports in the total exports of the euro area 16 was 77 percent (The World Bank 2010: 238-240, Table 4.4). Moreover, import penetration in manufacture in 2008 (constant prices 2000) accounted for 80 percent of the domestic apparent consumption (Athanasoglou 2010: 137-138, Figure 2.2.6). This is a chronic structural weakness of the Greek economy. According to the *Annual Report 2002* of the Bank of Greece (2003: 32), "despite the progress made, some structural weaknesses have not been eliminated yet and, as a result, the economy's export orientation remains limited, while the number of branches that produce dynamic exportable products, *i.e.* products with high income elasticity of demand, remains small." Simultaneously, the high income elasticity of

[8]According to the Bank of Greece (2009b: 121) "[t]he widening of the trade deficit … reflects … *the inability of domestic supply to meet domestic and foreign demand in terms of both composition and growth.*"

Table 2. Ratio of tradable to non-tradable goods and services (gross value added, constant prices 2005).

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
EU-27	1.072	1.058	1.041	1.031	1.028	1.019	1.026	1.039	1.019	0.977	0.992
Greece	0.866	0.797	0.777	0.716	0.695	0.693	0.666	0.648	0.661	0.689	0.601

Source: Own calculations using Eurostat's data.

demand for imported (industrial in general) goods is combined with low price elasticity of demand for these goods. As a result, the economic growth is accompanied by increasing imports payments (see Bank of Greece 2000: 209).

Under these conditions the deficits of the balance of goods and services of the Greek economy are further worsened by the fact that the economic growth emanated mainly from the sectors of non-tradable goods and services.

As it can be seen from Table 2, the ratio of tradable to non-tradable goods and services is higher in the EU-27 against Greece for the period 2000-2009. Thus, for the entire period after the entry of Greece into the euro area the Greek economy based its development on productive sectors not exposed to the international competition, comparatively more than the EU-27 as a whole. Therefore, the type of development of the Greek economy neither presupposed nor led to the improvement of its international competitive position. Moreover, in the period 2000-2009 the ratio of tradable to non-tradable goods and services for Greece was less than one. Consequently, for the entire period the development of the Greek economy was primarily based on the production of non-tradable goods and services. The growth of incomes in non-tradable sectors augmented the demand of tradable goods and services from abroad (Gibson 2010: 337 ff.), deteriorating trade deficits.

Given the above, if we accept Furtado's (1964: 170) point of view it could be said that, during these years, Greek economic development reproduced the "disequilibrium between the structure of supply and the composition of demand" which "is transferred to the balance of payment" for fixed exchange rates.

3.2. Exports and technology

Let us examine Greek exports more analytically.

Table 3 shows the Greek export structure per sector for 2010 (for sectors classification see Table 5 in the appendix).

As can be seen, the main export sectors are: 15-16, 1-5, 27 and 23. The sectors 15-16 and 1-5 are of low technology, whereas 27 and 23 are of low-medium technology (see Table 6 in the appendix). In accordance to our theoretical framework, the main Greek exports are of low income elasticity of demand and low technological level.

The latter is inextricably linked to the Greek productive structure. The "Greek enterprises have the *smallest* average size in the EU." In 1990, the Greek small and medium-sized enterprises (SMEs) employed an average of three workers (Liargovas 1998: 203). In 2010, the Greek SMEs employed on average less than three workers (own calculations, European Commission 2010/11). Moreover, in 2010 the majority of employees in Greece were employed in micro enterprises (57.6 percent for Greece against 29.8 percent for EU-27), and, overall, in SME enterprises (85.6 percent for Greece against 66.9 percent for EU-27) (European Commission 2010/11). The Greek small enterprises have limited access to capital, thus limited possibilities for research and development (R&D), incorporation, and utilization of new foreign technology (Liargovas 1998: 203, 206-207, 210). In this structural frame, for 2010 the R&D expenditures in all sectors of the

Table 3. Greek sectoral export structure 2010.

Sector	%
1-5	11.83
10-14	1.07
15-16	15.10
17-19	8.50
20-22	2.15
23	10.53
24	6.75
33	6.24
25	3.13
26	2.26
27	11.44
28	2.15
29	9.76
34	0.99
35	2.29
36-37	1.29
40-41	0.47
Waste	1.21
Unclassified	2.82

Source: Own calculations using OECD Stat Extracts.
Note: The grouping of sectors in the analysis of exports is owed to data availability. The analysis of sectors on the basis of OECD data differs from that of NACE Rev.1.1.

Greek economy were only 0.58 percent of GDP against 2.01 percent for EU-27 and 2.10 percent for euro area 16 (Eurostat).

3.3. Productive diversification

In the case of Greece, the "unfavorable" income elasticities of demand for imports and exports are accompanied by exports that are not sufficiently differentiated (Athanasoglou *et al.* 2010: 179). This reflects the strong specialization profile of the Greek economy, compared with the other EU national economies. Greece is a small country and it is among the top five countries of the EU exhibiting "a strong specialization profile"; the others are Malta, Bulgaria, Romania, and Latvia (European Commission 2009: 61). Moreover, as seen above, Greek exports are of a low technological level, the Greek economic structure is dominated by small enterprises with restricted absorption of new technology, while the share of manufacturing exports in the total exports of Greece is below the average of the euro area and the imports' penetration in manufacture is very high. Consequently, according to the previous analysis, behind the weakness of the productive structure of the Greek economy there must be rather weak domestic sectoral productive linkages. If it is so, the Greek economy has the characteristics of a rather "extraverted" economy.

A further inquiry into the question of the "structural characteristics" of the Greek economy will be based on input-output analysis. More precisely, considering that backward domestic multipliers depict the strength of domestic sectoral productive linkages within a national economy, through this analysis the strength of domestic sectoral productive linkages of the Greek economy within the EU will be tested.

4. Input-Output Analysis: Backward Multipliers

4.1. The method

The strength of domestic sectoral productive linkages, and consequently the competitiveness of a national economy,[9] can be estimated using input-output analysis (IO analysis).

IO analysis is based on the fundamental work developed by Wassily Leontief in the late 1930s (see Leontief 1936, 1966). Since then it has been widely used as an analytical tool to assess the economic performance of a specific sector and production interdependence. (For the assumptions and the limitations of IO analysis see Lahr and Dietzenbacher 2001; Guo and Planting 2000; Miller and Blair 1985, 2009.)

Backward multipliers is a tool for establishing the linkages between the sectors of an economy, purposed by Rasmussen (1956) and Chenery and Watanabe (1958). The term backward linkage (expressed by the backward multiplier) is used to allocate the specific kind of interconnection of a particular sector to those sectors from which it purchases intermediate inputs. If a sector (*i.e.* sector j) increases its output, there will also be an increased demand from sector j (as a purchaser) for the products of those sectors whose products are used as inputs for j.

In IO analysis, the production process of an economy divided in n sectors of economic activity can be described by the equation:

$$\sum_j x_{ij} + Y_i = X_i$$

where x_{ij} is the elements of the matrix of intermediate transactions Z_d (also known as domestic input-output table) and shows the production of sector i used as input for the production of sector j. Y_i is the final demand for the products of i which is covered from the domestic production. X_i is the production of sector i.

Since the intermediate input (x_{ij}) is part of the production of sector i, the intermediate transaction matrix can be expressed by Z_d=AX, the above equation is transformed as follow:

$$AX + Y = X \quad \text{or}$$
$$(\text{I-A})X = Y \quad \text{or}$$
$$X = (\text{I-A})^{-1}Y$$

where A denotes the matrix of technological coefficients, expressing production technology.

Matrix $(\text{I-A})^{-1}$ is the so-called Leontief's inversed matrix, and expresses the intensity of the intersectoral relations of the economy. The element b_{ij} of $(\text{I-A})^{-1}$ measures the additional product which will be produced by a domestic industry i if the output of j is increased by one monetary unit.

The sum of the columns of Leontief's inversed matrix, $b_j = \sum_{i=1}^{n} b_{ij}$, is called the backward (domestic) multiplier, and shows the backward (vertical) intersectoral interconnections of sector j, *i.e.* the additional product produced within a national economy by a unit increase in production of j. Thus, the backward domestic multiplier measures the significance of a sector j for a national economy, that is it shows the multiplying potential of an industry within an economy. The larger the value of a backward domestic multiplier the greater the sector's dependence on other

[9]"Input-output analysis shows that the competitiveness … is not the result of merely aggregating individual industries' performances but is the result of a complex network of relationships between them" (European Commission 2009: 75).

domestic sectors. Part of this additional domestic product is produced by the extra demand of sector j for inputs by its suppliers (direct product). Another part is produced due to the increase of the production of the domestic sectors that are connected (as suppliers) with the input suppliers of sector j (indirect product). These indirect effects express the spillover effects within a national economy (see Hoekstra and van den Bergh 2003). Consequently, the backward domestic linkage is defined "as the direct and indirect dependence of a particular industry on all industries, as they supply intermediate inputs for its own production. Dynamic industries are expected to increase their backward linkages …. Leading industries with strong vertical integration are … expected to exert a pull on the economy" (Albala-Bertrand 2006: 162). Given the previous analysis, *ceteris paribus*, the more advanced technologically a sector is, the stronger the pull for technological development in a national economy, as a result of an increase in the sector's demand for domestic inputs.

4.2. Backward multipliers and domestic productive linkages: Hypotheses

Backward domestic multipliers depict the strength of domestic sectoral productive linkages within a national economy. However, a given value of backward domestic multipliers indicating strong or weak domestic productive linkages does not exist. Thereby, any suggestion on this could be based only on evidence arising from international comparisons. Therefore, the inquiry into the question of the strength of domestic sectoral productive linkages of the Greek economy will be based on international sectoral comparisons, within the EU frame.

More precisely, the sectoral Greek backward domestic multipliers will be compared with the EU (22), German, and Belgian sectoral backward domestic multipliers, for 2005 (the current available data, see below). These comparisons will be supplemented with comparisons among the EU (22), the German, and the Belgian sectoral backward domestic multipliers.

a. The comparison of the Greek multipliers with the average EU multipliers is grounded on the fact that the EU determines the basic competitive economic environment in which the Greek economy functions. Specifically, in 2010, the Greek imports from the EU-27 amounted to 51.1 percent of its total imports, while the Greek exports to EU-27 to 62.6 percent of its total exports (Eurostat).
b. The comparison of the Greek with the German multipliers is based on the fact that the German economy is assumed to be a "model" of an "autocentric" economy, according to our theoretical framework. In particular: Germany had one of the highest manufacturing shares in the EU in 2007, and it is among the EU countries where manufacturing activities have increased their share in the GVA (gross value added) during the period 1995-2007, following the opposite trend to the EU as a whole. It is among the most diversified economically and least specialized EU countries. Finally, Germany is also among the EU countries that clearly specializes in high-tech sectors (European Commission 2009: 7, 9, 57, 60-61). Thus, strong domestic sectoral productive linkages within the German economy could be expected, especially in the manufacturing industry and in the industrial sectors of a rather high technological level, *vis-à-vis* Greece and the EU economy. From this point of view the German economy is assumed to constitute a benchmark.
c. The comparison of the Greek with the Belgian multipliers is based on two facts. First, since the German economy constitutes a benchmark, the comparison of the Greek multipliers with those of another small country may offer a clearer picture of the supposed Greek economic "extraversion." Belgium is of approximately the same size as Greece, from the aspect of the total labor force: 4,951,900 against 5,291,600, respectively, for 2010 (AMECO). Additionally, this comparison will test the exposed analysis. More precisely, although Belgium is a small country, it is one of the least specialized countries of the EU,

> as seen above. Therefore, if the previous analysis stands, Belgium is claimed to have greater domestic sectoral productive linkages against the strong specialized Greek economy, despite the fact that Belgium is one of the EU countries that is most dependent on external intermediate inputs; other countries are Estonia, Ireland, Hungary, and Slovakia (European Commission 2009: 9).

Since the manufacturing industry, and especially the high-tech industry, can be seen as the main driver of increasing productivity and capitalist development, the relative strength of domestic sectoral productive linkages in these sectors acquires a distinguished importance, under the condition that these sectors exhibit a significant magnitude: "One sector may have a high multiplier and, at the same time, be very small in a given country" (European Commission 2009: 76).

Before proceeding to IO result analysis, it must be noted that, in 2005, the share of the secondary sector of the Greek economy in the GVA was 18.69 percent against 25.43 percent of the EU-27, 25.09 percent of the EU-15, 28.98 percent of the German economy, and 21.59 percent of the Belgian economy. In particular, the share of high and medium-high technology sectors of the Greek economy in the GVA was 1.83 percent against around 7.5 percent of the EU-27 and EU-15, 12.87 percent of the German economy, and 5.89 percent of the Belgian economy. As to the high technology sectors the percentages were: 0.41 percent for Greece, around 1.9 percent for the EU-27 and EU-15, 3.3 percent for Germany, and 1.1 percent for Belgium (own calculations, Eurostat).

4.3. IO result analysis

Table 4 shows the backward domestic multipliers of the Greek, German, and Belgian economies for 2005 in 58 economic sectors. Our calculations are based on Eurostat's IO tables. The IO tables are available in an analysis of 58 sectors (NACE Rev.1.1): 3 of the primary sector of the economy, 30 of the secondary, and 25 of the tertiary. The IO tables are renewed every five years. The last available table is for 2005.[10]

Table 4 also shows the average, maximum, and minimum sectoral backward domestic multipliers for 22 EU countries for 2005. The non-existance of EU available data for all sectors and countries limits the extent of comparisons of the EU with the Greek, German, and Belgian multipliers.

i. German and EU multipliers:

In 27 of the total 43 sectors, of the available data, the German multipliers exceeded the EU (22) average multipliers. In 21 of the total 26 sectors of the secondary sector the German multipliers exceeded the EU (22) average multipliers. Moreover, the German multipliers exceed the EU (22) average multipliers in all sectors of high technology (sectors 30, 31, 32, and 33) and medium-high technology (sectors 24, 29, 34 and 35); see Table 6 in the appendix. The relatively strong domestic sectoral productive linkages of the German economy and especially of the German secondary sector and high-tech industrial sectors, within the EU frame – given also their significant magnitude in terms of GVA – confirm the theorization of the German economy as a "model" of an "autocentric" economy.

[10]Recently, Eurostat released the Greek input-output table for 2010. The backward multipliers derived from this table are not presented here, because, apart from the absence of corresponding tables for other countries, the classification of industries has changed (Rev. 2), making impossible the comparison with the results for 2005.

Table 4. Greek, German, Belgian, and average, maximum, and minimum EU backward domestic multipliers (2005).

Sectors	Backward domestic multipliers (Greece)+	Backward domestic multipliers (Germany)+	Backward domestic multipliers (Belgium)+	Average backward domestic multipliers (EU countries)*	Maximum backward domestic multipliers (EU countries)*	Minimum backward domestic multipliers (EU countries)*
1	1.44	1.81	1.86	na	na	na
2	1.53	1.61	1.17	na	na	na
5	1.31	1.60	1.62	na	na	na
10	1.43	2.17	1.51	na	na	na
11	1.44	1.66	0.00	na	na	na
13	1.40	0.00	1.56	na	na	na
14	1.49	1.72	1.63	na	na	na
15	1.85	2.06	1.84	2.05	2.43	1.78
16	1.68	1.77	1.55	1.52	2.02	1.13
17	1.64	1.65	1.62	1.56	1.93	1.3
18	1.49	1.63	1.54	1.52	1.98	1.15
19	1.59	1.68	1.52	1.60	2.14	1.12
20	1.96	2.03	1.69	1.83	2.06	1.51
21	1.65	1.74	1.49	1.67	1.97	1.25
22	1.55	1.79	1.74	1.71	1.95	1.12
23	1.26	1.25	1.35	1.39	2.08	1.08
24	1.57	1.69	1.57	1.55	1.92	1.07
25	1.56	1.68	1.57	1.55	1.84	1.29
26	1.73	1.85	1.67	1.72	2.01	1.34
27	1.88	1.68	1.64	1.72	2.11	1.38
28	1.68	1.73	1.71	1.63	1.93	1.28
29	1.48	1.76	1.59	1.64	2.03	1.34
30	1.74	1.67	1.55	1.52	1.77	1.08
31	1.63	1.82	1.66	1.56	1.93	1.15
32	1.47	1.53	1.50	1.48	1.95	1.01
33	1.46	1.57	1.53	1.52	1.83	1.17
34	1.49	2.01	1.52	1.61	2.06	1.12
35	1.54	1.71	1.64	1.66	2.13	1.13
36	1.55	1.70	1.62	1.65	2.01	1.31
37	1.93	2.25	0.00	1.87	2.69	1.30
40	1.44	1.66	1.47	1.69	2.62	1.34
41	1.24	1.29	1.93	1.62	2.22	1.24
45	1.69	1.79	2.14	1.85	2.10	1.52
50	1.33	1.42	1.60	1.58	2.08	1.24
51	1.38	1.61	1.59	1.62	1.97	1.25
52	1.33	1.60	1.58	1.56	1.83	1.29
55	1.53	1.64	1.84	1.77	2.10	1.45
60	1.48	1.80	1.73	1.57	1.85	1.28
61	1.41	1.48	1.91	1.69	2.31	1.06
62	1.36	1.78	1.82	1.78	2.52	1.36
63	1.47	1.95	1.73	1.79	2.12	1.42
64	1.16	1.69	1.56	1.57	1.86	1.16
65	1.30	1.57	1.54	1.66	4.31	1.21

(continued)

Table 4. (continued)

Sectors	Backward domestic multipliers (Greece)+	Backward domestic multipliers (Germany)+	Backward domestic multipliers (Belgium)+	Average backward domestic multipliers (EU countries)*	Maximum backward domestic multipliers (EU countries)*	Minimum backward domestic multipliers (EU countries)*
66	1.74	2.18	1.88	1.66	2.19	1.24
67	1.48	1.54	1.68	1.66	2.72	1.16
70	1.18	1.30	1.35	1.41	1.80	1.18
71	1.56	1.28	1.65	1.58	1.89	1.30
72	1.59	1.38	1.64	1.56	1.77	1.22
73	1.52	1.68	1.51	1.55	1.85	1.27
74	1.63	1.47	1.74	1.61	1.85	1.37
75	1.29	1.39	1.28	na	na	na
80	1.13	1.28	1.12	na	na	na
85	1.29	1.36	1.45	na	na	na
90	1.20	1.68	2.05	na	na	na
91	1.79	1.39	1.54	na	na	na
92	1.49	1.53	1.70	na	na	na
93	1.22	1.31	1.68	na	na	na
95	1.00	1.00	1.00	na	na	na

+**Source**: Own calculations using Eurostat's IO tables.
*__Source__: European Commission 2009: 76-77, Table III.10.
*__Note__: Based on 22 countries: Belgium, Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Latvia, Lithuania, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, and the United Kingdom.
na: not available.

ii. German and Greek multipliers:

In 49 of the total 58 sectors, the German multipliers exceeded the Greek multipliers. In the secondary sector with the exception of three sectors (23, 27, and 30) the German multipliers exceeded the Greek multipliers. With the exception of sector 30, the German multipliers exceeded the Greek multipliers in all sectors of high and medium-high technology. It should be noted that sectors 23, 27, and 30 are relatively small in both countries. For 2005, their share in the GVA was 0.236 percent, 1.026 percent, and 0.189 percent, respectively, for Germany and 0.599 percent, 0.384 percent, and 0.002 percent, respectively, for Greece (own calculations, Eurostat).

iii. Greek and EU multipliers:

In 29 of the total 43 sectors, the EU (22) average multipliers exceeded the Greek multipliers. In 15 of the total 26 sectors of the secondary sector, the EU (22) average multipliers exceeded the Greek multipliers. With the exception of sectors 24, 30 and 31, the EU (22) average multipliers exceeded the Greek multipliers in all sectors of high technology and medium-high technology. However, sector 30, as seen above, is one of the smallest sectors of the Greek economy and also a small sector for the EU (22) (only 0.089 percent of the GVA). Sector 31 is a very small sector for Greece; its share in the GVA was only 0.192 percent for 2005, when its size for the EU (22) was 0.861 percent. Sector's 24 GVA share for Greece is also well below the EU (22) average (0.623 against 1.822 percent for 2005) (own calculations, Eurostat).

iv. Belgian and German multipliers:

In 37 of the total 58 sectors, the German multipliers exceeded the Belgian multipliers. In the secondary sector with the exception of three sectors (23, 41, and 45), the German multipliers exceeded the Belgian multipliers. This means that in all sectors of high and medium-high technology the German multipliers exceeded the Belgian multipliers. From this comparison is also affirmed the characterization of Germany as a benchmark.

v. Belgian and EU multipliers:

In 24 of the total 43 sectors, the Belgian multipliers exceeded the EU (22) average multipliers. In 13 of the total 26 sectors of the secondary sector, the Belgian multipliers exceeded the EU (22) average multipliers. The Belgian multipliers exceeded the EU (22) average multipliers in all sectors of high technology. Consequently, the Belgian economy can be considered as an economy of rather strong multipliers within the EU, although the relative weight of the Belgian secondary sector and high and medium-high technology sectors are lower than in the EU, in terms of GVA, as seen above.

vi. Belgian and Greek multipliers:

As expected, the Belgian multipliers exceeded the Greek multipliers, although at a lower degree than the German. In 40 of the total 58 sectors, the Belgian multipliers exceeded the Greek multipliers. In 15 of the total 26 sectors of the secondary sector, the Belgian multipliers exceeded the Greek multipliers. Moreover, with the exception of sector 24 and 30, the Belgian multipliers exceeded the Greek multipliers in all sectors of high and medium-high technology.

Figure 4 depicts the data of Table 4.The maximum and minimum sectoral backward domestic multipliers for the EU (22) indicate the borderlines in which the German, Belgian, average EU (22), and Greek sectoral backward domestic multipliers' line appear. The German multipliers' line tends to be the nearest to the EU (22) maximum multipliers' line, the Belgian multipliers' line tends to be the nearest to the EU (22) average multipliers' line, while the Greek multipliers' line tends to be the nearest to the EU (22) minimum multipliers' line.

The IO analysis confirms that the Greek economy must be considered as a rather "extraverted" economy within the EU frame.

5. Conclusion

The Greek economy is an economy of the EU with:

- relatively weak domestic sectoral productive linkages (especially in manufacturing industries and high-tech industrial sectors),
- strong specialization,
- relatively low level of industrial and technological development,
- "unfavorable" relative income elasticities of demand, and accordingly
- relatively low international competitiveness.

Therefore, it is concluded that the Greek economy is a rather "extraverted" economy within the EU frame, *i.e.* within the basic competitive economic environment in which the Greek economy functions. The content of the weaknesses of the productive structure and the consequent low competitiveness of the Greek economy is reduced to this "extraversion."

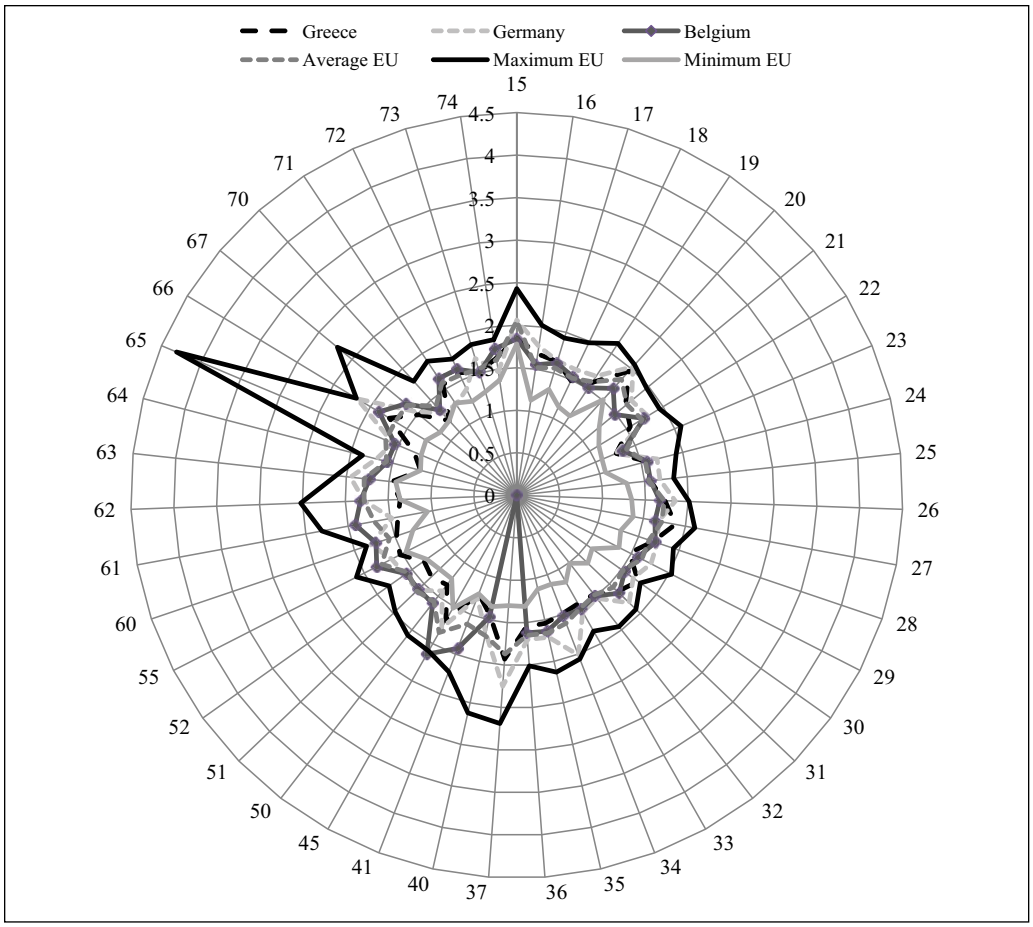

Figure 4. Greek, German, Belgian, and average, maximum, and minimum EU (22) backward domestic multipliers (2005).

Given that, according to our analysis, "extraversion" indicates that the competitiveness problem of a national economy is not a matter of low "cost" but of low "structural" competitiveness, it follows that the low competitiveness of the Greek economy is not due to "cost" but to "structural" factors. Besides, the Greek economy is an economy of low wages within the EU-15 frame.

From the above it is also inferred that Greece's vulnerability to balance of payment issues and debt crisis could not be explained by the "mainstream" position that current problems are the result of wages being too high. The "mainstream" view, ignoring the "structural weakness" of the Greek economy, does little to explain Greece's lack of competitiveness, or the debt crisis.

Appendix

Table 5. Industries' [sectors'] classification (NACE Rev. 1.1).

01	Products of agriculture, hunting
02	Products of forestry, logging
05	Fish and other fishing products
10	Coal and lignite; peat
11	Crude petroleum and natural gas
13	Metal ores
14	Other mining and quarrying products
15	Food products and beverages
16	Tobacco products
17	Textiles
18	Wearing apparel; furs
19	Leather and leather products
20	Wood and products of wood and cork
21	Pulp, paper and paper products
22	Printed matter and recorded media
23	Coke, refined petroleum products and nuclear fuels
24	Chemicals, chemical products and man-made fibres
25	Rubber and plastic products
26	Other non-metallic mineral products
27	Basic metals
28	Fabricated metal products
29	Machinery and equipment n.e.c.
30	Office machinery and computers
31	Electrical machinery and apparatus n.e.c.
32	Radio, television and communication equipment
33	Medical, precision and optical instruments, watches and clocks
34	Motor vehicles, trailers and semi-trailers
35	Other transport equipment
36	Furniture; other manufactured goods n.e.c.
37	Secondary raw materials
40	Electrical energy, gas, steam and hot water
41	Collected and purified water, distribution services of water
45	Construction work
50	Trade, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel
51	Wholesale trade and commission trade
52	Retail trade
55	Hotel and restaurant
60	Land transport; transport via pipeline
61	Water transport
62	Air transport
63	Supporting and auxiliary transport; travel agency
64	Post and telecommunication
65	Financial intermediation
66	Insurance and pension funding
67	Services auxiliary to financial intermediation
70	Real estate
71	Renting of machinery and equipment and household goods

(continued)

Table 5. (continued)

72	Computer and related activities
73	Research and development
74	Other business
75	Public administration and defence
80	Education
85	Health and social work
90	Sewage and refuse disposal,
91	Membership organisation n.e.c.
92	Recreational, cultural and sporting
93	Other services
95	Private households with employed persons

Table 6. Technology level for primary and secondary sector.

01	LT
02	LT
05	LT
10	LMT
11	LMT
13	LMT
14	LMT
15	LT
16	LT
17	LT
18	LT
19	LT
20	LT
21	LT
22	LT
23	LMT
24	MHT*
25	LMT
26	LMT
27	LMT
28	LMT
29	MHT
30	HT
31	HT
32	HT
33	HT
34	MHT
35	MHT
36	LT
37	LT

Source: OECD 2005; Di Mauro *et al.* 2010: 40, Table 10.
Note: LT=Low Technology, LMT= Low and Medium Technology, MHT= Medium and High Technology, HT= High Technology.
*Excluding Pharmaceuticals which are of HT.

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