Estimation of Structural Changes in the Trade Sector Resulting from the Integration with the E.E.C.: The Case of Greece

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I. Introduction

The economic impact of an economic association, such as the common market, on its full participants has been discussed extensively in economic literature. Most of the analysis evolves around the economic integration of a group of developed economies, like the original group in the European Economic Community (E.E.C.), or alternatively around a group of integrated developing economies. However, the integration impact on a developing economy (such as Greece)[1] joining a group of developed economies (the E.E.C.) has not been fully presented in the literature. Our study concentrates on this unique relationship and its implications with regard to other potential "associate" or "full" members.

Greece became an "associate"[2] member of the E.E.C. effective November of 1962 and joined as a "full" member in January of 1981. The estimations and analysis relate to the "associate" membership period. Similar to other economic associations or

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[1] Greece was defined by the U.N. as a developing economy up until the mid-1970's.

[2] The agreement allowed the economy to go through a 22-year transitional period so that changes in the structure and efficiency would be sufficient to adapt to the economic environment of the E.E.C. The E.E.C. adjusted its tariff and quota structure on Greek products to those of its members effective Nov. 1, 1962. Greece on the other hand was given a 22-year period to adjust gradually its restrictions on E.E.C. imports. For more details see Triantis (1967).

economic unions, this relationship results in a partial or full development of a customs union for trade and commerce among the participants. The economic association imposes changes in the tariff and quota structures of the participants (complete elimination among full members) and the development of a common tariff structure with relation to the rest of the world, in addition to the introduction of other economic measures that result in economic integration. All of these changes are expected to contribute to changes in the trade patterns between the full and the associate members of the common market since alterations in tariffs and/or quotas result in changes in the relative prices of commodities imported and exported. The changes in the relative prices of the traded goods also introduce changes in the trade flow of goods and services with relation to the rest of the world.

The primary objective of this paper is to determine if this common market type of trade relationship has contributed to structural changes in the trade sector of the Greek economy since the association went into effect. Although we cannot attribute the structural changes (break) exclusively to the association with the E.E.C., in general, we can suggest whether it is likely that such a relationship has made a contribution. Therefore, on an *a priori* basis we expect that the trade pattern and composition of Greek imports and exports would change relative to the pre-association period. Additionally, we expect that such structural changes were the major force behind the transformation of the economy towards a larger industrial base — given the manufacturing sector's preferential treatment in the association agreement. The increased demand for exports is for importation of the necessary capital goods and technology to sustain a substantial rate of economic growth in the industrial sector.[3] For our analysis, we present first a statistical overview of the trade sector and then apply econometric techniques to measure the structural changes.

II. Historical Overview of the Trade Sector

A preliminary examination of the composition of imports and exports of Greece reveals major changes during the 1952-1978

[3] See Papantoniou (1979).

period. The econoy during this period had been transformed from a relatively agricultural oriented economy to an economy that is primarily industrial and service oriented. The sectoral share of the Gross National Income (GNI)[4] shows that in 1950 the industrial component was 20% of the GNI and by 1978 had increased to 32.6%. On the other hand, the GNI percentage share of the agricultural sector decreased from 27.7% in 1950 to 13.8% in 1978 while the service sector retained the same approximate share of 51% between the two periods. This transformation is also evident when one examines the changes in the trade sector. Athough the economy has sustained chronic balance of trade deficits, the exports of goods as a percentage of the imports of goods changed from 21.1% (in current prices and exchange rates) in 1950, to 28.9% in 1960 and to 44.1% in 1978.[5] This positive structural change, in addition to the changes in the composition of the imports and exports as seen in Table 1, verifies our contention that the transformation was also prevalent in the trade sector.

On the import side we observe that there has been a continous decline in the percentage share of imported agricultural goods over the years with the highest share of 21.4% in 1952, and the lowest 9.9% in 1978. This is a reflection of the continuous growth in prouctivity and overall expansion of the Greek economy and its ability to become self-sufficient in terms of basic food commodities. The decline in the share of imported raw materials is primarily due to the expansion of the domestic mining industry and its ability to satisfy part of the domestic demand for raw material industrial inputs. In the case of imports of mineral fuels we observe a substantial increase in the mid-1970's caused primarily by the dramatic increases in the price of imported oil and its derivatives.

A substantial gain is also observed in the domestic industry's import demand for machinery and equipments. This is primarily due to the fact that in a fast developing economy, captal goods are necessary inputs for the expansion and improvement of the industrial sector. When we examine imports of manufactured goods we observe an increase up to the early 1960's and a substantial decrease afterwards. This is simply a reflection of the expanded

[4] Derived from the *National Accounts of Greece.*

[5] Derived from the *National Accounts of Greece.*

Table 1
% DISTRIBUTION OF IMPORTS AND EXPORTS

Gategories S.I.T.C.	Imports[1]						Exports					
	1952	1960	1970	1972	1975	1978	1952	1960	1970	1972	1975	1978
0 Food & Live Animals	21.4	14.6	12.2	10.9	10.2	9.9	23.8	25.6	22.9	25.0	22.3	22.7
1 Beverages & Tobacco	0.0	.0	.2	.2	.1	.3	46.4	37.1	17.5	16.0	8.2	7.7
2 Raw Materials	16.5	12.7	10.6	9.5	9.0	7.7	18.5	25.2	16.9	14.1	8.8	8.4
3 Mineral Fuels	14.7	10.2	8.7	10.8	25.4	22.8	0.0	.0	1.0	1.2	11.0	9.5
4 Oil and Fats	.2	.2	.8	.2	.4	.2	.9	2.1	.8	1.5	1.8	2.2
5 Chemicals	6.5	10.6	10.2	10.7	10.0	9.7	3.0	4.1	7.2	7.4	5.8	4.3
6 Manufacturers	17.6	24.1	19.7	18.7	15.9	15.7	6.3	4.1	28.6	26.4	28.7	31.6
7 Machinery - Transport Goods	20.3	24.2	33.9	35.4	26.1	31.0	.9	.9	1.5	2.2	3.9	3.0
8, 9 Miscelaneous Manufacturers & Others	2.8	3.4	3.7	3.6	2.9	2.7	.2	.9	3.6	6.2	9.5	10.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Agricultural (0, 1)	21.4	14.6	12.4	10.2	10.3	10.2	70.2	62.7	40.4	41.0	30.5	30.4
Industrial (All other categories)	78.6	85.4	87.6	89.1	89.7	89.8	29.8	37.3	59.6	59.0	69.5	69.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sources: *External Trade Statistics*, N.S.S.G., various issues
National Accounts of Greece; 1958-75
Economic Surveys: Greece; O.E.C.D., 1979

1. Excluding ships

role of the domestic manufacturing industry and its import-substitution tendency.

A major structural change in the pattern of exports is also evident from the statistics in Table 1. The exports of food, animals, beverages and tobacco represented 70.2% of the total exports in 1952 but by 1978 their share decreased to 30.4% of the total exports of goods. We also observe a substantial decrease in the share of exports of raw materials, from 18.5% in 1952, decreasing to 8.4% of total exports by 1978. This reflects the increased domestic production of raw materials. There are three export categories for which we observe major increases in their shares of exports. One is the exports of mineral fuel. The other two categories are the exports of manufactured goods and the related category of miscellaneous manufacturers. Both of the last two export components reflected only 6.5% of the total exports in 1952 whereas by 1978 their share reflected 42.4% of the total. The major gain in the share of exported manufacturers was achieved during the 1960's. In 1960 this category (6) represented 4.1% of the total exports, by 1970 it represented 28.6%. Some or all of the gain can be attributed to the somewhat favorable terms that the manufacturing industry received in the 1962 "Athens Agreement" that established the associate membership with the E.E.C. (Triantis, 1967). This contention is further reinforced when the econometric results are examined in section IV of this paper.

For an overall comparison of the import and the export sector's share of agricultural goods, the category of industrial goods is composed of all other S.I.T.C. categories other than 0 and 1. The calculated values (bottom of Table 1) represent the percentage share of agricultural commodities in relation to total imports and exports. It is clearly apparent that, while the share of the imports of agriculture goods was declining, the industrial goods share of the total imports continued to increase from 78.6% in 1952 to 89.8% in 1978. This reflects the continued development and industrialization of the economy requiring an expanded amount of capital goods to allow for growth in addition to the increased expenditures for mineral imports (primarily due to the oil price increases of the early 1970's). On the other hand, the share of imported manufactured goods continued to decline over the period studied.

A comparison of the aggregated major categories of exports

(in Table 1) reveals the continued importance of the industrial sector played in terms of foreign exchange earnings. The share of agricultural goods exported decreased over time from 70.2% in 1952 to 30.4% in 1978. The major change took place in the 1960's which may be partially explained by the unfavorable treatment given to the agricultural sector by the association agreement. In contrast to the changes in the exports of agricultural goods, the industrial exports share increased from 29.8% in 1952 to an impressive 69.9% by 1978. Again, the major gain in the export share of industrial goods is observed during the 1960's changing from 37.7% in 1960 to 59.6% in 1970.

It is evident from our preliminary statistical analysis that in the 1960's (when the association agreement went into effect) some substantial changes in the composition of imports and exports and their relative importance with regards to the trade deficit are observed. It is also clear that the industrial sector is now an important component of total exports and of foreign exchange earnings. In Section IV of this paper we attempt to quantify through econometric analysis these structural changes and determine to what degree they could be attributed to the E.E.C. partial integration.

III. Methodology

For our structural break analysis, we subdivide the trade sector into subsectors and estimate each specified stochastic equation independently. We test the null hopothesis of no structural break during the post-association period. We classify 1950-63 as the pre-association period and 1964-73 as the post-association period and exclude the immediate post-1973 period due to distortions relating to the Cypriot crisis, the resulting change of governments, and the trade distortions caused by the cartelization of the oil market by the OPEC. The data was collected from the statistical sources of the National Statistical Service of Greece, the O.E.C.D., and the U.N. (see bibliographical references for detailed information). *All variables are expressed in real terms (1970 = 100)*. Detailed definitions of the variables are given in the Tables 2-4 presenting the econometric results.

Our methodological approach in testing for structural change

introduces into the individual equations interaction variables and a dummy distinguishing the two periods. The dummy (DEEC) takes the value of one for 1950-1963 (pre-association) and the value of zero for the remainig (post-association) period. We include 1963 in the pre-association period, although the agreement was signed in 1962, because we believe that it required at least one year for the appropriate mechanisms of the association to go into effect. The introduction of the dummy variable allows the regression to change intercept from one period to the other. Its coefficient estimates the change in the intercept from the pre-association period to the post-association period. The interaction variables introduced into the equations allow the regression line to change slope from one period to the other. The coefficient of the interaction variable estimates the slope difference between the two periods. Thus the introduction of the dummy and the interaction variable(s) allows us to estimate the intercept and the independent variable's coefficients separately for the pre- and post-association periods.

Each equation is specified applying economic rationale and is estimated with OLS (Ordinary Least Squares) and/or 2SLS[6] (Two Stage Least Squares) techniques with principal components as instruments. The null hypothesis of no structural change is rejected if the absolute value of the t-statistic of the interaction variable(s) is larger than the tabulated value. If the null hypothesis is rejected, we assume that there is strong evidence of structural break for that sector or subsector, and there is evidence that the association may have contributed to such change. We then analyze the overall econometric results and compare them to our *a priori* expectations for a final determination as to what the impact of the association may have been. Our econometric results are generally good and the right-hand variables explain, in most cases, over 95% of the variation of the dependent variable; also in most cases we observe absence of autocorrelation as tested by the Durbin-Watson statistic. The 2SLS estimates are generally similar to the OLS results, thus, in order to avoid repetitiveness, we discuss 2SLS estimates only when we observe a substantial difference from the OLS estimates.

[6] The reason for this is that the individual equations estimated were also used as part of two alternative macroeconometric models that were developed for my doctoral dissertation (Giannaros, 1981).

IV. Structural Changes in the Export Sector

For our exports estimations we examine five major categories of exports (manufactured goods, raw materials, tobacco, agricultural, and other exports) testing them for structural break. First, we estimate the behavioral equations of aggregate exports (X), measured in millions of drachmas, to determine whether its structure was altered during the post-association period. We treat our total exports equation as a demand function with total E.E.C. imports (MEEC), and imports by the rest of the world (MWN) — both expressed in millions of dollars — as the primary explanatory variables. The relative price variable is excluded from our trade functions for two reasons. First, the composition and quality of exports changes over time and cannot be accurately reflected in the price.[7] Second, Greece is a relatively open economy and thus its export prices would not likely be significantly different from the rest of the world to influence the value of exports substantially. We hypothesize that the variation of MEEC should play a major role in explaining the variation in the demand for Greek exports given that the European community absorbs over 40% of the total exports of Greece. This interdependency is expected to increase further in the near future now that Greece has become a full member of the E.E.C. Although some other equations were tested, our basic specification as defined above is as follows:

$$X = a_0 + a_1 DEEC + a_2 MEEC + a_3 (DEEC \times MEEC) + a_4 MWN + a_5 D_1 + u$$

where u = error term and $a_2, a_4 > 0$, $a_5 < 0$, a_1, $a_3 > 0$ or < 0

On an *a priori* basis, we expect that the relationship between X and MEEC and MWN would be positive. The coefficients a_1 and a_3 would be either positive or negative depending on the direction of the post-association change in the intercept and slope of the demand equation. Because DEEC is a dummy variable with units for the pre-association period, a negative a_3 would mean that the elasticity of export demand increased after the association was established.

[7] A number of alternative specifications were tested (some including the price variable). However, the results were not acceptable based either on economic or statistical grounds.

When we examine the econometric results of Table 2 (equation 1) we observe the statistical significance of all the explanatory variables — both jointly and individually — and, in particular, of the interaction variable. The significance of DEEC and the interaction variable (DEEC×MEEC) allows us to reject the null hypothesis of no structural change and accept hypothesis of sturctural break in the export sector. The regression estimates indicate that the slope and the intercept of the regression line changed significantly between the pre- and post-association periods. The estiamtes of equation 1 provide the following information:

Coefficient of	Constant	MEEC
1st period	$2771.7 = a_0 + a_1$	$.0500191 = a_2 + a_3$
2nd period	$-1820.7 = a_0$	$.109373 = a_2$
Change in coefficient	$4592.1 = a_1$	$-.0593539 = a_3$

Examining the above results we observe that there was a downward shift in the intercept of the regression line, from 2771.7 to -1820.7, and an increase in the regression line's slope between the two periods. The above table shows dX/dMEEC was equal to approximately .05 in the first period while in the second period it was more than double reading .109. The implication of these estimates is that the marginal change in the Greek exports due to a change in the imports of the E.E.C. was doubled after the association with the E.E.C. This is consistent with the observed higher rate of growth in the Greek export sector after the association and it also concurs with our *a priori* expectations. Although some other factors may have been in play, it seems that the E.E.C.'s decrease of tariffs and the removal or decrease of the import quotas for most of the Greek industrial products in the period immediately following the association seems to be the main cause of the rapid growth of the Greek export sector. The results of equation 2 of Table 2 also verify our contentions of structural break in the export sector, although equation 2 seems to be statistically inferior to equation 1.

The specification of equation 2 uses the World GDP *Index* (GDPW) as the primary explanatory variable of aggregate exports. In other words, exports are a function of the world demand for goods and services. The structure of equation 2 is as follows:

$$X = b_0 + b_1 DEEC + b_2 GDPW + b_3 (DEEC \times GDPW) + b_4 DI + u$$

where u = error term and $b_2 > 0$, b_1, $b_3 > 0$ or < 0

The estimated regression results (Table 2) show that both the dummy DEEC and the interaction variables are statistically significant confirming our analysis of the equation 1 estimates and providing us with the following information:

Coefficient of	Constant	GDPW
1st period	$903.0 = b_0 + b_1$	$117.551 = b_2 + b_3$
2nd period	$-20830.9 = b_0$	$399.560 = b_2$
Change in coefficient	$217733.9 = b_1$	$-282.009 = b_3$

The above values again show a substantial increase in the coefficient of the explanatory variable (GDPW) during the post-association period, pointing towards an upward shift in the regression line. In the pre-association period a 1% increase in the GDP of the world caused 117.5 million dks. increase in exports whereas during the post-association period the same change resulted in 399.5 million dks. increase.

The analysis of the regression results allows us to reject the null hypothesis of no structural break and accept the alternative hypothesis of positive structural break regarding the export sector after the association became effective. Even so, we cannot conclusively claim that all of the change in the slope of the regression line was due to the association. It is very possible that other factors may have contributed to it and that this structural break coincided with the association. It is plausible, however, that the association was the major cause of the change in the slope. This contention can be reinforced if one reads the conditions by which Greece entered the association (see Triantis, 1967). In view of the above deduction, we now attempt to determine which subsectors of the export sector contributed to this change and how each was affected. This particular task carried us into structural change testing of all subsectors. Utilizing the same estimation and evaluation procedure, our econometric estimations and our statistical analysis allows us to state reliably that only the exports of manufacturing showed strong evidence of structural change and

Table 2

ESTIMATED EQUATIONS FOR *EXPORTS OF GOODS (X)*[1]

Right Hand Variables of X

# of Equation	Method	Const.	DEEC	MEEC	(DEEC×MEEC)	MWN	D_1	R^2	D.W.	F-Stat.
1	OLS	−1820.7 (−1.132)	4592.1 (2.173)*	.109373 (4.624)*	−.0593539 (−2.171)*	.0281086 (3.597)*	−1944.49 (−2.671)*	.9888	2.0276	298.941
		Const.	DEEC	GDPW	(DEEC×GDPW)		D_1			
2	OLS	−20830.9 (−9.265)*	21733.9 (6.473)*	399.560 (16.879)*	−282.009 (−5.615)*		−1877.53 (−1.9170)**	.9785	1.3447	204.504

ESTIMATED EQUATIONS FOR *EXPORTS OF MANUFACTURED GOODS* (XMH)

Right Hand Variables of XMH

# of Equation	Method	Const.	DEEC	MEEC	(DEEC × MEEC)	MWN	(DEEC×MWN)	D_1	R^2	D.W.	F-Stat.
3	OLS	−7176.23 (−9.811)*	6160.35 (6.998)*	.0570466 (5.3007)*	−.0727559 (6.802)*	.030880 (8.687)*			.9935	2.4158	658.992
4	2SLS	−7184.84 (−8.488)*	6343.32 (6.057)*	.0577588 (4.621)*	−.0763811 (−5.794)*	.0305141 (7.474)			.9932	2.3837	585.993
5[L]	OLS	−31.294 (−20.219)*		2.47099 (5.163)*		.932730 (2.360)*		1.09086 (4.291)*	.9798	1.0390	307.240
6	OLS	−7139.16 (−9.597)*	6877.36 (5.064)	.0563779 (−5.144)*	−.0518813 (−1.638)**	.0311219 (8.591)*	−.0273166 (−.7008)		.9937	2.441	533.378

Variables (1970 = 100)–All Nominal Values Transformed to Real Values

MEEC – Imports of goods and services of E.E.C. in mil. $'s

MWN – World imports minus MEEC in mil. $'s.

X – Total exports of goods in mil. of dks.

XMH – Exports of manufactured goods in mil. dks.

GDPW – World GDP index (excluding services of gov't and private organizations)

DEEC – E.E.C. Association dummy; 1950–1963 = 1 and zero elsewhere

DEECxMEEC – Internation variable (DEEC takes the value of 1 for pre-association period and 0 after)

DEECxGDPW – Interaction variable (DEEC takes the value of 1 for pre-association period and 0 after)

1 – Values in parenthesis are the estimated t-values

L – Estimated in logarithmic form

D_1 – Dummy; 1950–53 = 1 and zero elsewhere

* – Significant at 0.05 level

** – Significant at 0.10 level

thus, for space limitations, we concentrate our analysis on that sector only.

Exports of Manufacturing

The manufacturing subsector is of particular importance because Greek authorities emphasized the expansion of this sector for the prospect of economic development and industrialization. The exports of manufacturing (SITC categories 6, 8, and 9 in Table 1), expressed in millions of dks., represented 42.2% of the total exports in 1978 versus 6.5% in 1950. This suggests a substantial rate of growth and points towards substantial structural changes during the post-association period.

The basic stochastic functions estimated (that test for structural break) take the same form as the basic equation of our total exports function with imports of the E.E.C. (MEEC) and imports of the world (MWN) — both expressed in millions of dollars — as the primary explanatory variables. Thus our specification takes the following form:

$$XHM = c_0 + c_1DEEC + c_2MEEC + c_3(DEEC \times MEEC) + c_4MWN + u$$

where u = error term and $c_2, c_4 > 0$, $c_1, c_3 > 0$ or < 0

The estimates shown in Table 2 clearly indicate that the equation 5 without the interaction variable exhibits positive autocorrelation (D.W. = 1.0390). We have observed throughout our econometric anaylsis that when the interaction variable is statistically significant the specification without the DEEC and the interaction shows autocorrelation. The presence of the dummy and the interaction variables in equations 3 and 4 of Table 2 improved the statistical results considerably, especially the Durbin-Watson statistics. A comparison of the regression coefficients of equation 3 for the two periods points to structural break:

Coefficients of	Constant	MEEC
1st period	$-1015.88 = c_0 + c_1$	$-.015693 = c_2 + c_3$
2nd period	$-7176.23 = c_0$	$.570466 = c_2$
Change in coef.	$6160.35 = c_1$	$-.0727359 = c_3$

Here we observe a dramatic change in the coefficient of MEEC from one period to the other implying a significant upward shift in the slope of the regression line. This is combined with the downward shift of the intercept from -1016.00 to -7176.23. An increase in MEEC by 1 million dollars caused a 57 thousand dks. increase in the exports of manufactured goods during the post-association period whereas a similar increase in MEEC would result in a decline of XMH equal to 15 thousand dks. This negative relationship estimated for the first period could be explained by either misspecification of the equation, inaccuracy in some data or it may be a reflection of the E.E.C.'s negative impact on this sector during the pre-association period when the European common market was in force but Greece was not affiliated with it. In other words, increases in trade barriers for noncommon market countries like Greece during the 1958-1963 pre-association period may have caused the exclusion of Greek manufactured goods in the Common Market.

The above abnormality in the coefficients of MEEC is not observed when the exports of manufacturing function is re-specified to include a double interaction. That is:

$$XMH = d_0 + d_1DEEC + d_2MEEC + d_3(DEEC \times MEEC) + d_4MWN + d_5(DEEC \times MWN) + u$$

where u = error term and d_2, $d_4 > 0$, d_1, $d_3 > 0$ or < 0

Although the added interaction (DEECxMWN) improves the signs of the estimated coefficients making them more meaningful, its t-statistic (see Table 2, equation 6) shows a statistically insignificant role in explaining the variation of XMH. Nevertheless, the estimated regression coefficients allow for some interesting observations to be made:

Coefficient of	Constant	MEEC	MWN
1st period	$-1261.80 = d_0 + d_1$	$.0044955 = d_1 + d_3$	$.00380 = d_4 + d_5$
2nd period	$-7139.16 = d_0$	$.0563779 = d_1$	$.03112 = d_4$
Change in coef.	$6877.36 = d_1$	$-.0518813 = d_3$	$-.02732 = d_5$

The above estimates reinforce the argument that there was a positive change in the slope of the regression line during the post-association period. The MEEC coefficient for both periods is now

positive and a dramatic change in the coefficient between the two periods is observed. The positive structural change seen in the above table was also noted when we discussed the percentage share changes in the composition of exports (Section II of this paper). The implication here, of course, is that the association may have made a positive contribution to the expansion of this sector. This view is reinforced when we compare the coefficients of MWN (world imports net of E.E.C. imports) to those of the MEEC in the above table. The comparison reveals that the MEEC coefficient increased proportionately more than that of the rest of the world from the pre-association period to the post-association period. The implication is that the E.E.C. has increased proportionately its marginal rate to import Greek manufacturers to a greater degree (d_3 increased by .0518879) than that of the rest of the world (d_5 increased by .02732). This fact confirms our previous contention that there is evidence showing this subsector may have benefited from the association agreement. No other major economic or political factors occurred to cause such structural change.

Therefore, although we cannot say with absolute certainty what the exact change in the coefficients was, we can with a relatively high degree of certainty observe from the results the strong impact the E.E.C. may have had on the export of manufacturing goods. This conclusion can be reinforced by observing the plotted actual and fitted values of regression #3 (see Graph 1). It becomes evident from visual observation that at about 1963 (14th observation) there seems to be a break in behavior of the function.

In conclusion, the export sector of Greece seems to have been impacted in a positive way since the association went into effect. Manufacturing exports gained tremendous momentum while the other export subsectors did not show any singificant evidence of structural change. The next section analyzes the empirical results of structural change estimations regarding the import sector.

V. Structural Changes in the Import Sector

The total imports of goods (MT) sector, expressed in millions of dks., was tested for structrual change utilizing the same econometric techniques discussed earlier. Similar to the export

Graph 1

Equation 3. — Exports of Manufacturing Goods

ID	ACTUAL	FITTED	Plot of Actual (*) and Fitted (+) Values	RESIDUAL
2	96.96	133.8	+	-36.9
3	118.9	242.4	+	-124.
4	140.9	-81.38	+*	222.
5	91.19	-90.75	+*	182.
6	90.19	26.61	+*	63.6
7	146.6	180.2	+	-33.6
8	181.6	365.6	+	-184.
9	210.2	171.6	+	38.6
10	156.9	212.6	+	-55.7
11	236.9	268.7	+	-31.8
12	260.2	305.8	+	-45.6
13	495.2	391.5	+*	104.
14	456.0	555.0	+	-99.0
15	683.1	674.8	+	8.35
16	1095.	1275.	+	-180.
17	1550.	1970.	*+	-420.
18	2620.	2420.	+	200.
19	3602.	3464.	+	138.
20	5527.	4865.	+*	662.
21	6800.	6477.	+*	323.
22	6720.	7847.	* +	-.113E+04
23	.1066E+05	.1022E+05	+*	439.
24	.1574E+05	.1578E+05	+	-42.9

sector, the import sector is expected to be affected directly by any changes in trade policy due to the economic association since tariffs, quotas, and other restrictions are changed as a result of this trade relationship. We subdivided the import sector for our analysis into seven major categories[8] and each category was tested

[8] The categories are: food & tobacco, mineral fuels, manufactured goods, machinery and transport equipment (capital) and rest of imports.

individually for significant structural change. Our basic specification of the import equation was that of a demand function. We introduce as our primary explanatory variable the total national expenditures (GNP) which is measured in millions of dks. In addition to the above mentioned explanatory variable, we introduce the dummy DEEC and the interaction variable (DEEC×GNP) to test for structural change. Our aggregate imports function is then specified as follows:

$$MT = e_0 + e_1 DEEC + e_2 GNP + e_3(DEEC \times GNP) + u$$

where u = error term and $e_2 > 0$, e_1, $e_3 > 0$ or < 0

Therefore, the total imports equation is expressed as a function of national expenditures (GNP). The results indicate that the independent variable explains over 97% of the variation of the dependent variable (equation 1 of Table 3). Additionally, the t-statistics of the dummy DEEC and of the interaction variable allow us to reject the null hypothesis of no structural change with about 95% confidence. Thus there is evidence that the regression line moved upwards in the post-association period. This implies that the association may have contributed to this structural change which may have been caused by the gradual reduction of the tariff and quota barriers regarding the E.E.C. countries' goods and to some degree on non-E.E.C. traded goods as was required by the agreements. In fact, the average tariff and quota level was reduced, opening the economy further to international competition. The estimated coefficients presented below reinforce our argument of structural break:

Coefficient	Constant	GNP
1st period	$-3011.7 = e_0 + e_1$	$.169441 = e_2 + e_3$
2nd period	$-22832.6 = e_0$	$.233937 = e_2$
Change in coefficient	$+1482.9 = e_1$	$-.064496 = e_3$

The estimated changes in the GNP regression coefficients from one period to the other imply that an increase in GNP by one million dks. would result in additional imports of 169,441 dks. and 233,937 dks. for the pre-association and post-association respectively. The import component of the economy seems to have increased after the association went into effect. The above analysis

indicates that the import sector faced structural change that made Greece more import dependent in the second period. This observation has negative implications with regard to the chronic trade deficits facing the country. On the other hand, the expansion of the import sector may have been necessary at least partially to facilitate the increased demand for imported capital goods to satisfy the capital thirst of the fast growing economy. Next we present the import sector's disaggregated analysis for structural change. For space considerations, only subsectors that showed econometric evidence of structural change are analyzed and discussed.

A. Imports of Manufacturers

The manufacturing sector of Greece during the period studied had been expanding at an average annual rate of about 8.5%. This dramatic expansion leads us to conclude that as the economy became more and more industrialized a greater component of the domestic final and intermediate consumption of manufactured goods would be supplied by domestic sources. This factor, combined with the somewhat favorable conditions that the association agreement provided for the manufacturing sector, allows us to state *a priori* that the proportion of imported manufactured goods in relation to GNP should decrease during the post-association period. The above statement is based on the fact that Greece was to eliminate tariffs on industrial goods gradually over a 24-year period, whereas the E.E.C. was to eliminate tariffs (with the exception of some special agreements) related to the Greek exports of industrial goods soon after the association went into effect.

In testing for structural change, we construct a demand function for the imports of manufactured goods (MM) with gross national expenditures (GNP) lagged one year as our primary explanatory variable (both MM and GNP measured in millions of dks.). Our basic equation takes the following form:

$$MM = f_0 + f_1 DEEC + f_2 GNP_{(-1)} + f_3 (DEEC \times GNP_{(-1)}) + f_4 DM + u$$

where $u =$ error term and $f_2 > 0$, f_1, $f_3 > 0$ or < 0

When we analyze the estimated econometric results of Table 3 (equation 2 and 3) we observe the following: The statistical

Table 3

Right-Hand Variables of MT and MM[1]

# of Equation	Method	Const.	DEEC	GNP	(DEEC × GNP)	$GNP_{(-1)}$	$(DEEC \times GNP_{(-1)})$	DM	R^2	D.W.	F-Stat.
		Estimated Equation for *Total Imports of Goods* (MT)									
1	OLS	-22832.6 (-4.384)*	14820.9 (2.0926)	.233937 (13.642)*	-.0644962 (-1.680)**				.9736	1.3641	221.355
		Estimated Equations for *Imports of Manufactured Goods* (MM)									
^2_L	OLS	-2.60405 -1.412	-14.9089 (-3.639)*			.973030 (6.599)*	1.23092 (3.610)*	.038999 (.3137)	.9829	1.610	229.249
^3_L	2SLS	-2.5047 (-1.297)	-15.6064 (-3.372)*			.965356 (6.257)*	1.28808 (3.333)*	.0771196 (.5364)	.9827	1.6312	229.200

Variables (1970 = 100)–All Nominal Values Transformed to Real Values

DM – Dummy reflecting derivation of values from different sources; 1950–1956 = 1, and zero elsewhere
GNP – Gross National Expenditures in millions of drachmas
L – Logarithmic transformation applied
MT – Total Imports of Goods in millions of drachmas
MM – Imports of Manufactured Goods in millions of drachmas
1 – Values in parenthesis respresent t-statistics
* – Significant at the 0.05 level
** – Significant at the 0.10 level

results of both the DEEC dummy and the interaction variable which test for structural change reflect the high probability of structural break. The null hypothesis of no structural break has to be rejected since in both the dummy DEEC and the interaction variable ($DEEC \times GNP_{(-1)}$) the t-statistics ($t = 3.639$, $t = 3.610$ respectively) show statistical significance in explaining the variation of the dependent variable. Additionally, the explanatory variables explain over 98% of the variation in the dependent variable. The same basic observations are made when we examine the same equation estimated with 2SLS.

The estimated coefficient results of equation 2 (estimated in *logarithmic* form) shown below indicate that during the 1st period a 1% change in GNP would have resulted in 2.2% change in imports of manufactured goods — i.e., a highly income elastic response. After the association goes into effect, a 1% change in the GNP results in .97% change in MM, i.e., a unitary income elastic response which supports our *a priori* expectations.

Coefficient	Constant	GNP
1st period	$-17.51295 = f_0 + f_1$	$2.20395 = f_2 + f_3$
2nd period	$-2.60405 = f_0$	$.97303 = f_2$
Change in coefficient	$-14.90890 = f_1$	$1.23092 = f_3$

Interpreting these econometric results leads us to the conclusion that the income elasticity of imported manufacturers decreased during the post-association period. The above evidence implies that the association agreement may have encouraged less importation and more domestic production (import-substitution) of these goods. In other words, the reduction of tariffs on Greek manufactured products by the E.E.C. may have encouraged promoting import-substituting manufacturing production. This conforms with our earlier analysis of the exports of manufacturers and with the estimations of production functions which we do not discuss in this paper.[8]

[8] For our economy-wide econometric model we estimated sectoral production functions that tested for structural change, see Giannaros (1981).

B. Imports of Raw Materials and Chemicals (MRM)

The raw materials and chemicals subsector of imports is composed primarily of items which become inputs in the production of other goods. Therefore, it would be expected that a general change in the economy's production level would have a direct impact on the amount of raw materials and chemicals imported. The basic stochastic function estimated introduces GNP as the primary explanatory variable of the variation of the imports of raw materials and chemicals (MRM). On an *a priori* basis when testing for the structural change we would expect that the association agreement would enhance import-substitution and thus decrease (during the post-association period) the proportion of the GNP that is allocated to MRM. The elimination of trade restrictions would then allow certain sectors of the industry for the wider E.E.C. market, thus deriving economies of scale and improving its competitive position.

We specify our basic stochastic function of MRM as follows:

$$MRM = g_0 + g_1 DEEC + g_2 GNP + g_3 (DEEC \times GNP) + g_4 DM + u$$

where u = error term and $g_2 > 0$, g_1, $g_3 > 0$ or < 0

Production is the primary independent variable explaining the variation in MRM and both variables are measured in millions of drachmas. Equations 1 and 2 (Table 4) which reflect the above specification indicate that all variables are significant at 95% level of confidence. The estimated of equation 1 provide us with the following information:

Coefficient	Constant	GNP
1st period	$-260.36 = g_0 + g_1$	$.026772 = g_2 + g_3$
2nd period	$-4409.13 = g_0$	$.0461735 = g_2$
Change in coefficient	$4148.77 = g_1$	$-.0193963 = g_3$

Both the intercept and the slope of the regression line show a significant change. The dMRM/dGNP ratio increases from .026772 in the pre-association period to .0461735 in the post-association period. For a million dks. increase in GNP there would be an approximate increase of 26 thousand dks. in MRM during the first period, but an approximate 46 thousand dks. increase in

Table 4

# of Equation	Method	Right-Hand Variables of MRM[1] Const.	DEEC	GNP	(DEEC × GNP)	DM	IT	(EEEC × IT)	R^2	D.W.	F-Stat.
		Estimated Equations for *Imports of Raw Materials and Chemicals* (MRM)									
1	OLS	-4409.13 (-8.650)*	4148.77 (3.749)*	.0461753 (27.513)*	-.0193969 (-3.025)*	-744.626 (-2.112)*			.9938	2.205	636.483
2	2SLS	-4535.21 (-8.617)*	4107.07 (3.177)*	.0465687 (26.993)*	-.0186982 (-2.382)*	-647.192 (-1.663)			.9937	2.2630	631.805
		Estimated Equations for *Imports of Capital Goods* (MMT)									
3	OLS	-6724.0 (-2.837)*	6999.22 (3.451)*				.276068 (11.944)*	-.164285 (-2.940)*	.9547	1.9808	126.51
4	2SLS	6859.79 (-4.064)*	7047.27 (3.200)*				.278032 (11.490)*	-.161720 (-2.546)*	.9529	1.9827	114.57

Variables (1970 = 100)-All Nominal Values Transformed to Real Values

DM - Dummy distinguishing two different data sources; 1950–1956 = 1, and zero elsewhere
L - Logarithmic transformation applied
MRM - Imports of raw materials and chemicals in millions of drachmas
MMT - Imports of capital goods in millions of drachmas
LT - Gross fixed national investment in millions of drachmas
1 - Values in parenthesis respresent t-statistics
* - Significant the at 0.05 level
** - Significant the at 0.10 level

MRM during the second period.

The implication here is that the association, contrary to our expectations, may have enhanced the importation of such materials. Our earlier analysis indicated that the association contributed to the expansion of the manufacturing industry which uses raw materials and chemicals as inputs in manufacturing production process thus adversely affecting this sector. It also implies that as the manufacturing sector is expanding there is no proportional expansion in the industries of raw materials and chemicals to compensate for the additional domestic demand for these products.

C. Imports of Capital Goods (MMT)

The imports of capital goods category is composed of imports of machinery and transport equipments. The types of commodities involved in this category relate to investments in the replacement of capital and/or its accumulation and, as a result, are directly related to national investment activity (IT). Investment itself is partially a function of national production (GNP). As the private and public sectors change the amounts allocated for investment in capital, the demand for the imports of these goods increases. Here we specify our basic MMT stochastic function with total fixed investment as the primary explanatory variable. Both MMT and IT are measured in millions of drachmas. Adjusting the equation for the structural change test we have:

$$MMT = h_0 + h_1 DEEC + h_2 IT + h_3 (DEEC \times IT) + u$$

where u = error term and $h_2 > 0$, h_1, $h_3 > 0$ or < 0

On an *a priori* basis, we expect that there would be a positive change in the slope of the regression line during the post-association period for two fundamental reasons. On one hand, the economy's rate of growth expands during this period requiring, at the minimum, proportional changes in investment goods to allow for increased productive capacity. On the other hand, tariffs on E.E.C. capital goods (which are not produced in Greece) were to be eliminated by the end of the 12-year period from the date the association goes into effect. This second element makes imported capital goods relatively less expensive thus increasing their demand.

The estimated MMT equations of Table 4 (equations 3 an 4) reveal that there was structural change in this subsector of imports. The interaction variable introduced along with DEEC shows statistical significanc in explaining the variation of MMT in both equations. A close look at equation 3 which expresses MMT as a function of gross fixed investment provides us with the following quantitative results:

Coefficient	Constant	IT
1st period	$275.22 = h_0 + h_1$	$.111795 = h_2 + h_3$
2nd period	$-6724.00 = h_0$	$.276968 = h_2$
Change in coefficient	$6999.22 = h_1$	$-.164285 = h_3$

Equation 3 in Table 4 proves to be statistically sound with the independent variables explaining 95.5% of the variation in MMT. The coefficients estimated reveal significant change in the intercept and the slope of the regression line from the pre-association to the post-association periods implying structural break. The slope of the regression line more than doubles during the second period. A one million dks. increase in IT resulted in 111.795 thousand dks. increase in MMT in the first period whereas an equivalent change in IT results in a marginal increase of MMT equal to 276.068 thousand dks. during the post-association period. The observed structural change may have been necessary to allow for economic growth and development but given its magnitude it must have put additional strains on the trade deficit. This must have also benefited the E.E.C. countries for they were the primary exporters of such goods to Greece.

In conclusion, several observations can be made with regard to our imports structural change analysis. There is sufficient evidence that during the post-association period the import component of the GNP increased. Furthermore, it can be stated that the association agreement, which imposed overall decreases in the Greek tariff and quota structure, may have had a direct impact on this change. In analyzing subcomponents of the aggregate imports of goods, we detect that imports of manufacturing as a proportion of GNP decreased whereas that of the imports of capital goods and that of imports of raw materials increased during the post-association period. The other subsectors of imports which were tested failed to show any significant structural break.

IV. Conclusion

The change in the tariff and quota structures of the economy as were required by the economic association with the E.E.C. seem to have, as expected, contributed to the changes in the trade pattern causing substantial structural change. Our *a priori* expectations that the composition and trade pattern of the Greek imports and exports would change substantially during the post-association period were satisfied throughout our econometric and descriptive anaylsis of these sectors.

Although we cannot attribute the structural changes exclusively to the association with the E.E.C., our econometric estimation and analysis allow us to suggest that this relationship may have contributed substantially to such changes. First, it is relatively clear from the quantitative results that the economy became more trade depenent as its trade barriers decreased. Second, the rate of growth of total exports changed positively after the association went into effect, thereby improving partially the foreign exchange constraint facing the economy. The primary beneficiary of such structural break was the manufacturing industry whose exports grew at a substantially higher rate during the post-association period. Third, although the import component of the GNP increased after the association, the imports of manufacturing goods decreased proportionately reflecting the import substituting and export promoting capabilities of the expanding industrial sector. This, combined with the positive structural change in the imports of capital goods (which are necessary for industrialization), allows us to conclude that the association may have made positive contributions towards the industrialization and trade liberalization of the Greek economy. This conclusion should be of great interest given that this is a unique economic association entailing the partial integration of a developing economy (during the period studied) with a "club" of industrialized countries.

Several questions remain to be answered in order to attain strong convictions in our conclusions. Hopefully, the results will facilitate further research on other countries facing this unique economic relationship before our conclusions can be generalized.

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