Nicholas Tsounis

THE GREEK EXPERIENCE
FROM THE EU MEMBERSHIP

Abstract

The paper presents further quantitative estimates of the trade and welfare effects of the entrance of Greece into the E.U. and formulates a tool for assessing the impact of the candidate countries' accession to the E.U. Static and dynamic effects of the entrance of Greece into the EU are examined. Upon the examination of the static effects, it has been shown that there was a «net» trade creation of about 1.6 billion U.S dollars, which accounted for approximately 4.4% of the GDP produced in the year before the accession. It was also found out that 86% of the total trade creation was internal trade creation, while 84% of the total trade diversion was external trade diversion. These results accord with the theory of the customs union. As a result of examining the dynamic effects it has been found out that the entrance of Greece into the E.U. was mixed in the various sectors. It was found that for about two thirds of the examined sectors, the integration of Greece into the E.U. has been desirable. In general, however, the integration indexes found are very close to unity showing that the dynamic effects of the entrance of Greece into the E.U. have been minimal.

Key words

Accession, Greece, EU, candidate countries.

1. Introduction

The accession of Greece to the E.U. in 1981 from the economic perspective was a historic event. It was the first time that a customs union was formed between high-income developed economies and a middle-income developing economy such as Greece[1].

Some attempts have been made in the literature to qualitatively and quantitatively estimate the economic implications of the Greek accession. Plummer [1991] investigated the static effects of the accession using an *ex-post* import-growth model [Verdoorn and van Bochove:1972] for the estimation of trade creation and trade diversion resulted from the Greek accession. He found out that in the Greek market, positive trade creation is derived for most of the agricultural goods while trade diversion was present in most manufactured and semimanufactured products. Giannitis [1988] using the «shares in apparent consumption» approach found that the Greek accession has caused a considerable trade diversion for agricultural products from the third countries to

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Nicholas Tsounis, Professor, Department of International Trade, Kastoria Campus, Technological Educational Institution of Western Macedonia, Greece.

[1] For analysis of the development prospects of Greece into the E.U. see Polychronopoulos [1994].

the E.U., while at the same time increased considerably the imports of agricultural and manufactured products from the E.U. These effects have been attributed by the author to Common Agricultural Policy (CAP) of the E.U. and to slackening in protection of consumer products. Katos [1982], on the other hand, analysed the possible effects of the economic integration of Portugal, Spain and Greece with the E.U. upon the welfare of the region. The analysis was done with respect to dynamic effects related to changes in relative efficiency brought by the increased foreign competition with an *ex ante* model based on the years 1970 and 1973. He concluded that the dynamic effects of the integration of the three countries with the E.U. is «marginal» while the accession of Greece to the E.U. had had no effect on the overall E.U. GDP. However, he found that the accession of Greece had increased E.U.'s agricultural GDP by 3.1% but reduced manufacture's GDP by 0.41%. More recently, Mattas and Tzouvelekas [1999] concluded that Greece's accession to the E.U. had both positive and negative effects on its economy. They found that the most important benefits came from the budgetary transfers, mainly due to CAP, which improved the income of farmers. On the other hand, it was found that the balance of trade was negatively affected due to trade liberalisation,

significant price increases of imported agricultural products and domestic inflationary pressures.

The purpose of this paper is to present further quantitative estimates of the trade and welfare effects of the entrance of Greece into the E.U. and to formulate a tool for assessing the accession impact of the candidate countries to the E.U. Greece's course towards integration into the E.U. could highlight the path for the successful accession of new applicants with dissimilar economies like Greece[2]. Both static and dynamic effects are examined. The static effects of the entrance are examined via an *ex-post* model while the the possible dynamic effects (changes in relative efficiency caused by increased competition and the employment of economies of scale) of Greece's entrance into the E.U. and, therefore, on the community's output, are examined with the help of an *ex-ante* model. The structure of the paper is as follows: in section 2 the methodology for analysing the static effects of integration and the data used are presented and a quantification of trade creation and trade diversion caused by Greece's accession is provided. Section 3 provides an estimate of the dynamic effects stemming from this accession to the E.U., and section 4 gives conclusion.

2. The static effects of the entrance of Greece into the E.U.

Customs unions theory – applied for usually small country, perfect competition, full employment, perfect factor mobility, upward sloping supply curve and downward sloping demand curve assumptions – defines that a reduction in internal tariffs accompanying the formation of a customs union results in a decline in the domestic price followed by expansion in consumption (consumption effect) and a reduction in the quantity supplied by domestic resources (production effect). The decline in the domestic production will follow the increase in imports from the partner countries and the decrease in imports from the non-member countries, given all the usual assumptions of perfect price-elastic supply curves of the partner and non-partner countries. One then expects that the price reduction in the domestic market would be accompanied by the decline of the

share of domestically produced products in the total consumption, the increase in the share of imports from the partner countries and the decrease in the share of the non-partner countries.

It is suggested on the basis of the above analysis that by measuring the shares of domestic supply, the shares of imports from the non-member countries and the shares of imports from the partner countries in the «apparent» consumption before and after the formation of a customs union, and under the assumption that the pre-integration shares would have remained unchanged in the absence of integration, inference can be made to trade creation and trade diversion by observing the differences between the pre-integration and post-integration periods.

[2] For extensive analysis of the trade effects of integration on three CEECs, Hungary, Bulgaria and the Czech Republic see Tsounis [1998]. The methodology presented in the paper can be used for analysing integration effects of other areas of preferential trading and/or regional association, like the Black Sea Economic Co-operation Countries (BSEC), for a detailed analysis of the effects of BSEC on its member countries see Siskos [1998], the EFTA etc.

Table 1: **Pattern of shares**

Sign of the change in the share of	Domestic	Partners	Non-partners
1. Double trade creation (internal \ external)	−	+	+
2. Internal trade creation and external trade diversion	−	+	−
3. External trade creation and internal trade diversion	−	−	+
4. Double trade erosion (external \ internal)	+	−	−
5. Internal trade diversion and internal trade erosion	+	−	+
6. External trade diversion and external trade erosion	+	+	−

Source: [Truman:1969, p.205, Truman:1975, p.5]

The shares for each case are calculated in the following way:

demand satisfied out of domestic production: $D^d = Q - X$

demand satisfied out of imports from partners: $D^{E.U.} = M^{E.U.}$

demand satisfied out of imports from non-members: $D^{TC} = M^{TC}$

«apparent» consumption: $C = Q - X + M^{E.U.} + M^{TC}$

share of «apparent» consumption satisfied out of domestic production: $DS = D^d / C$

share of «apparent» consumption satisfied by imports from partners: $ECS = M^{E.U.} / C$

share of «apparent» consumption satisfied by imports from non-members: $TCS = M^{TC} / C$

Q is the gross domestic product, X denotes exports and $M^{E.U.}$, M^{TC} denote imports from partners and imports from non-members, respectively. In each year the shares sum to one and their changes between any two years sum to zero.

There are six cases of possible patterns of the three shares attributed to the economic integration which are given in Table 1.

The term «trade creation» is given to the case where there is a decline in the domestic share. The decline can be absorbed by both the partner countries and the non-members. This is the case of double trade creation (internal and external). The case where the decline of domestic share is accompanied by the decline in the share of non-members while there is a rise in the share of the partner countries is case 2. This is the case where the pattern of movement of the shares accords to that predicted by the traditional customs union theory. The decline of the domestic and the partners' share

accompanied by a rise in the share of the non-members is case 3.

The term «trade erosion» is given to the cases where the domestic share increases at the expense of both the member and the non-member countries, accompanied by an increase in the country's share (case 4), or at the expense of the partner countries (case 5), or at the expense of the non-members alone (case 6).

The static partial equilibrium analysis of customs unions shows, that the reduction in the internal tariffs will lead to the reduction in domestic production only if there is a reduction in the domestic price. Without the decline in the domestic price, there may be no trade creation but can be external trade diversion (case 2 and 6). The amount of trade creation and trade diversion for a particular commodity depends on the size of the tariff and the relevant supply and demand elasticities. The lower the initial level of imports from the third countries the smaller is the trade diversion. If the domestic and partners' supply curves were perfect price inelastic, there could be no trade creation or diversion. Furthermore, if the non-members' excess supply curve was perfect price elastic, there could be no trade creation.

If in addition to the reduction of internal tariffs there was a reduction in the tariff on imports from the non-members, this would *ceteris paribus* increase trade creation and reduce trade diversion and might lead to the increase in the share of non-members (cases 1 and 3). On the other hand, the increase in the tariff on imports from non-members might increase the domestic price and domestic production (cases 4 to 6). While case 6 can be considered as plausible, cases 4 and 5 are seldom observed. The change in the level of effective protection for a commodity might generate case 4 [Truman: 1975, pp.6–7].

The approach considering shares abstracts from the effects of growth of the economy. However, the assumption is needed that the growth has a neutral effect with respect to the

three shares; that is, the elasticity of each share with respect to increases in income is equal to zero.

This method defines directly trade creation; the substitutions caused in production and consumption by economic integration are studied together. The deficiencies are the usual problems for the period chosen for the construction of the *anti-monde*. Also, it was argued that systematic shifts in the domestic share, caused by home pressure of demand and structural change apart from that caused by the integration, tend to cause unreliability in the conclusions regarding trade creation [Verdoorn-Bochove:1972, p.346].

To overcome this problem, a measure of domestic demand pressure is included as one of the explanatory variables in the regressions to explain the change in the shares (other independent variables included variables for the measurement of cyclical movement of the shares and the time trends).

A direct application of the method is to compute the shares between some base pre-integration year and some «representative» post-integration year and examine their changes according to the analysis given above. However, this approach requires a very strong assumption that in the absence of integration nothing would have happened to alter systematically the pattern of shares in the base year.

Three factors that influence the three shares should be taken into account:
• the cyclical changes of the shares over time;
• the general trend exhibited in the shares of some sectors;
• the level of domestic demand pressure.

The effects of the cyclical changes on the shares can be neutralised by taking the average value of the shares over a pre-integration period and over a post-integration period, rather than single years. The method of averaging, however, has a disadvantage that it does not take into account the general trends of the shares before and after the integration. If for example, before the integration period the domestic share had a tendency to increase at the expense of the partners' and the non-partners' share, and in the post-integration period this pattern was reversed, then by taking averages over consecutive pre-integration and post-integration years one could find that the shares remained unchanged.

The second factor that might create errors in conclusions derived by the observation of the changes in the shares, concerns the assumption according to which, in the absence of integration, the three basic shares would have been remained unchanged from their pattern exhibited

in the specified base year. In the absence of integration, the domestic shares of expenditure on apparent consumption might have been declining while the partners' and the non-members' shares might have been increasing. Thus, the use of the assumption that there is no trend in the shares if such a trend actually exists would lead to overestimation of the trade creation.

Finally, it was assumed that the level of domestic demand pressure on the economy would not change. If a change in the productive capacity of the economy takes place or there is a change in domestic demand, there would be a change in the shares that cannot be attributed to integration.

To test for the existence of trends, the statistical significance of the average changes in the shares over the two periods has been examined. If the difference between the average rates of change of the shares in the two periods is statistically different from zero, the hypothesis of *no trend* or a *change in the trend* will be accepted (it will be explained later how the two cases can be distinguished from one other).

Regarding the third assumption, domestic demand pressure should not exhibit any structural change which will change the domestic, the partners' and the non-partners' shares in «apparent» consumption.

To test whether or not the domestic demand pressure remained constant in the pre-integration and in the post-integration period, in each sector the following procedure was followed: the change in the domestic demand pressure can be caused by the supply side or the demand side, or both. Therefore, measures representing both sides should be included in the test. As a measure of the domestic demand pressure it was decided to use the ratio of the total «apparent» consumption (C=Q−X+M) over the GNP. Changes on the demand side would be reflected in «apparent» consumption and changes on the supply side are taken to be measured by the GNP.

To test for a structural change in the domestic demand pressure the domestic shares of each sector were regressed on the ratio of (C/GNP) for the periods 1976–1980 and 1981–1986 and a Chow test was performed to test for the structural stability of the coefficients with the F-statistic (see also [Tsounis:1999]).

The F-statistic was calculated from the formula:

$$F = \frac{(RSS_R - RSS_1 - RSS_2)/k}{(RSS_1 + RSS_2)/(n_1 + n_2 - 2k)} \quad (2)$$

where RSS is the residual sum of squares from the regression:

$$DS_{it} = a_i + b_i(C_t / GNP_t) \qquad (3)$$

for the period t=1976–1980 and RSS_2 is the residual sum of squares from the estimation of equation (3) for t=1981–1986. RSS_R is the residual sum of squares from the estimation of

(3) for the period t=1976–1986; k=2, n_1=5 and n_2=6 [3].

Formula (2) follows the F-distribution with 2.7 degrees of freedom. The results of the test are given in Table 2.

Table 2: Chow test for structural stability of the demand pressure

Sector[1]	F-statistic[2]	Sector	F-statistic
100*	2.206	354	1.516
311	1.990	355	4.480
313	1.839	356	1.452
314	4.130	361	5.866
321	6.276	362	2.251
322	2.737	369	1.118
323*	0.584	371	3.772
324	2.228	372	3.337
331	1.801	381	1.432
332	9.284	382	6.016
341	0.347	383	3.158
342*	1.780	384	5.324
351	1.095	385	0.517
352	1.756	390	0.470
353*	7.582		

1. The desription of sectors is given in the Appendix.
2. Experimentation has been made with other candidate measures of the pressure of domestic demand; equation (3) has been estimated for the ratio of industry's «apparent» consumption to that of the GNP and for semi-logarithmic form of both ratios (C_t/GNP$_t$) and (C_{it}/GNP$_t$) to allow for possible non-linearities. On the basis of the coefficient of determination and the t-statistic of the b coefficient, equation (2) was chosen. However, in the sectors with an asterisk, the ratio of sector's «apparent» consumption to that of the GNP performed better than the ratio of the total «apparent» consumption to that of the GNP and the F-statistic for these sectors corresponds to the Chow test done for the coefficients of the regression DS$_{it}$=a$_i$+b$_i$(C$_{it}$/GNP$_t$).

From the statistical tables of the F-distribution we find that $F_{2,7}^{0.01}$=9.55. Therefore, it is concluded that no structural change has taken place in any of the sectors and the domestic demand pressure remained constant over the period 1976–1986.

As has been said, to eliminate the cyclical fluctuations of the shares, averages have been taken over the pre-integration and post-integration periods. The statistical significance of the two means was tested by the use of the t-test.

The application of the means method-as described above – will not produce correct results in the case where there are general trends in the movement of the shares of a sector. As already discussed, there are two cases in which trends can be exhibited:

- there might be a general trend (increasing or decreasing) of the shares in both the pre-integration and post-integration period, and;
- there might be a trend (increasing or decreasing) of the shares in the pre-integration period and a reverse trend in the post-integration period.

In either of these cases, the averaging of the shares will not produce correct results because in the first case it will show a structural break in the post-integration period which has not occurred, and in the second case it will not show the structural break which has taken place, since the averages of the two periods could be almost equal.

To overcome the problem of trends in the shares, the average rate of change in the shares over the two periods has been calculated as

[3] DS is the domestic share, C is the total «apparent» consumption and i denotes sector i.

well, and the t-statistic has been used to test for the statistical significance of the two means from the two periods.

If the first case applies to the sector, then it is expected that a structural break has occurred

only if the difference of the average rates of change of the shares in the two periods is statistically different from zero. The average rates of the shares' change would have the same sign.

Table 3: Patterns of change in the expenditure shares in «apparent consumption»

SECTOR	SIGN OF SHARE CHANGE		
	DOMESTIC	E.U. PARTNERS	NON-E.U. MEMBERS
100	−	+	+
311	−	+	−
313	−	+	+
314	−	+	0
321	−	+	+
322	−	+	+
323	−	−	+
324	−	+	+
331	−	+	+
332	−	+	+
341	−	+	+
342	+	+	−
351	−	−	+
352	−	−	+
353	−	+	+
354	−	−	+
355	−	+	−
356	−	+	+
361	−	+	+
362	−	+	+
369	−	+	+
371	−	+	−
372	−	+	−
381	−	+	−
382	−	+	−
383	−	+	−
384	+	+	−
385	−	+	−
390	+	−	−

If the second case applies to the sector, then it is expected that although its means of the shares of the two periods might be the same (their difference is not statistically significantly different from zero), the signs of the average rate of change of the shares in the two periods are different and their difference is statistically different from zero.

Finally, in the case where no general trend is exhibited in the sector and a structural break has occurred after integration, it is expected that the difference of the means of the shares from

the pre-integration and from the post-integration period would be statistically different from zero and the difference in the average rate of change in the shares over the two periods would not be statistically significantly different from zero.

However, this case can be mistaken for the first case, where no structural break has taken place and the difference in the means is due to the general trend of the shares. Therefore, for these two cases, one must examine the shares of that sector over the whole pre-integration and post-integration period.

The minus sign, in Table 3, shows a decrease in the share, the plus sign an increase and zero shows the constant share over the pre-integration and the post-integration periods.

Sectors 323 (leather products), 353 (petroleum refineries), 354 (miscellaneous petroleum and coal products), 355 (rubber products), 372 (non-ferrous metals) and 384 (transport equipment) belong to the second category described above; there was a tendency for the domestic shares to increase in the pre-integration period but in the post-integration period this tendency was reversed. Taking the averages of the shares in these periods would not be representative of integration effects (if the break is to be attributed to integration). In these sectors the last year of the pre-integration period (1980) was taken as the representative year for the construction of the *anti-monde* and it was compared with the last available year of the post-integration period (1986).

Trade creation has occurred in 26 sectors (decrease in the domestic share) and trade erosion in 3 (increase in the domestic share). In 9 sectors case 2 (of Table 1) has occurred, with internal trade creation and external trade diversion. This is the case that, the traditional theory of customs unions predicts, will occur after the formation of a customs union. The sectors of food products (311), rubber products (355), iron and steel (371), non-ferrous metals (372), fabricated metal products (381), machinery except electrical (382), machinery electrical (383), professional and scientific equipment (385), and agricultural products (100) belong to that category.

In 12 sectors double trade creation (internal and external) has occurred (case 1 of Table 1). This concerns the sectors of beverages (313), textiles (321), wearing apparel (322), footwear (324), wood products (331), furniture (332), paper and products (341), petroleum refineries (353), plastic products (356), pottery and china (361), glass and products (362), and miscellaneous non-metallic mineral products (369).

In four sectors there was external trade creation and internal trade diversion (case 3 of Table 1). These were the sectors of leather products (323), industrial chemicals (351), other chemicals (352), and miscellaneous petroleum and coal products (354).

Of the three cases of trade erosion, the two, printing and publishing (342) and transport equipment (384) where the domestic and the

partners' shares increased at the expense of the non-partners (case 6 of Table 1) are plausible, (as mentioned above), while the third case might be caused by the change in the level of effective protection (this occurred in the sector 390 of «other» manufactured products). However, this result could have been caused simply by the nature of the sector which is a residual, and therefore, heterogeneous sector.

Finally, there was the case of sector 314 of tobacco, where the non-members' share remained the same while the partners' share increased at the expense of the share of domestic production.

From the figures of the change in the three shares and from the level of «apparent» consumption in the post-integration period, the total trade creation (internal and external,) – definitions according to Table 1 – the total trade diversion (internal and external) and the total trade erosion (internal and external) can be calculated.

Table 4 shows the substitution effects between the three sources of supply – domestic, imports from members, and imports from non-members – on the «apparent» consumption, in US dollars (in 1980 prices and 1980 exchange rates).

The substitution effect shows the magnitude of the effects attributable to integration in value terms, under the assumption that the only cause of change in the shares is the formation of the customs union. It is calculated by multiplying «apparent» consumption in the post-integration period by the change in the appropriate shares over the pre- and post-integration periods:

$$C^{81-86}(S^{81-86}-S^{76-80}).$$

The total trade creation was found to be about 2.4 billion US dollars, the total trade diversion about 400 million US dollars and the total trade erosion about 300 million US dollars, giving a «net» trade creation (substitution effect) of 1.6 billion dollars (*i.e.* 4.427% of the GDP for the 1980 – the GDP in 1980 amounted to 36,766,498,000 US dollars – or about 20.789% of the average total trade flows of the same year-total average trade flows=(total exports+total imports)/2)-).

Most of the total trade creation was internal trade creation (86% of total trade creation) while most of total trade diversion was due to external trade diversion (84% of total trade diversion) which is a «normal» result and accords with the customs union theory.

Table 4: Quantification of trade creation and trade diversion

ISIC	TRADE CREATION		TRADE DIVERSION		TRADE EROSION	
	INTERNAL	EXTERNAL	INTERNAL	EXTERNAL	INTERNAL	EXTERNAL
100	795445702			197319864		
311	85929150			3736050		
313	7024701	8429641				
314	9796756					
321	220362268	7598699				
322	71499356	7606314				
323		11487980	3473110			
324	12865363	7602260				
331	5357793	26301894				
332	8241434	2392674				
341	17012934	11341956				
342						1514727
351		46378393	37945958			
352		74659527	17498327			
353	12309246	46159672				
354		53460657	8161932			
355	12870126			4756351		
356	17100990	9500550				
361	3644438	2939063				
362	11276816	10525028				
369	18748002	852182				
371	469306737			74817016		
372	41683947			7204633		
381	19376780			11072446		
382	106634485			28709284		
383	71987768			9162080		
384						307741981
385	10829099			9342752		
390					2179352	4358704
SUM	2029303891	327236490	67079327	346120476	2179352	313615412
	TRADE CREATION		TRADE DIVERSION		TRADE EROSION	
	2356540381		413199803		315794764	
	«NET» TRADE CREATION[1]: 1627545814					

1. «NET» TRADE CREATION = (TOTAL TRADE CREATION – TRADE DIVERSION – TRADE EROSION)

3. The dynamic effects
of the entrance of Greece into the E.U.

In section 2 the static effects, *i.e.* the changes in prices which occur after the integration, have been examined. In this section an attempt will be made to examine the dynamic effects of the entrance of Greece into E.U. Dynamic effects are concerned with the changes in the degree of competition and the degree of monopoly power, and also the exploitation of economies of scale, the use of the external economies, the improvement in the rate of technological change, the increase in investment, and the possible reduction of investment risk and uncertainty. Other effects that cannot easily be classified under these two categories of effects are the elimination of supply bottlenecks, abandonment of some national policies of small business protection, and greater technological contact (see Tsounis [1999, pp. 246–249] for a review of the economic integration effects).

In this section an attempt will be made to study one aspect of the dynamic effects: the changes in relative efficiency caused by the increased competition and the exploitation of the economies of scale. For this purpose an *ex-ante* model will be used, based on the data for the year before the integration.

3.1. The model

To examine the dynamic effects of economic integration on each sector of a region which will potentially integrate, the «normal» products of each sector of the region when being integrated are compared with the «normal» products of each sector of each individual country in the absence of economic integration [Sakamoto:1969, p.284]. The «normal» products are functions of the regional income, the market size and the level of a sector efficiency in terms of the overall efficiency in the economy [Chenery:1960, p.630, UN:1963, pp.3–6]. The «normal» products for the economy as a whole and for various sectors individually of a country are given by:

$$V_{Tj} = A_T Y_j^{a_T} P_j^{b_T} \quad ; \; j=1,...,m \qquad (4)$$

$$V_{ij} = A_i Y_j^{a_i} P_j^{b_i} D_{ij}^{c_i}; \; j=1,...,m, \; i=1,...,n \quad (5)$$

where the subscripts T, j and i denote all sectors of economy j taken together, country j and sector i, respectively. The variables V, Y, P and D denote gross value-added, per capita income, population and relative rate of efficiency, *i.e.*, the efficiency of a sector in terms of the overall efficiency in the economy (the formal definition of the variables will be given later in this section); A is a constant term and the a, b and c are elasticities. Thus, a_i is the income elasticity of value-added of sector i, b is the population elasticity of value-added of sector i and c is the elasticity of value-added of sector i with respect to the sector's relative degree of efficiency. The variable value-added was used because it was considered as a more appropriate measure than gross output for the measurement of the relative importance of an industry both as compared with other industries and in the context of the national economy as a whole. However, experimentation has been made with the use of gross output as the dependent variable. It was found that the (adj R^2) and the statistical significance of the independent variables were lower.

Assume now that a region R is composed of two blocks: the nine E.U. countries and Greece, with per capita incomes $Y_{EU} = (\Sigma_j Y_j P_j)/(\Sigma_j P_j)$; j=1,...,9 and Y_{GR} and population $P_{EU}=\Sigma_j P_j$; j=1,...,9 and P_{GR} respectively.

Equations (4) and (5) express relationships in which (given income, population and relative efficiency) it is possible to determine the «normal» product of different sectors. Therefore, we can define the integration of the two regions as beneficial according to a Pareto criterion as:

«the situation ... in which the regional product of at least one of the branches is larger than the sum of the respective product of the two countries [regions], and where the regional product of the remaining branches is not smaller than the sum of the two countries' [regions'] products» [Sakamoto: *op.cit.*, p.285]. Consequently, if it is observed that the integration in some sectors yields a larger product but at the same time the products of the remaining branches are smaller, no judgement can be made about the total effects of the integration on all sectors.

To formulate the above, the «normal» equations of each block, in our case of the E.U.-9 and Greece, corresponding to the sector i of the economy, would be:

$$V_{iEU} = A_i Y_{E.U.}^{a_i} P_{E.U}^{b_i} D_{iEU}^{c_i} \qquad (6)$$

and

$$V_{iGR} = A_i Y_{GR}^{a_i} P_{GR}^{b_i} D_{iGR}^{c_i}. \qquad (7)$$

Assume now that Greece integrates with the E.U.. The per capita income of the ten countries will be $Y_R=(\Sigma_j Y_j P_j)/(\Sigma_j P_j)$; j=1,...,10 and the population of the region $P_R=\Sigma_j P_j$; j=1,...,10. The «normal» equations for each of the i sector of the region would be:

$$V_{iR} = A_i Y_R^{a_i} P_R^{b_i} D_{iR}^{c_i}. \qquad (8)$$

According to the above stated, integration would be beneficial for the i sector, if $V_{iR}>V_{iEU}+V_{iGR}$ or it would not be beneficial if $V_{iR}<V_{iEU}+V_{iGR}$. Alternatively, an «integration index» can be defined as:

$$I_i = \frac{V_{iR}}{V_{iEU} + V_{iGR}} \qquad (9)$$

for each sector i. If $I_i>1$ integration is beneficial for the i sector, if $I_i<1$ then integration will not be beneficial for the i sector. It is noted, however, that the «integration index» indicates only whether integration is beneficial or not for a specific sector i and no conclusion can be derived for all the sectors taken together if in some of them I_i is greater than unity and in some others less than unity. Additionally, it should be noted that the analysis is only applicable if the «normal» equations are a good approximation to the actual products of the sectors of the countries under consideration. Otherwise, the results would be subject to an overestimation or underestimation.

3.2. The estimation procedure

For the calculation of the «normal» products given by the equations (6), (7) and (8), the coefficients a_i, b_i and c_i should be estimated first. This can be done by estimating equations (4) and (5) in a double logarithmic form. The estimation of (4) is necessary for the calculation of the D_{ij} variable.

V_{Tj}^* is the total gross value-added product at producers' prices for economy j in 1980 in ECUs; $j=1,....,9$ [4], Y_j is the per capita income for 1980 in economy j in ECUs and in purchasing power parities (PPP) [5], P_j is the total population of economy j in 1980. The variable D_{ij} is the relative efficiency of the ith sector of the j economy and it has been calculated as $D_{ij} = R_{ij}/E_j$, where the efficiency variable E_j of the jth economy is defined as the ratio of the actual over «normal» values of V_{Tj}, i.e., $E_j = V_{Tj}^*/V_{Tj}$ (the asterisk indicates actual values) and R_{ij} is the efficiency variable of the i sector of the jth economy defined as the ratio of the actual over the «normal» values of V_{ij}, i.e. $R_{ij} = V_{ij}^*/V_{ij}$.

The explanatory power of the independent variables is very high as can be seen from the high $(adjR^2)$ coefficients; for all sectors they are over 0.95.

The income coefficients can be called growth elasticities rather than income elasticities since in the long-term with rising income factor proportions as well as demands vary. Similarly, the population coefficients are market size elasticities and represent the effects of the increase in the market size.

The relative efficiency variable was introduced into the model to capture the effects of the changes in the relative efficiency of a sector on its output. It is interesting to note that the introduction of the relative efficiency variable left unchanged the values of the regression coefficients of the other two explanatory variables and also of the constant terms of equation (5), but it raised the value of their t-statistic. Thus, it can be regarded as a «correction» term in the equation in the sense that it is used to increase the stability of the estimates and to capture a part of the unexplained part of the dependent variable, since its t-values for all sectors are high (in 26 sectors it is statistically significantly different from zero at 5% level of significance and for the remaining 3 sectors at 10% level of significance).

Its estimated coefficient can be interpreted as the relative efficiency elasticity of output showing the effects of of the efficiency percentage change of a sector relative to the overall efficiency of the economy in regards of the percentage change of output, the other variables remaining unchanged.

The population variable was the most statistically significant variable, being for all sectors statistically significantly different from zero at 1% level of significance. It is observed that for the sectors of tobacco (314), wood products and furniture (331, 332), paper (341), chemicals (351, 352), plastic products (356), glass and non-metallic minerals (361, 369) and metal products and machinery (381, 382, 383), the population (size) elasticity is close to unity showing a constant relation of changes in the sectors' products caused by the changes in the population in these sectors.

Agricultural (100), food and beverages (311, 313), printing and publishing (342), and professional and scientific equipment (385) sectors have a population elasticity less than unity, showing that production growth in these sectors does not keep pace with the market size growth. This result may seem surprising for the sectors 342 and 385, since one would expect a population elasticity of at least one for those sectors. However, the same result has been obtained for the year 1979: sector 342 had a population elasticity of 0.677 and sector 385 a population elasticity of 0.858, both statistically significantly different from zero at 1% level of significance.

On the other hand, the sectors of textiles, clothes and footwear (322, 323, 324), petroleum refineries (353), rubber products (355), pottery (361), iron, steel and other metals (371, 372) and transport equipment (384) have a population elasticity greater than one. These sectors after the integration of two regions will benefit from the expansion of the size of the market alone, (the other independent variables remaining unchanged), and their relative position in the economy will improve.

Regarding the growth (income) elasticities, six sectors (agriculture (100), textiles (321), wearing apparel (322), leather products (323), footwear (324) and pottery (361)) have a negative growth elasticity. This shows that

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[4] The data for Luxemburg is included in the data for Belgium.

[5] PPPs were used for the conversion of the per capita income in ECUs because in that way the calculated per capita income of Greece and of the other E.U. countries with a different level of development would be more comparable [Officer:1976].

agriculture and textile industry have a diminishing importance in the growth of the economies in the region. It may also reflect the fact that, in the E.U., the notion of economic growth is tightly related to the growth of heavy industry sectors. The values of the growth elasticities indicate the changes in economic structure of the region under investigation. The highest growth elasticity is that for the professional and scientific equipment sector

(385), while other sectors with high growth elasticities are printing and publishing (342), industrial chemicals (351), iron and steel (371), and machinery (381, 382, 383) sectors. All growth coefficients are statistically significantly different from zero at, at least, 5% level of significance, apart from the coefficients of the sectors 314, 322, 324 and 372 which are significant at 10% level.

3.3. The results

In Table 5 the «integration index» calculated from (9) and the «normal» products for each sector of the nine E.U. countries and Greece

before integration and of the E.U.-10, after integration are presented.

Table 5: **Dynamic effects of integration**

ISIC	Integration Index	V_{is} E.U.-9	V_{ir} E.U.-10	V_{ih} Greece	D_{ir} E.U.-10	D_{is} E.U.-9	D_{ir}/D_{is}
100	1.02162	50,024,202,101	55,563,304,206	4,363,245,489	1.436	1.390	1.03337
311	1.02008	67,227,494,294	69,376,498,976	783,347,673	2.048	1.999	1.02480
313	1.00481	15,172,703,067	15,433,654,756	187,032,885	1.444	1.442	1.00171
314	0.99807	7,986,723,389	8,078,529,076	107,407,225	1.216	1.231	0.98826
321	1.00274	20,618,576,261	21,489,066,961	811,812,045	0.757	0.761	0.99409
322	0.99927	12,229,799,131	12,617,033,477	396,496,977	0.693	0.704	0.98453
323	1.00738	2,463,500,236	2,565,347,146	83,063,407	0.576	0.590	0.97663
324	1.01100	4,351,405,437	4,491,537,327	91,274,690	0.531	0.549	0.96667
331	0.99861	8,226,311,517	8,408,718,004	194,145,579	1.008	1.007	1.00107
332	1.00174	10,074,212,574	10,213,360,282	121,410,894	1.190	1.169	1.01801
341	1.00128	11,869,377,507	11,986,196,491	101,502,952	1.042	1.032	1.00958
342	0.99826	19,457,690,330	19,600,894,476	177,461,117	1.663	1.620	1.02609
351	1.00198	27,003,537,844	27,206,658,642	149,258,617	1.207	1.181	1.02147
352	1.00007	19,869,618,031	20,123,645,724	252,569,251	1.111	1.121	0.99182
353	0.99554	18,330,686,116	18,379,991,273	131,679,773	0.394	0.406	0.97099
354	1.00634	1,757,662,829	1,800,141,075	31,145,681	3.239	3.148	1.02877
355	0.99157	5,790,908,404	5,798,612,962	56,979,726	0.528	0.544	0.97156
356	1.00156	11,320,080,035	11,514,548,669	176,511,133	1.097	1.094	1.00224
361	0.99911	3,380,453,027	3,431,704,963	54,325,464	0.647	0.672	0.96290
362	1.00228	5,593,861,595	5,643,965,396	37,247,273	1.146	1.147	0.99920
369	0.99883	17,337,032,461	17,707,020,338	390,687,954	1.112	1.111	1.00069
371	1.00256	30,286,561,204	30,525,917,990	161,488,344	0.423	0.427	0.98955
372	1.00538	7,608,153,627	7,825,463,120	175,459,741	0.451	0.455	0.99058
381	0.99993	32,256,826,466	32,669,302,155	414,657,347	1.132	1.120	1.01106
382	1.01300	67,609,657,553	68,617,256,671	127,233,052	1.483	1.442	1.02849
383	1.00384	49,365,032,606	49,810,501,269	254,858,113	0.901	0.894	1.00758
384	0.98286	29,629,075,484	29,521,036,212	406,887,478	0.571	0.577	0.98917
385	1.00698	9,778,476,281	9,854,233,487	7,442,649	1.853	1.779	1.04168
390	1.00487	5,954,196,108	6,040,739,692	57,239,120	1.580	1.552	1.01778

It is observed that integration will not be beneficial for all sectors since the sectoral integration indexes are not all higher than unity: 19 sectors are found to have $I_i > 1$ and 10 sectors $I_i < 1$. Therefore, no general statement about the «convenience» of integration of Greece with the E.U. can be made. It can only be examined whether or not the integration would be «convenient» for each sector individually. An examination of the first column of Table 5 shows that integration would be «convenient» for the sectors 100, 311, 382, 324, 323, 385, 354, 372, 390, 313, 383, 321, 371, 362, 351, 332, 356, 341 and 352, while for the remaining sectors it would not be «convenient». The highest integration index is reported in agriculture, while high values of the index are also reported for the food products sector (311), machinery, except electrical (382), footwear, except rubber or plastic (324) and leather products (323). It should be noted though that all integration indexes are within the range of 0.98 and 1.02, with the majority of them being very close to unity, showing that the integration of Greece, a small country, into the E.U. would not have a dramatic impact in the total product of the region.

Although, as mentioned above, not all sectors have integration indexes greater than unity, so that no statement can be made about the increase or decrease in welfare, it was tempting to calculate the integration index for all sectors by summing up the «normal» products of all sectors. The integration index for all sectors had a value of 1.00586, showing that the entrance of Greece into the E.U. has marginally increased the product of the region. Furthermore, in Table 5 the relative efficiencies of the E.U. are reported with and without the integration of Greece, and in the third column the ratio of the relative efficiency of the E.U. with Greece to the relative efficiency of the E.U. without Greece is reported for each sector.

The relative efficiency index shows the position of the relative efficiency of a sector within the overall efficiency of the economy. Therefore, a value of the ratio D_{ir}/D_{is} greater than one shows that the sector improved its position relative to the other sectors after the entrance of Greece into the E.U. The values of the ratios of the relative efficiencies range from 0.96 to 1.04. The entrance of Greece into the E.U. improved marginally the position of 16 sectors, while it worsened the position of 13 sectors.

4. Conclusion

It is difficult to make an overall evaluation of the effects of the accession of Greece to the E.U. because some consequencies cannot be quantified (changes in legal framework, limitations of the type of policy the Greek government can or cannot implement), and other effects are difficult to estimate (competitive position of Greek products in international markets).

In this paper an attempt has been made to examine the static and one aspect of the dynamic effects (changes in relative efficiency) of the entrance of Greece to the E.U..

To examine the static effects, the shares in «apparent» consumption approach has been used. Under the assumption that the only cause of change in the shares of domestic production, imports from members and imports from non-members in the «apparent» consumption is the formation of the customs union, it was found that there was a «net» trade creation of about 1.6

billion dollars (about 4.427% of the GDP produced in 1980). 86% of the total trade creation was internal trade creation, while 84% of the total trade diversion was external trade diversion. These results accord with the customs union theory.

In the last section of this paper the dynamic effects of the entrance of Greece to the E.U. with respect to changes in relative efficiency have been examined, utilising an *ex-ante* model. The results found by the application of this model in respect to the entrance of Greece into the E.U. suggest that entrance had mixed effects in the various sectors of the region. Integration has been «convenient» for two thirds of the examined sectors. In general, the integration indexes were very close to unity, showing that the dynamic effects of the entrance of Greece to the E.U. have been minimal, something that was expected since Greece is a small country comparing to the E.U.

Appendix: **Description of Sectors**

Sector Code	Description
100	AGRICULTURAL PRODUCTS
311	FOOD PRODUCTS
313	BEVERAGES
314	TOBACCO
321	TEXTILES
322	WEARING APPAREL, EXCEPT FOOTWEAR
323	LEATHER PRODUCTS
324	FOOTWEAR, EXCEPT RUBBER OR PLASTIC
331	WOOD PRODUCTS, EXCEPT FURNITURE
332	FURNITURE, EXCEPT METAL
341	PAPER AND PRODUCTS
342	PRINTING AND PUBLISHING
351	INDUSTRIAL CHEMICALS
352	OTHER CHEMICALS
353	PETROLEUM REFINERIES
354	MISC. PETROLEUM AND COAL PRODUCTS
355	RUBBER PRODUCTS
356	PLASTIC PRODUCTS
361	POTTERY, CHINA, EARTHENWARE
362	GLASS AND PRODUCTS
369	OTHER NON-METALLIC MINERAL PROD.
371	IRON AND STEEL
372	NON-FERROUS METALS
381	FABRICATED METAL PRODUCTS
382	MACHINERY, EXCEPT ELECTRICAL
383	MACHINERY ELECTRIC
384	TRANSPORT EQUIPMENT
385	PROFESSIONAL\SCIENTIFIC EQUIPM.
390	OTHER MANUFACTURED PRODUCTS

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