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Economic Theory

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DYNAMIC EFFECTS OF THE ENLARGEMENT ON EU MANUFACTURING*

Abstract

The paper presents quantitative estimates of the dynamic effects of integration of the entrance of ten Central and Eastern European countries including Malta and Cyprus into the E.U. The dynamic effects of integration were examined using an *ex-ante* model. The results found by the application of this model suggest that the accession of the ten counties in the EU would have mixed effects in different sectors of the region. The sector that would benefit the most from integration is manufacture of pulp, paper and paper products. Other sectors expected to exhibit positive integration effects are the following: mining and quarrying sector, tanning, dressing of leather; manufacture of luggage, manufacture of medical, precision and optical instruments, watches and clocks, manufacture of furniture, manufacture of chemicals and chemical products and pub-

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* *The models were developed for the case of 15 EU member-countries and 10 applicant countries. Despite the fact that the applicant countries have already joined the EU, the Editorial Board decided to publish this article, since it can be used to forecast both the effects of the enlargement which has already occurred and the effects of the new enlargement which is only expected to occur.*

lishing, printing, reproduction of recorded media, for which the total product of the region is expected to decrease.

Key words:

Enlargement countries, dynamic integration effects.

1. Introduction

The accession of the central and eastern European countries (CEECs) to the E.U. is from an economic perspective, a historic event. It is the first time that a customs union will be formed between high-income developed economies and many middle-income developing economies.

International trade theory suggests that we can categorise the economic effects of integration in terms of allocation, accumulation and location effects (Baldwin and Venables 1995). Further, there could be also an important effect on technical change and innovation and thus growth, as described in particular by Grossman and Helpman (1992).

The **allocation effects** (static effects) refer to an increase in real income (welfare) due to a more efficient allocation of factors of production that result from decreasing trade barriers and from the elimination of price distortions in production and consumption (de la Fuente 1995). However, the distribution of welfare gains may be uneven with some larger countries experiencing net welfare losses (the optimal tariff argument).

Another possible source of welfare loss after removing trade barriers may result from trade diversion as opposed to trade creation. Trade diversion occurs when there is a switch in trade from outside efficient suppliers to less efficient suppliers inside the union. Originally, the literature on trade diversion/trade creation was developed by Viner (1950), Meade (1955), Lipsey (1960), and Michaelly (1963), and surveyed by Krauss (1972). However, Mundell (1964) and Kemp and Wan (1976) have developed theoretical frameworks which show how member countries can benefit from an economic union even if there is trade diversion.

The above assumes perfectly competitive markets. The allocation effects on income and welfare could probably be larger if we allow for economies of scale (increasing returns) and imperfect competition. (See Krugman and Venables (1994) for an introduction to this literature). This theoretical literature has not however reached unambiguous conclusions. The welfare impact on individual countries is difficult to evaluate *ex ante* and its size depends very much on the assumptions made by the specific model on the relevant importance of supply and demand elasticities, economies of scale, market size, industry concentration, and other trade distortions. Nevertheless, empirical models show that

the welfare gains are larger under imperfect competition and economies of scale than they would have been under the situations of perfect competition (de la Fuente, *op. cit.*).

Another source of efficiency gains comes from the reduction of internal organisational slack termed X-inefficiency by Leibenstein (1966). Economic integration increases competition forcing better (more efficient) allocation of the firms managerial resources.

The allocation effects are *static* in the sense that they do not take into consideration the impact of integration on factor accumulation.

The **accumulation effects** (dynamic effects) of integration can be analysed in terms of factor accumulation through changes in relative efficiency caused by increased competition and the exploitation of economies of scale, on the one hand, and in terms of technical progress, on the other, and both affect output growth.

This analysis of the effect on factor accumulation and growth of trade liberalisation measures can be expanded to allow for permanent productivity-enhancing factor accumulation effects (endogenous growth). The new growth literature initiated by Romer (1986) has made the accumulation of factors of production a ceaseless endogenous process of the economic system. This literature emphasises the micro-foundations of factor accumulation specifying private costs of and gains from the new investment in human capital and technical progress. The conclusion reached by this «new» literature is that continuous output growth can be achieved by sustained productivity growth generated, for example, by a continuous process of R&D investment and innovations.

Further, the elimination of trade barriers will affect the geographical concentration of economic (industrial) activity as stressed by Krugman (1991a and 1991b) and Krugman and Venables (1990, 1993 and 1994). Two factors emphasised by this new literature are: a) the increasing returns to scale in production that are internal to the firm and b) the trade costs, such as transport costs, marketing costs and communication costs, stemming from language and/or cultural differences.

The distribution of economic activity across regions cannot be determined *a priori*. It is true that for those industries that experience increasing returns (due to large fixed costs), the elimination of trade barriers makes it profitable to concentrate production in specific regions. On the other hand, if economies of scale are not large enough compared to regional demand and trade costs, then the economic activity may spread in many regions. This effect, which can be called the *location effect* of integration, may be reinforced by wage differentials from arising labour immobility.

Economic integration has a **technical progress effect** through its impact on the accumulation of technological knowledge. Grossman and Helpman (1992) have identified four mechanisms by which economic integration might affect the accumulation of technological knowledge.

First, economic integration will facilitate the communication of technical information. Second, competition, which is the expected result of economic integration forces private agents to implement new ideas and technologies. Third, economic integration increases the size of the market creating more profit opportunities. This can have a positive effect on the innovation process even though increasing competition may have a negative effect on innovation. Fourth, innovation may be encouraged through the specialisation fostered by economic integration.

Baldwin (1992) has also developed a theoretical argument that links the accumulation of human capital (knowledge) to the removal of trade barriers and economic growth. Nevertheless, it is quite possible that integration might negatively affect incentives to invest in technological innovations and human capital accumulation, and this may be particularly so for the relatively less-developed countries. Grossman and Helpman (*op. cit.*) give four reasons why this might be the case. First, more trade implies more competition, and national firms might find that this reduces the anticipated profitability of their investment in knowledge. Second, opening up trade with a technologically advanced country may force a less advanced country to reduce investment in innovation. This might lead to the concentration of technological progress in a few regions that had an advantage in innovation production before economic integration. Third, countries with unskilled (manual) labour endowment may be forced by economic integration to specialise in commodities that are low in technological content. Fourth, countries that invested relatively more in human capital before economic integration will experience a higher reward after economic integration, which might reduce the incentives to invest in research and development.

The above paragraphs present a literature review of theoretical aspects of integration. International trade theory literature is very rich of the empirical studies that try to estimate qualitatively and quantitatively the economic implications of integration. Plummer (1991) and Tsounis (2001, 2002) investigated the static effects of the Greek accession using the *ex-post* import-growth model and the shares-in-apparent-consumption model respectively[1]. Katos (1982) analysed possible effects of economic integration of Portugal, Spain and Greece. Other authors estimated the integration effects of the common EU market on the structure of trade and production. A short-list includes Amiti (1996), Buigues-Sheehy (1995), Italianer (1994), Jacquemin (1990), Jacquemin-Sapir (1988), Neven-Roller (1991), Pelkmans (1993), Sapir (1990, 1992, 1996), and Tsounis (1999, 2002, 2003).

The purpose of this paper is to present quantitative estimates of the welfare effects of the entrance of ten Central and Eastern European countries including Malta and Cyprus into the E.U. The dynamic effects on manufacturing sectors are examined. These effects are related to the changes in relative efficiency caused by increased competition and the exploitation of economies of

[1] For description of different types of models used for the analysis of integration effects see (Verdoorn and van Bochove 1972).

scale of the Community's output of the Enlargement, and they are examined with the help of the *ex-ante* model. The structure of the paper is as follows: in Section 2, the model for analysing the dynamic effects is presented; Section 3 describes the estimation procedure of the model; Section 4 provides a quantitative estimate of the dynamic effects of the EU enlargement and Section 5 concludes.

2. The Model

To examine the dynamic effects of economic integration on each sector of the region which is expected to integrate, the «normal» products of each sector of the region in the case of being integrated are compared with the «normal» products of each sector of each individual country in the absence of economic integration. The «normal» products are functions of the regional income, the market size and the level of efficiency of a sector in terms of the overall efficiency in the economy (Sakamoto 1969, p.284, Chenery 1960, p.630, UN 1963, pp. 3–6). The «normal» products for the economy as a whole and for the various sectors individually of a country are given by[2]:

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

$$Q_{ij} = A_i Y_j^{a_i} P_j^{b_i}; j = 1,..., m, i = 1,..., n \quad (2)$$

where the subscripts T, j and i denote all sectors of economy j taken together, country j and sector i, respectively. The letters Q, Y, P and D denote output, per capita income, population and relative rate of efficiency. The relative rate of efficiency is defined as the efficiency of a sector in overall efficiency of the economy (the full description of the variables and the method of calculation of the relative efficiency variable is given in Section 3); A is a constant and a, b and c are elasticities. Thus, a_i is the income elasticity of output of sector i, b is the population elasticity of output of sector i and c is the elasticity of output of sector i with respect to the sector's relative degree of efficiency.

Assume now that region R is composed of two blocks: the fifteen E.U. countries and the ten enlargement countries[3], with per capita incomes

$$Y_{EU} = (\Sigma_j Y_j P_j) / (\Sigma_j P_j); j = 1, \ldots, 15$$

and

[2] The model used here was developed by the UN (1963) and Sakamoto (1969) and refined by Katos (1982) and Tsounis (2002, 2003). The full description and explanation of equations 1–6 is given in Tsounis (*op. cit.*).

[3] The Enlargement countries include the ten countries than became members of the E.U. on 1st May, 2004. These countries are: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.

$$Y_{CEEC} = (\Sigma Y_n P_n) / (\Sigma P_n);\ n = 1, \ldots, 10;$$

and population

$$P_{EU} = \Sigma P_j;\ j = 1, \ldots, 15$$

and

$$P_{CEEC} = \Sigma P_n;\ n = 1, \ldots, 10$$

respectively.

Equations (1) and (2) 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 the 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 products 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 upon all sectors.

To formalise the above, the «normal» equations of each block, in our case of the E.U.-15 and the Enlargement countries, corresponding to the sector *i* of the economy would be:

$$Q_{iEU} = A_i Y_{EU}^{a_i} P_{EU}^{b_i} D_{iEU}^{c_i} \tag{3}$$

and

$$Q_{iCEEC} = A_i Y_{CEEC}^{a_i} P_{CEEC}^{b_i} D_{iCEEC}^{c_i} \tag{4}$$

Assume now that the enlargement countries integrate with the E.U.. The per capita income of the twenty five countries will be $Y_R = (\Sigma Y_j P_j) / (\Sigma P_j)$; $j = 1, \ldots, 25$ and the population of the region $P_R = \Sigma P_j;\ j = 1, \ldots, 25$. The «normal» product equations for each of the *i* sector of the region would be:

$$Q_{iR} = A_i Y_R^{a_i} P_R^{b_i} D_{iR}^{c_i} \tag{5}$$

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

$$I_i = \frac{Q_{iR}}{Q_{iEU} + Q_{iCEEC}} \tag{6}$$

for each sector *i* (Sakamoto *op.cit.*, Katos *op.cit*). If $I_i > 1$, integration is beneficial for the sector *i*; if $I_i < 1$, then integration is not be beneficial for sector *i*. It is noted, however, that the «integration index» indicates only whether integration is beneficial or not to specific sector *i*, and no conclusion can be derived regarding 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 considered. Otherwise the results would be either overestimated or underestimated. In our case, the «normal» products were found to be very good approximations of the actual products, since the value of their correlation coefficient was 0.9723 and it was statistically different from zero at a less than 1% level of statistical significance.

3. The Estimation Procedure

For the calculation of the «normal» products given according to (3), (4) and (5), the coefficients a_i, b_i and c_i should be estimated first. This can be done by estimating equations (1) and (2) in a double logarithmic form. The estimation of (1) is necessary for the calculation of the D_{ij} variable.

Q_{Tj}^{*} is the total output for economy *j* in 1999 in EUROs; $j = 1, \ldots, 15$, Y_j is the PPP-based per capita income for 1999 in economy *j* in EUROs[4], P_j is the total population of economy *j* in 1999[5]. The variable D_{ij} is the relative efficiency of sector *i* of economy *j* calculated as $D_{ij} = R_{ij}/E_j$, where the efficiency variable E_j of economy *j* is defined as the ratio of the actual to the «normal» values of Q_{Tj}, i. e., $E_j = Q_{Tj}^{*}/Q_{Tj}$ (the asterisk indicates actual values) and R_{ij} is the efficiency variable of sector *i* of the economy *j* defined as the ratio of the actual to the «normal» values of Q_{ij}, i. e. $R_{ij} = Q_{ij}^{*}/Q_{ij}$.

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 0.93.

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 that represent the effects of the increase in the market size.

The relative efficiency variable was introduced into the model to capture the effects of changes in the relative efficiency of a sector on its output. It is interesting to note that the introduction of the relative efficiency variable did not change the values of the regression coefficients of the other two explanatory variables and also of the constant terms of equation (2), but it improved the value of their t-statistic. Thus, it can be regarded as a «correction» term in the

[4] For the use of PPPs see Officer (1976).
[5] Data was extracted from Eurostat (2003).

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 (it is statistically significantly different from zero at 1% level of significance for all sectors). Its estimated coefficient can be interpreted as the relative efficiency elasticity of output showing the effects of a percentage change in the sector's efficiency relative to the overall economy's efficiency on the percentage change in 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 manufacture of tobacco products (160), manufacture of textiles (170), tanning, dressing of leather, manufacture of luggage (190), manufacture of rubber and plastic products (250), manufacture of other non-metallic mineral products (260), manufacture of basic metals (270), manufacture of office machinery and computers (300), recycling (370) and electricity, gas and water supply (400) 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.

Manufacture of food products and beverages (150), manufacture of wood and of products of wood and cork (200), manufacture of pulp, paper and paper products (210), publishing, printing, reproduction of recorded media (220) and manufacture of radio, television and communication equipment and apparatus (320) sectors have the population elasticity of 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 150 and 320, since one would expect a population elasticity of at least 1 for those sectors.

On the other hand, the sectors of mining and quarrying (100), manufacture of wearing apparel, dressing, dyeing of fur (180), manufacture of coke, refined petroleum products and nuclear fuel and manufacture of chemicals and chemical products (230, 240), manufacture of fabricated metal products, except machinery and equipment, manufacture of machinery and equipment, (280, 290), manufacture of electrical machinery and apparatus (310), manufacture of medical, precision and optical instruments, watches and clocks (330), manufacture of motor vehicles, manufacture of other transport equipment (340, 350), and manufacture of furniture (360) have the population elasticity greater than 1. These sectors will benefit from the expansion of the size of the market alone, (the other independent variables remaining unchanged), occurring after the integration of the two regions, and their relative position in the economy will improve.

Regarding the growth (income) elasticities, one sector (manufacture of wearing apparel; dressing; dyeing of fur (180)) has zero growth elasticity. This shows that sector 180 has little importance in the growth of the economies in the region. The values of growth elasticities indicate the changes in economic structure of the region under investigation. The highest growth elasticity is that for the

manufacture of tobacco products (160), while other sectors with high growth elasticities are the manufacture of other transport equipment (350), manufacture of medical, precision and optical instruments, watches and clocks (330), publishing, printing, reproduction of recorded media (220), manufacture of chemicals and chemical products (240) and machinery (290, 300) sectors. All growth coefficients are statistically significantly different from zero at, at least, 1% level of significance, apart from the coefficients of the sector 180.

4. The Results

Table 1 presents the «integration index» calculated from (6) and the «normal» products for each sector of the fifteen E.U. countries and the enlargement countries before integration and of the E.U.-25 after the integration.

It is observed that integration will not be beneficial for all sectors since the sectoral integration indexes are not all higher than unity: 12 sectors are found to have $I_i > 1$ and 13 sectors $I_i < 1$. Therefore, no general statement can be made as to whether integration of the ten enlargement countries with the E.U. was beneficial or not according to the Pareto criterion given in Section 2. It can only be examined whether or not the integration would be beneficial for each sector individually. An examination of the first column of Table 1 shows that integration would be beneficial for the sectors 100, 190 to 210, 230, 300, 320 to 340 and 360 to 400, while for the remaining sectors it would not be beneficial. The highest integration index is reported in the sector of manufacture of radio, television and communication equipment and apparatus (320), while relatively high values of the index are also reported for mining and quarrying sector (100), tanning, dressing of leather; manufacture of luggage sector (190), manufacture of medical, precision and optical instruments, watches and clocks sector (330) and manufacture of furniture sector (360). It should be noted though that most integration indexes are within the range of 0.95 and 1.05, with the majority of them being very close to unity, showing that the integration of the ten enlargement countries into the E.U. would not be expected to have a dramatic impact on the total product of the region.

The relative efficiency index shows the position of the relative efficiency of a sector within the overall efficiency of the economy. Therefore, the value of the ratio $D_{if}/D_{is} > 1$ shows that the sector will improve its position compared to the other sectors as the ten enlargement countries enter the E.U. The values of the ratios of the relative efficiencies range from 0.80 to 1.20. The entry of the ten countries into the E.U. will improve marginally the position of 16 sectors, while it will worsen the position of 9 sectors.

Table 1.

Dynamic Effects of Integration

NACE[6]	Integration Index	Q_{is} E.U.-15	Q_{ir} E.U.-25	Q_{ih} CEEC[7]	D_{ir} E.U.-25	D_{is} E.U.-15	D_{ir}/D_{is}
100–140	1.01243	86180	93566	6237	1.00028	1.01567	0.98484
150	0.99059	608016	625667	23597	1.59943	1.46243	1.09368
160	0.99359	32721	33161	654	1.79233	1.50550	1.19052
170	0.99937	113552	117812	4335	1.34801	1.33275	1.01145
180	0.99675	79942	83214	3543	0.38861	0.47599	0.81643
190	1.01109	48190	50216	1475	1.50077	1.66992	0.89871
200	1.00726	105586	111555	5165	1.73621	1.82205	0.95289
210	1.00778	142869	148503	4487	2.84402	2.64620	1.07475
220	0.98095	214338	215790	5643	2.19202	1.94517	1.12690
230	1.00592	234989	241914	5502	0.41165	0.44088	0.93371
240	0.97198	791383	781396	12539	0.68654	0.66300	1.03550
250	0.98253	195833	198623	6321	1.06150	1.00738	1.05372
260	0.99764	159136	167770	9031	1.27499	1.28064	0.99559
270	0.99691	194983	203723	9372	1.39334	1.30344	1.06897
280	0.98702	381574	386551	10059	0.92473	0.88937	1.03975
290	0.99829	472518	481875	10181	0.87333	0.83697	1.04344
300	1.00760	82230	86319	3437	1.73355	1.60913	1.07732
310	0.99572	193503	199732	7086	0.66718	0.70383	0.94793
320	1.03407	213386	226559	5708	4.68170	4.01101	1.16721
330	1.01079	105609	109198	2423	0.88837	0.81744	1.08677
340	1.00577	590135	610950	17307	0.45258	0.47619	0.95042
350	0.99991	150389	152994	2619	0.90057	0.83815	1.07447
360	1.01006	155694	163572	6248	0.64181	0.67156	0.95570
370	1.00412	9045	9715	630	1.01071	0.92636	1.09105
400–410	1.01006	347500	373374	22157	0.65935	0.65651	1.00431

5. Conclusion

The purpose of the paper is to present the estimates of the dynamic effects (changes in relative efficiency) of the accession of the ten enlargement countries into the E.U. using the *ex-ante* model. The results found by the application of this model suggest that the entrance of these countries in the E.U. would have mixed effects in various sectors of the region. The sector that would benefit the most from integration is the manufacture of radio, television and communication equipment and apparatus. Other sectors where positive integration effects are expected include mining and quarrying sector, tanning, dressing of leather; manufacture of luggage, manufacture of medical, precision and opti-

[6] The description of sectors is given in the Appendix.
[7] The acronym CEEC stands for Central and Eastern European Countries. However, we use it here for the 10 enlargement countries because most of them are CEEC.

cal instruments, watches and clocks and manufacture of furniture. Integration would not be beneficial for the sectors of manufacture of chemicals and chemical products and publishing, printing, reproduction of recorded media for which the total product of the region is expected to decrease.

Appendix

Description of Sectors

Sector Code [8]	Description
100–140	*Mining and quarrying*
150	Manufacture of food products and beverages
160	Manufacture of tobacco products
170	Manufacture of textiles
180	Manufacture of wearing apparel; dressing; dyeing of fur
190	Tanning, dressing of leather; manufacture of luggage
200	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
210	Manufacture of pulp, paper and paper products
220	Publishing, printing, reproduction of recorded media
230	Manufacture of coke, refined petroleum products and nuclear fuel
240	Manufacture of chemicals and chemical products
250	Manufacture of rubber and plastic products
260	Manufacture of other non-metallic mineral products
270	Manufacture of basic metals
280	Manufacture of fabricated metal products, except machinery and equipment
290	Manufacture of machinery and equipment n.e.c.
300	Manufacture of office machinery and computers
310	Manufacture of electrical machinery and apparatus n.e.c.
320	Manufacture of radio, television and communication equipment and apparatus
330	Manufacture of medical, precision and optical instruments, watches and clocks
340	Manufacture of motor vehicles, trailers and semi-trailers
350	Manufacture of other transport equipment
360	Manufacture of furniture; manufacturing n.e.c.
370	Recycling
400–410	Electricity, gas and water supply

[8] NACE, Rev. 1.

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