A TRADE THEORETIC APPROACH TO ECONOMIC INTEGRATION OF A SMALL ECONOMY

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INTRODUCTION

Since Greece became the tenth member of the European Union (EU) in 1981, the Greek economy has been affected significantly. The phenomenal economic growth of the 1950s and 1960s slowed during the 1970s. In the 1980s and early 1990s, Greece experienced double digit inflation and large deficits in the trade account and the government budget.[1] The country suffered an economic setback after 1981 during the post EU accession period. In light of these developments, several questions arise regarding the accession of Greece to the EU. Was the accession of the country responsible for the slowdown of the Greek economy? Is it possible for the trend to reverse? Indeed the last five years, real per capita GDP grew at rates above the EU average GDP growth rate. One, however, cannot be certain that this will continue into the future. Economic theory can help shed light on such issues and answer these and other questions pertinent to the effects of the accession of Greece to the EU, on the Greek economy. In the sections to follow a trade model to address these issues is presented together with some empirical evidence on the performance of the Greek economy. The trade model is designed to address the case of the accession of a small country to an economically integrated groups of countries. The integration process may be triggered by changes in the prices in the Greek economy. The accession agreement provided for trade liberalization between Greece and the EU, that caused changes in many commodity prices. Economic integration can also be triggered by factor movements between Greece and the EU which were not permitted before the accession agreement. Lastly, a factor which could lead to economic integration is neutral technological progress in the Greek industrial sector. This may be attributed to the efforts of the Greek producers in this sector to compete with the technologically advanced EU counterparts, or it may be the result of EU technological transfers to Greece encompassed into new EU investment in the Greek industrial sector. All these possible new routes for economic integration between Greece and the EU that became possible after the accession agreement will be studied using a trade model in a comparative statics framework. Some empirical evidence will be also provided regarding the performance of the Greek economy after the accession.

A MODEL FOR INTERNATIONAL TRADE: A COST FUNCTION APPROACH

To study the effects of the accession of Greece to the EU on the Greek economy, a three-sector general equilibrium model of a small economy is employed. The model assumes: two countries, Greece and the EU[2], three sectors: agriculture, industry and services, each producing a composite output or "good." Each sector employs two factors of production capital and labor, which are assumed to be fully employed and mobile across sectors within each country but not between countries. It is assumed that pure competition prevails in both product and factor markets, and the three production functions are characterized by constant returns to scale. These assumptions imply factor price equalization across the sectors of the Greek economy. There is, however, an exception in the labor market, while agricultural workers respond to wage differentials the response is not sufficient to equalize agricultural wages with the wages of the industry and the service sectors[3]. Agricultural wages are lower than the industrial and service wages despite the continuous migration of workers from the agricultural to the other two sectors. Lastly, agricultural prices are set by the EU Common Agricultural Policy

(CAP) almost always above the world agricultural prices. The price of the industrial good is determined competitively. Because of the accession of Greece to the EU, the Greek economy may be affected or it already has been affected through any of the following channels: 1) Increase of the capital stock in Greece as a result of direct physical investment by member EU countries to Greece; this may occur when EU firms seek new profit opportunities and invest in Greece. 2) Reduction in the Greek labor force due to emigration of Greek workers to other EU member countries motivated by higher real wages in these countries; 3) Reduction in the price of the industrial good due to the lifting of Greek protective trade barriers on imports from member EU countries; and 4) Increased efficiency in the industrial sector due to the response and effort of the Greek producers in this sector to become competitive with their EU counterparts after the accession. The industrial sector faced more competition than any other sector of the economy. In contrast, the agricultural sector is protected by the EU. The service sector, which often is referred to as the non-traded sector, also enjoys a certain degree of protection because many services are provided locally. In this study we examine the effects of changes in the price of the industrial good on the returns or rewards to capital and labor. The effects of a change in factor supplies and the change in the technical efficiency in the industrial sector on the three sectoral outputs are studied as well.

A Model[4]

$$a_{K1}(w/\mu r)r + a_{L1}(w/\mu r)w/\mu = 1 \qquad (1)$$

$$a_{K2}(w/r, \Omega)r + a_{L2}(w/r, \Omega)w = \overline{P_2} \qquad (2)$$

$$a_{K3}(w/r)r + a_{L3}(w/r)w = P_3 \qquad (3)$$

$$a_{K1}X_1 + a_{K2}X_2 + a_{K3}X_3 = \overline{K} \qquad (4)$$

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = \overline{L} \qquad (5)$$

$$D_3[\overline{P_2}, P_3, X_1 + \overline{P_2}X_2 + P_3X_3] = X_3 \qquad (6)$$

Production of each unit of the sectoral outputs requires certain amounts of capital and labor. Let: X_j = output of sector j = 1,2,3, where 1 = agriculture, 2 = industry, 3 = services; a_{Kj} = amount of capital required to produce one unit of j = 1,2,3 output; a_{Lj} = amount of labor required to produce one unit of j = 1,2,3; a_{Kj} and a_{Lj} are known as the factor coefficients.

Where w_1 = wage rate in the agricultural sector, w_2 and w_3 are the wage rates in the industrial and service sectors assumed equal to each other. Where μ is a constant distortion parameter of the labor market assumed greater than one: $\mu w_1 = w = w_2 = w_3$. The ratio a_{Kj} / a_{Lj} reflects the factor intensity in sector j. Pure competition implies that the unit cost in each sector is equal to output price.

Based on data of the Greek economy, the service sector is the most capital intensive; it is followed by the industrial sector, while the agricultural sector is the least capital intensive of the three.

Equations (1), (2), and (3) state that the unit cost of each composite sectoral output is equal to its price; these are the competitive equilibrium conditions. Note that $a_{Kj}(w/r)$ and $a_{Lj}(w/r)$, the factor coefficients, are functions of the factor price ratios. In the case of industry, a_{K2} and a_{L2} are functions of the factor price ratio and Ω, a parameter denoting technical efficiency, i.e., $a_{K2}(w/r, \Omega)$ and $a_{L2}(w/r, \Omega)$.[5]

The price of the agricultural good is assumed to be the numeraire, i.e., set equal to one. Equations (4) and (5) are the full employment conditions denoting that the two factors of production, capital, and labor are fully employed in the three sectors. Equation (6) states that demand for the service (non-traded) sector clears domestically. The model is used to answer two questions: 1) How a change in the price of the industrial good will affect factor prices? 2) What are the effects of changes in factor supplies on the sectoral outputs?

EFFECTS OF CHANGES IN THE PRICE OF THE INDUSTRIAL GOOD ON FACTOR PRICES

To examine the effect of a change in the price of the industrial good on the factor prices, equations (1), (2), and (3) are totally differentiated to obtain:

$$a_{K1}dr + (a_{L1}/\mu)dw = 0 \qquad (1)\square$$

$$a_{K2}\,dr + a_{L2}\,dw \quad = d\overline{P_2} \qquad (2)\square$$

$$a_{K3}\,dr + a_{L3}\,dw - dP_3 = 0 \qquad (3)\square$$

From the above system we obtain[6]:

$$dr/d\overline{P_2} > 0, \quad dw/d\overline{P_2} < 0, \quad dP_3/d\overline{P_2} > 0. \quad (7)$$

The above results are interpreted as follows: 1) a decline in the price of the industrial good depresses the rate of return to capital; 2) the real wage rate increases as the price of the industrial good decreases; and 3) the reduction in the price of the industrial good results in a decrease in the price of the non-traded good. All three results are reversed if value intensity reversal occurs.[7] An explanation of the above results is provided, as the price of the industrial good declines, domestic industrial production also decreases releasing resources which will be employed by the other sector(s). The increase in the relative prices of the agricultural and the service goods leads to increases in the production of one or both of these sectors. As the industrial sector contracts and the other sector(s) expand, resources are reallocated, causing a change of factor prices. If we assume that only the agricultural sector expands then capital is demanded and is rehired in a smaller proportion than it was laid off; this will reduce the rate of return to capital in all sectors. The opposite is true for the wage rate. As the labor intensive sector of agriculture expands, labor is demanded in higher proportions to capital, than was laid off. The excess demand for labor results in a rise in the real wage rate.

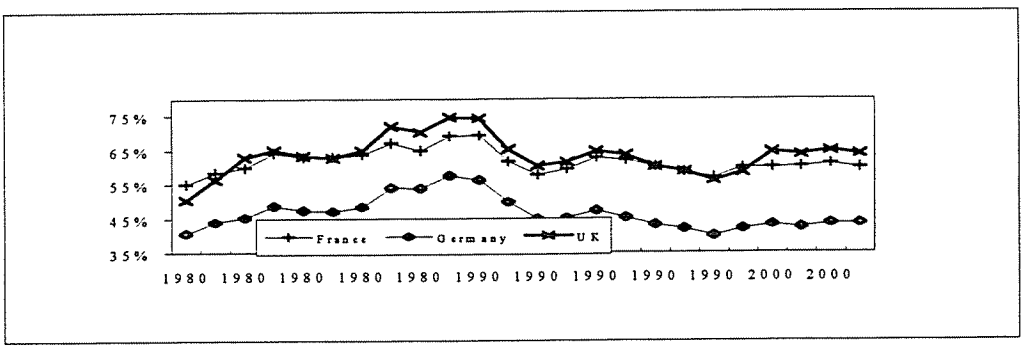
Considering the fact that Greece is a relatively labor abundant country while most of the other EU countries are relatively capital abundant, real wages ought to be, as indeed they are, lower in Greece; in contrast the rates of return to capital are lower in the other EU countries. In light of the above, a reduction in the price of the industrial, good according to the analysis presented, will bring about convergence in factor prices between Greece and the other EU countries.[8] Factor price equalization has not yet taken place between Greece and the EU. When examining historical data of the Greek economy, one observes that the entire industrial sector of Greece did not contract as it was suggested, only its manufacturing subsector experienced a reduction in output of .3 percent per year for the post-accession to the EU period 1981-1993. For the same period (1981-1993), the agricultural sector remained about unchanged, but the service sector grew at a 3.4 percent per year. This finding provides support for divergence in factor prices between Greece and the rest of the EU member states. Starting the year 1994 all sectors of the Greek economy with the exception of construction began growing. The service sector however expanded at the highest rate while agriculture experienced the lowest rate of growth.

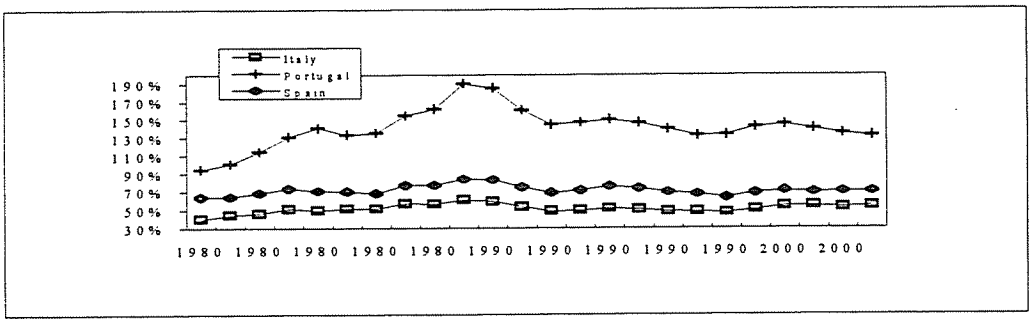
In figure 1 the relative real hourly Greek manufacturing wages are presented as a percentage of the wages of the eleven member countries manufacturing wages. Real relative Greek wages compared to the three most recent member wages of the EU, Sweeden, Finland and Austria, that joined the EU in 1995 were excluded. The

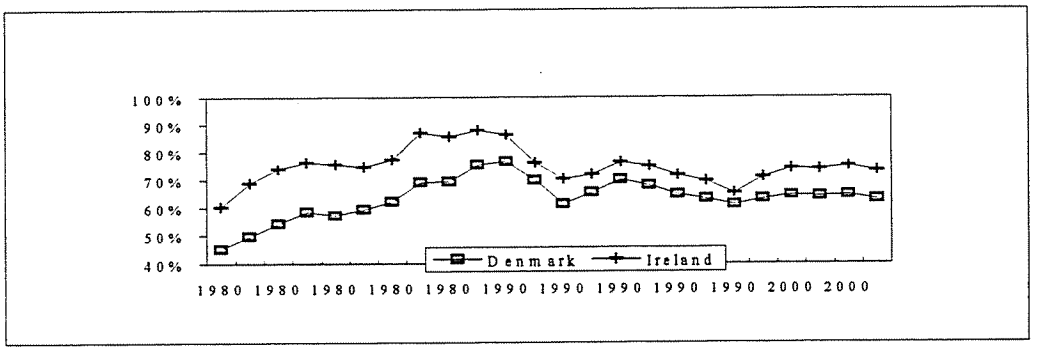
hourly wages were prepared by the U.S. Bureau of Labor Statistics. They are referred to as "Hourly Compensation Costs" and include all items of labor compensation providing a comparable basis of total hourly compensation between countries. Nominal wages in national currencies were transformed to real using each country's consumer price index (CPI), and thereafter into real 1990 U.S. dollars by using the purchasing power parities (PPP) for private consumption expenditures.

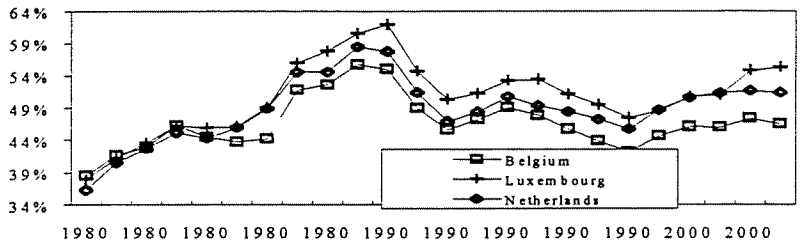
These constant 1990 U.S. dollar wages are a good proxy measure of the standards of living of the production workers of the EU countries.[9] It is clearly demonstrated in Figure 1 that relative real Greek wages vis a vis any of the other 11 countries ceased growing and started declining in 1983-84, i.e., only a couple of years after the accession of the country to the EU. In 1993 there was, however, a reversal in the trend of the real Greek wages. The relative Greek wages started increasing vis a vis almost all the rest of the EU countries manufacturing wages. The above constitutes evidence for gradual convergence of real Greek wages to the real EU wages.

Figure 1
RELATIVE REAL GREEK WAGES BASED IN 1990 US DOLLARS (PPP)









EFFECTS OF CHANGES IN FACTOR SUPPLIES ON SECTORAL OUTPUTS

To study the effects of changes in factor supplies on sectoral outputs, the system of equations (4), (5) and (6) is differentiated. Equation (6) states that demand for the output of the non-traded sector (services) is a function of income, $I = X_1 + P_2 X_2 + P_3 X_3$ and the sectoral output prices. The same equation implies that the sector clears domestically.

$$a_{K1}dX_1 + a_{K2}dX_2 + a_{K3}dX_3 = d\bar{K} \qquad (4)'$$

$$a_{L1}dX_1 + a_{L2}dX_2 + a_{L3}dX_3 = d\bar{L} \qquad (5)'$$

$$(\partial D_3/\partial I)dX_1 + (\partial D_3/\partial I)\bar{P_2}dX_2 + [(\partial D_3/\partial I)P_3 - 1]dX_3 = \qquad (6)'$$
$$-[\partial D_3/\partial \bar{P_2} + (\partial D_3/\partial I)X_2]d\bar{P_2} - [\partial D_3/\partial P_3 + (\partial D_3/\partial I)X_3]dP_3$$

The system consists of three equations in three endogenous variables (dX_1, dX_2, and dX_3); these equations are used to derive the effect of changes in the factors of production on the sectoral outputs. The only required assumption in this exercise is that the non-traded good is normal. The effect of an increase in capital on the sectoral outputs is:

$$dX_1/d\bar{K} < 0 \qquad dX_2/d\bar{K} > 0 \qquad dX_3/d\bar{K} \gtrless 0 \qquad (7)$$

These results are interpreted in the following way. If direct EU investment takes place in Greece after the accession, one would expect output in the agricultural sector (X_1) to decline and output in the industrial sector (X_2) to increase. Lastly the effect on the output of the service sector (X_3) is indeterminate.

The effect of a decrease in labor on the Greek sectoral outputs is:

$$dX_1/d\bar{L} > 0 \qquad dX_2/d\bar{L} < 0 \qquad dX_3/d\bar{L} \gtrless 0 \qquad (8)$$

The meaning of these results is that labor emigration from Greece to the EU will lead to the contraction of the agricultural sector and expansion in the industrial sector[10]. The effect on the service sector is indeterminate. Labor emigration from Greece to the EU can be motivated by higher EU wages. Value intensity reversal will cause a change in the sign of the first two results in (7) and (8). The above analysis indicates that the suggested exogenous changes in the factor supplies will lead the Greek economy to industrialization and thus convergence to the EU economies. There is empirical evidence that this has not yet happened. EU private investment in Greece after the accession remained at very low levels, while Greek labor emigration to the other EU countries was practically unnoticed.

An explanation for this is the fact that Greece is a relatively small country located far away from the major EU markets. Some suggested that the breaking up of the Soviet Union and the collapse of Communism may also have had a negative impact on EU investment to Greece. Many EU companies directed foreign investment to Central European countries which are located near the EU, and constitute a natural extension to the EU market. Greek emigration to the EU after the accession was insignificant despite the difference in the real wages. One cannot be certain why this happened. One explanation is that a relatively large number of Greek

workers emigrated to northern EU countries particularly to Germany during the 1950s and 1960s. Thereafter, the Greek standards of living rose substantially to the extent that after taking into consideration social and cultural factors, Greek workers no longer had an incentive to emigrate.

EFFECTS OF CHANGES IN TECHNICAL EFFICIENCY IN THE INDUSTRIAL SECTOR ON FACTOR PRICES AND SECTORAL OUTPUTS

We assume that there is an increase in the technical efficiency (neutral technical change) in the industrial sector motivated by the effort of the Greek producers of this sector to compete with the EU counterparts. Such an increase in technical efficiency can also be assumed to arise as a result of the inflow of new technologically rich investment from the EU countries to Greece.

To study the effects of an increase in technical efficiency of the industrial sector on factor prices and sectoral outputs a diagrammatic analysis is presented, following a method utilized by Woodland [1977], Neary [1978], Mussa [1979] and others.

The unit cost is a function of the real wage rate (w) and the real rental rate of capital (r). The unit cost function is graphed in the w, r space, for a given technology. The intersection of the three sectoral unit costs determines the wage rate and the rental rate of capital. The slope of each unit cost function represents the capital intensity of the sector K_i / L_i, this is equal to the ratio of the factor coefficients, (a_{Ki} / a_{Li}). In the case of Greece, the relationship of sectoral factor intensities according to time series data constructed by the author is as follows:

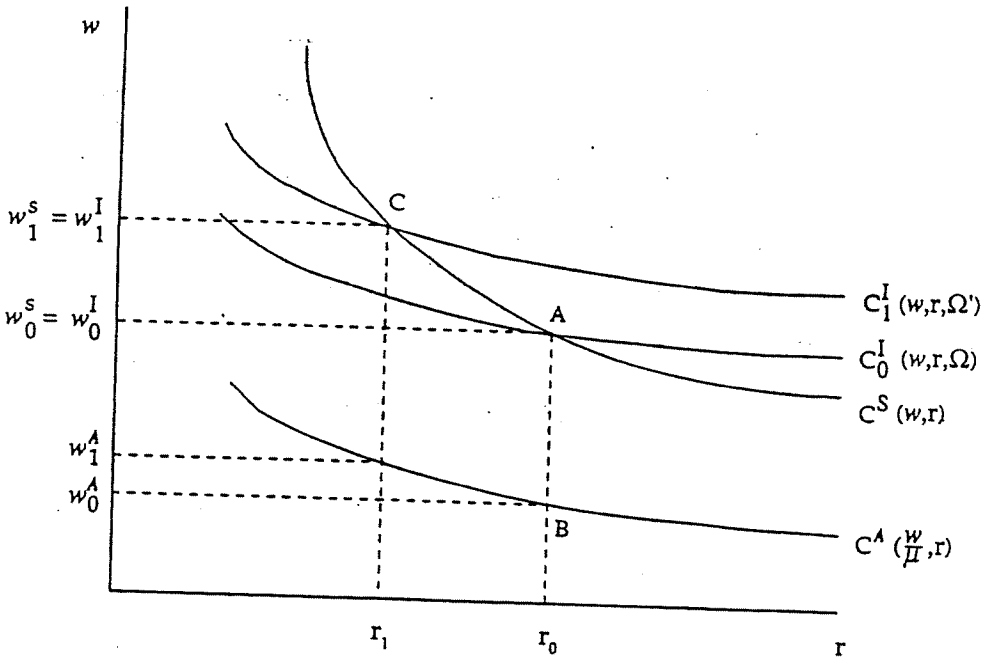
$$\frac{K_3}{L_3} > \frac{K_2}{L_2} > \frac{K_1}{L_1} \quad \text{or} \quad \frac{a_{K3}}{a_{L3}} > \frac{a_{K2}}{a_{L2}} > \frac{a_{K1}}{a_{L1}} \tag{9}$$

The above algebraic expression states that the service sector is the most capital intensive sector and is followed by the industrial sector, while the agricultural sector is the least capital intensive. Increased efficiency in any sector shifts the unit cost of that sector to the right. For the unit cost to remain constant, either w or r or both must increase.

The intersection of the service and the industrial unit costs at point A determine the wage rate in the two sectors: $w_0^I = w_0^S$, and the rental rate of capital in all three sectors r_0. The agricultural wage rate is lower than the other two sectoral wages, and equal to w_0^A where the perpendicular from the point A to the horizontal axis intersects the agricultural unit cost at point B. In an economy free of factor distortions, the three unit costs would intersect at the same point and will determine equal factor prices in all three sectors. In the case of Greece, the agricultural unit cost lies below the intersection point of the unit costs of the other two sectors, as it can be seen in Figure 2.

$C_0^I(w, r, \Omega)$ to $C_1^I(w, r, \Omega')$. The new industrial unit cost intersects the service sector unit cost at point C, and the two determine a new higher wage for the two sectors $w_1^I = w_1^S$. The increased efficiency in the industrial sector results in an increase in the agricultural wage rate from w_0^A to w_1^A, but still remaining lower than the wage rate of the other two sectors. The rental rate of capital decreases in all three sectors, from r_0 to r_1.

Figure 2
Increased efficiency in the industrial sector is shown by an outward parallel shift of the unit cost



The increased technical efficiency in the industrial sector reduces its average cost, this results in higher profits, that lead to the expansion of the sector. Expansion of the industrial sector creates an increase in the relative demand for labor. This increases the wage rate and suppresses the rental rate of capital. It can be seen in the diagram that the wage rate has increased while the rental rate of capital decreased. This process leads to factor price equalization between Greece and the EU.[11]

The above analysis suggests that convergence in factor prices is theoretically feasible with an increase in technical efficiency in the industrial sector. There is empirical evidence that this did not occur yet in Greece. It was, on the other hand, observed that the entire industrial sector remained unchanged over the post-accession period, 1981-1993. A more careful look at the industrial sector suggests that something crucial occurred within this major sector of the Greek economy. The manufacturing subsector of industry felt "the accession shock" more than any other sector of the Greek economy. Manufacturing is the most freely traded sector in Greece which after the accession became completely open to EU competition. The accession of Greece to the EU and the removal of barriers to trade for EU manufacturing products resulted in price decreases of the manufacturing products in Greece. This proved to be detrimental to the Greek manufacturing which experienced severe recession in the post-accession period. Greek manufacturing real output expressed in 1970 drachmas was 4.42 percent lower in 1993 than it was in 1981, the year Greece became a full member of the EU.

For many years manufacturing was the driving force of the Greek economy since it achieved very high rates of growth, surpassing the growth of the total economy in the pre-accession period. The manufacturing sector however faltered in the post-accession period pulling down the entire economy after 1981, the year Greece became a full member of the EU.

Table 1
Average Rate of Growth of Real Output

	1960-73	1974-80	1981-87	1981-93	1994-98
Total Economy	7.3	4.2	1.17	1.6	2.72
Manufacturing	11.0	4.8	-.4	-.34	1.76

It can be argued that the structural changes in the Greek economy such as the decline in the growth of the manufacturing are not necessarily the result of the accession of the country to the EU, but can be attributed to global trade liberalization. Such claim, however, is not valid for the simple reason that although Greece became a more open economy in the last four decades, it also became a closer trading partner with the EU after the accession (see Zestos, 1994). After 1995 the Greek economy started growing at higher rates than the EU average; during this period the manufacturing sector started growing as well. The manufacturing rates of growth were, however, trailing the growth rate of the entire economy. The Greek service sector in contrast grew at annual rates of growth that surpassed the growth rates of the entire economy.

CONCLUSION

Alternative versions of a trade model were utilized to examine the effects of economic integration on the Greek economy. The contribution of the present study is in applying existing trade theory to a specific real world situation. The main inquiry of this study was whether the Greek economy will converge to the more advanced EU economies. Convergence was broadly taken to include 1) factor-price equalization, 2) change in sectoral output shares in Greece, particularly examining whether a case of industrialization or deindustrialization can be supported by trade theory. The effects of exogenous changes in factor supplies, the price of the industrial good and neutral technical change on factor prices and sectoral outputs were also studied.

The conclusion is that the analysis based on trade theory does not predict convergence with absolute certainty. Some of the results depend on the structure of the Greek economy, particularly on the ranking of the physical sectoral capital intensities. The phenomenon of value intensity reversal was found to be important. Most cases examined in this study suggest that economic convergence is theoretically supported, but the support is not unequivocal. Looking at real world data of the Greek economy it is evident that during the few years immediately after the accession, the Greek economy experienced an economic slowdown. This set Greece further apart from the other EU developed countries. It is almost certain that the increased competition from the EU in the manufacturing sector affected this sector negatively. The contraction of the Greek manufacturing sector caused a slow down in the entire economy. Could this be a temporary "initial accession shock" phenomenon? Only time will tell. Trade theory suggests that a turning point and a tendency towards convergence is possible. Indeed after 1994 the Greek economy started growing at rates above the EU average. Such reversal allowed real Greek wages to start converging to the higher EU wages. The Greek economy improved sufficiently to the extent that in January 1, 2001, Greece became the 12th member of the European Monetary Union (EMU).

REFRENCES

Bhagwati, J. (ed.) (1984) *International Trade: Selected Readings.* The MIT Press, Cambridge Mass.

Hazari, B.R. (1986) *International Trade Theoretical Issues.* New York University Press, New York.

Jones, R.W. (1965) The Structure of Simple General Equilibrium Models. *The Journal of Political Economy,* 73:6, 557-573.

Monthly Statistical Bulletin, Bank of Greece, several issues most recent, February 2000.

Mussa, Michael. (1984) The Two-Sector Model in Terms of Its Dual: A Geometric

Exposition. In Bhagwati, J. (ed.) *International Trade: Selected Readings*, The MIT Press, Cambridge Mass.

Neary, P. (1988) Short Run Capital Specificity and the Theory of International Trade. *Economic Journal*, 488-510.

OECD (1983, 1987, 1989). *Flows and Stocks of Fixed Capital.* OECD, Paris.

Woodland, A.D. (1977) A Dual Approach to Equilibrium in the Production Sector in International Trade Theory. In *Canadian Journal of Economics*, 10, 50-68.

Zestos, George (1994). 'An Approach to Economic Integration of a Small Country' in *Economic Integration Between Unequal Partners* by Georgakopoulos T., Parakevopoulos, C., and Smithin, J. (Editors) Edward Elgar UK.

ENDNOTES

1. A reversal occurred in 1995 when the annual Greek inflation rate was reduced below 10 percent. This was perceived as a turning point for the Greek economy particularly since inflation is one of the Maastricht convergence criteria which must be met by candidate member countries to qualify for membership to the European Monetary Union. Interest rates and government deficits have also declined substantially since then.

2. In this model all the EU countries except Greece are treated as one country.

3. For a detailed discussion on reasons for wage differential among sectors of an economy see Hagen, E. E. (1958), also see Bhagwati, J. N. and Ramaswami, V. K. (1963).

4 Such representation of a general equilibrium model was developed originally by R. Jones (1965), and since was adopted by many other authors.

5. The notation $\alpha_{K1}\ (w/\mu r)$ for the capital coefficient of the agricultural sector means simply that the amount of capital required to produce one unit of the agricultural good α_{K1} is a function of the distorted factor price ratio. Similar interpretation is given to $a_{L1}\ (w/\mu r)$ the labor coefficient.

6. The derivation of these results are reported in Appendix A.1; they can be obtained by writing the author.

7. Physical intensities in Greece according Greek data are as follows: $K_1/L_1 < K_2/L_2$. In order for value intensity reversal to take place we must have: $\frac{r_1 K_1}{w_1 L_1} > \frac{r_2 K_2}{w_2 L_2}$ but since it is also assumed that $r_1 = r_2 = r$ and $\mu w_1 = w_2$, the above equation can be written as: $\mu k_1 > k_2$. Similarly, there will be value intensity reversal between sector one and three if $\mu k_1 > k_3$.

8. The above result will be obtained if the agricultural sector expands by more than the service sector. If the service sector was to expand by more than the agricultural sector then the rate of return to capital would increase and the wage rate will decline; leading to divergence in factor prices.

9. Purchasing Power Parities (PPP) exchange rates were provided by the Division of Foreign Labor Statistics and Trade of the U.S. Bureau of Labor Statistics but originally published by the OECD. Country consumer price indeces, used are from the IMF International Financial Statistics (IFS), CD-ROM electronic database.

10. These results will hold, provided the determinant of the system is positive, this condition is met if the parameters of the system assume plausible values. The derivation of these results are found in appendix A.2. The two appendices can be obtained from the author.

10. These results depend on the assumption that urban workers employed by the service sector are attracted and hired by the industrial sector. If instead, only agricultural workers are attracted and hired by the expanding industrial sector the opposite results regarding factor prices will be attained. In this case, the wage rate will decrease and the rental rate of capital will increase. Such a scenario will lead to divergence in factor prices between Greece and the EU.

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