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Working Papers

IEF Working Paper Nr. 40

HARALD BADINGER

Growth Effects of Economic Integration - The Case of the EU Member States (1950-2000)

December 2001

Althanstraße 39 - 45, A - 1090 Wien / Vienna
Österreich / Austria
Tel.: ++43 / 1 / 31336 / 4135, 4134, 4133
Fax.: ++43 / 1 / 31336 / 758, 756
e-mail: europafragen@wu-wien.ac.at

Impressum:

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Medieninhaber, Eigentümer Herausgeber und Verleger: Forschungsinstitut für Europafragen der Wirtschaftsuniversität Wien, Althanstraße 39—45, A—1090 Wien; Für den Inhalt verantwortlich: Univ.-Prof. Dr. Stefan Griller, Althanstraße 39—45, A—1090 Wien.

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By Harald Badinger

Institut für Europafragen
Wirtschaftsuniversität Wien
Althanstraße 39-45/2/3, A-1090 Wien
Tel.: 0043 (0)1 31336-4147, Fax: 0043 (0)1 31336-758
E-mail: harald.badinger@wu-wien.ac.at

December 2001

Abstract: Has economic integration improved the postwar growth performance of the actual fifteen member states of the European Union (EU)? To answer this question, we first construct an index of integration for each member state that explicitly accounts for global integration (GATT) as well as regional (European) integration. Using this variable, we test for permanent and temporary growth effects in a dynamic growth accounting framework, both in a time series setting for the (aggregate) EU and a panel approach for the EU member states. Although the hypothesis of permanent growth effects as postulated by endogenous growth models with scale effects is clearly rejected, we find significant levels effects: GDP per capita of the EU would be approximately one fifth lower today, if no integration had taken place since 1950. Interestingly, two third of this effect are due to GATT-liberalization.

Keywords: economic growth, economic integration, European Union, panel data
JEL classification: C33, F15, F43, O52

[*] This working paper is based on part of my doctoral dissertation, which I have written at the Institute for European Affairs, Vienna University of Economics and Business Administration. I am grateful to Fritz Breuss for his guidance and assistance. Furthermore, I would like to thank Peter Hackl, Gabriele Tondl and Werner Müller for a number of helpful comments.

I. Introduction

The second half of the twentieth century has been characterized by an unprecedented progress in both global and regional economic integration. The development of the European Union's (EU's) external and internal economic relationships mirrors these two overlapping processes. Global economic integration, here mainly considered as trade liberalization in the framework of the General Agreement on Tariffs and Trade (GATT), led to a reduction in the EU's (respectively the European Community's (EC's)) harmonized external tariff from 16.8 percent in 1968 down to 3.6 percent in 2000. Within the same time the EC has expanded from originally six to actually 15 member states, which have not only completely liberalized their intra-trade relations, but also formed a common market with a common currency, installed common institutions and implemented common policies in several important areas.

A question of great interest not only from an academic point of view but also from an economic policy and public perspective relates to the consequences of this process for economic growth and thus human welfare. Although economic theory clearly postulates growth enhancing effects of economic integration, empirical evidence for the EU is rather weak. Landau (1995) obtains no effect of EC-membership on growth at all. Quite contrary, Henrekson et al. (1997) find evidence for permanent growth effects of European integration (0.6 to 1.3 percent p.a.), which are in turn rejected in the study by Vanhoudt (1999). A critical point in all previous studies is the measurement of economic integration, which is usually undertaken by dummy variables for membership in the EC and/or the European Free Trade Association (EFTA) or by proxies for the "market expansion" (GDP, population) as a result of EC enlargements.

In this paper we propose a new measure of economic integration, which takes both GATT-liberalization and European integration into account. It captures all relevant steps of European integration (EC, EFTA, trade agreements between EC and EFTA, Common Market, European Economic Area (EEA)) in a more explicit way and considers their continuous implementation. This is the first contribution of the paper. In a second step we use our integration variable to test for permanent and temporary growth effects of integration in both a univariate time series analysis and a dynamic panel approach. We set up our empirical model in a (cross-country) growth accounting framework, an approach that has gained more attention recently over the convergence specification, which has been employed in growth regressions most frequently. We link our specification as close as possible to existing models and explicitly discriminate between the hypotheses of permanent growth effects of integration (postulated by many endogenous growth models with scale effects; e.g. Romer, 1990) and temporary growth effects (postulated by neoclassical growth theory and endogenous growth models without scale effects).[1] In both the univariate and the panel specification the hypothesis of permanent growth effects of economic integration is rejected. In line with the results of Jones (1995a) and Vanhoudt (1999) this is further evidence against endogenous growth models with scale effects. In a further step we investigate, if integration has caused temporary growth effects. Our empirical results point at significant level effects of the EU's economic integration: GDP per capita of the EU would be approximately one fifth lower today, if no economic integration had taken place since 1950.

The rest of the paper is organized as follows. In section two we present a brief survey of the effects of integration, postulated by growth theory. In section three we construct an index of economic integration for each of the EU member states that reflects both GATT-liberalization as well as European integration. In section four we specify our empirical model and test for permanent and temporary growth effects in a time series setting and in a dynamic panel approach, the latter of which we estimate using the GMM estimator by Arellano and Bond (1991). We go on to simulate the development of the growth rate and the level of GDP per capita under different scenarios (no integration, GATT-liberalization, GATT-liberalization and European integration). In the final section we summarize our conclusions and draw out some directions for future research.

II. Growth Effects of Economic Integration

The first systematic albeit descriptive investigation of output effects of economic integration was carried out by Balassa (1961) under the heading "dynamic effects of integration". According to Balassa these dynamic effects are rooted in internal and external economies of scale, faster technological progress as a result of economies of scale in the R&D-sector, enhanced competition, reduced uncertainty, the creation of a more favorable environment for economic activity and lower costs of capital due to the integration of financial markets. The revival of growth theory in the mid-80s led to a more formal

[1] The ad-hoc character of many growth regressions has often been criticized. Durlauf states that „it is no exaggeration to say that the theoretical and empirical growth literatures are evolving with little interaction.“ (Durlauf, 2001, p. 65).

reconsideration of the effects of integration on growth and shed more light on the questions involved.

At the outset, a terminological clarification is in order here. The most important distinction relates to the persistence of the effects of economic integration on the growth rate: *Permanent growth effects* lead to a change in the steady-state growth rate, resulting in a steeper growth path of the economy. On the other hand there are *temporary growth effects* (or *level effects*), which cause only an upward shift of the growth path, while leaving its slope unchanged in the long-run, i.e. after transition period the growth rate falls back to its steady-state level. Following Baldwin (1993, p. 131) level effects can be further subdivided into *static effects* that „lead to more output from the same amount of inputs“ and *dynamic effects* that “influence the accumulation of factors”. Also referring to the channels through which growth effects materialize, Baldwin and Seghezza (1996b) introduced the terms “integration-induced technology-led growth” and “integration-induced investment-led growth”. Although first used in the context of level effects, this distinction equivalently applies to permanent growth effects.

To analyze the consequences of integration for economic growth in a systematic way, two lines of theory have to be distinguished: *neoclassical* and *endogenous growth theory*. In *neoclassical growth theory*, economic integration and other institutional aspects or economic policy measures have no effect on the steady-state growth rate, which is solely determined by the exogenous rate of technological progress. As a result of diminishing returns to capital the capital stock and output per efficient worker grow only to the point where the investment-ratio equals depreciation plus the rate of technological progress (for constant labor). The growth of capital stock and output per worker in equilibrium is then given by the constant rate of technological progress (g). Institutional changes, increases in efficiency or changes in the investment-ratio have only temporary effects on the growth rate; after a transition period it falls back to its steady-state level. Thus, neoclassical growth theory clearly rejects the hypothesis of permanent growth effects.

Nevertheless, both static and dynamic level effects occur. Static effects arise from three main sources: lower trade costs, increased competition and enhanced factor mobility. This increase in efficiency leads to more output from the same amount of inputs in a first round (static effects). But this is not the end of the story. Given a constant investment-ratio, the increase in output also leads to higher investment and an increase in the capital stock, which in turn increases output in a second round (dynamic effects). The total static plus dynamic effect can be obtained by deriving the steady-state output per capita by technology (A). Using a simple Cobb-Douglas production function ($Y = AK^{\alpha}L^{1-\alpha,}$ with technology (A), output (Y), capital (K) and labor (L)), a one percent increase in efficiency (dA/A=1 percent) results in an increase in output per capita equal to $1/(1-\alpha)$ percent[2] (Baldwin, 1993). It is essential to note that the multiplier effect only occurs, if technological progress is Hicks-neutral and in this case the steady-state growth rate is also increased to $1/(1-\alpha)$. If technological progress is Harrod-neutral (i.e. labor augmenting: $Y = K^{\alpha}(AL)^{1-\alpha}$), as usually assumed in the neoclassical growth model, it can be shown that the multiplier effect disappears and a one percent increase in A leads only to a one percent increase in Y, where the static effect amounts to $1-\alpha$ and the dynamic effect to α percent. Alternative channels for integration-induced investment-led growth are presented more rigorously in a two-country model by Baldwin and Seghezza (1996), where the dynamic level effects are due to an increase in the demand for capital as a result of trade liberalization (assumption of a capital intensive export sector), lower costs of capital through the use of international intermediate goods and a pro-competitive effect, and finally, lower credit costs as a result of the integration of international financial markets. For our purposes it is sufficient to note, that neoclassical growth theory predicts only (static and dynamic) level effects, but contradicts the hypothesis of permanent growth effects.

Endogenous growth theory – at least part of it – takes another stand. Permanent growth effects could well occur here under certain conditions. For our analysis, we subdivide endogenous growth models into two classes: models with a constant technology parameter (AK-models) and models with variable, endogenously determined technology parameter.

In *AK-models* with constant returns to capital (e.g. Rebelo, 1991), permanent growth effects may occur, if one is willing to assume that integration increases the (otherwise constant) technology parameter A or the investment-ratio (s). This can be easily seen from the solution for the steady-state growth rate of output per capita (g_y), which is given by $g_y = sA–(n+\delta)$, where n = population growth and δ = depreciation. As capital stock and output grow at the same rate, the rise in the steady-state growth rate is due to a higher rate of capital accumulation (permanent investment-led growth effect). As A is constant in AK-models by assumption (as opposed to the continuously growing technological progress in the neoclassical model) the argument that A increases through integration is problematic. A more

[2] In an augmented production function with human capital ($Y = AK^{\alpha}H^{\beta}L^{1-\alpha-\beta}$), the multiplier increases to $1/(1-\alpha-\beta)$ due to induced accumulation of human capital (H).

reasonable channel for permanent growth effects in AK-models would be an increase in the investment-ratio as a result of integration. However, it is the knife-edge character of the AK-growth equilibrium in general, that remains a particular critical feature of this class of models: A stable, endogenous growth rate is only realized, if returns to accumulable factors (here K) are exactly constant; increasing returns would imply explosive growth and the case of decreasing returns would bring us back into the neoclassical world without endogenous growth (Solow, 1994, p. 50).

Among *endogenous growth models with variable, endogenously determined technological progress*, a further distinction between models with and without scale effects has to be made. The majority of endogenous growth models exhibit "scale effects", which means that the steady-state growth rate depends positively on the size of a country. Prominent examples are Romer (1990), Grossman and Helpman (1991) and Aghion and Howitt (1992). At the very heart of these models (and the scale property) is the (AK-like) production function in the R&D-sector ($\mathrm{d}A/\mathrm{d}t = \phi A H_A$) with constant returns to accumulable factors (A), which implies that the growth rate of knowledge (technological progress g_A) is a proportional function of the level(!) of human capital (H_A), employed in this sector ($g_A = \phi H_A$). Intuitively, one can easily imagine that this property is closely related to the predicted effects of economic integration, because economic integration – at least between very similar economies – can be regarded as an enlargement of the economy. A formal treatment in a two-country version of the Romer (1990) model is given by Rivera-Batiz and Romer (1991). Human capital is employed in two (identical) countries to generate knowledge; if (and only if) it is assumed that knowledge can disseminate internationally, integration triggers a scale effect in the R&D-sector (permanent technology-led growth effect), where it is additionally assumed that double inventions are ruled out after integration (redundancy effect). In a second round, integration may also lead to intersectoral and international reallocation effects. Several important extensions of the Rivera-Batiz and Romer-analysis have been made, e.g. by Rivera-Batiz and Xie (1994), who consider integration among two heterogeneous economies or by Walz (1998), who investigates also the liberalization of factor markets in a three-country model. One should note that integration may also trigger economic geography forces. For us it is sufficient to conclude, that permanent growth effects of integration can always be traced back to the production function in the R&D sector outlined above – this is the central insight we keep in mind for our empirical analysis. For a more comprehensive overview of integration and growth in the context of endogenous growth theory see Walz (1997, 1999).

The “scale effects property” and the AK-like production function in the R&D-sector has been criticized most notably by Jones (1995a), who showed that R&D-labor in the OECD countries significantly increased during the postwar period, while growth rates were relatively stable. As response, a number of endogenous growth models without scale effects have been developed, e.g. by assuming decreasing returns to accumulable inputs in the R&D-sector (Jones, 1995b), introducing the principle of “equivalent innovation” (Young, 1998) or assuming an increasingly difficult research process (Segerstrom, 1998). Other examples are Kortum (1997) and Aghion and Howitt (1998, chapter 12). For our purposes, the essential point is that these models are basically compatible with neoclassical growth theory as regards the predicted effects of economic integration: level effects, but no effect on the steady-state growth rate. A general treatment of endogenous growth models without scale effects and their transitional dynamics is given by Eicher and Turnovsky (1999, 2001).

Summing up our stylized survey in view of our empirical analysis, we have two competing hypotheses: permanent vs. only temporary growth effects of economic integration. The channels through which either of these effects may occur are increases in efficiency (integration-induced technology-led growth) and increases in factor accumulation (integration-induced investment-led growth).

III. On the Measurement of Economic Integration

Before estimating effects of economic integration, we have to concern ourselves with the measurement of integration itself. Many studies simply use dummy variables for EC- or EFTA-membership or proxies for the “market expansion” as a result of EC enlargements in terms of population, GDP or area. Other frequently employed variables include total or intra-EC trade (as percent of GDP) or the share of intra-EC trade in total trade. These variables, however, might only be rather poor proxies for the complex and continuous process of integration of the EU countries (see Table 1). A more appropriate measure should at least take into account: i) tariff reductions in the framework of the General Agreement on Tariffs and Trade (GATT), ii) the harmonization of the EC’s external tariff, iii) the elimination of tariffs between EFTA-countries, iv) the elimination of tariffs between EC-countries, v) the elimination of tariffs between the EFTA-countries and the EC in the 70s, and vi) the establishment of the Common Market and the European Economic Area (EEA) in the 90s. An ideal measure would also consider the elimination of non-tariff barriers as well as elements of positive integration, i.e. the creation of common institutions and common policies. The construction of such an ideal measure is beyond the scope of this paper. We confine our attention to the steps of real integration, listed in Table 1 and summarized by points i) to vi).

Table 1 – *Global and European integration of the EU member states*

European integration[1)]	GATT-liberalization[2)]
1944: Benelux Customs Union (BE, LU, NL) a) elimination of tariffs between BE, LU, NL, b) harmonization of external tariff (1950: 9%), (assumed) implementation: 1945-1950.	1950: Individual External Tariffs (%) AT(20), BE(9), DE(16), DK(5), ES*(24), FI(13.5), FR(19), GR*(24), IE*(17), IT(24), NL(9), PT*(24), SE(6), UK(17)
1957: EC-6 (BE, DE, IT, NL, LU, FR): Customs Union a) elimination of intra-EC-6 tariffs, b) harmonization of external tariff (1968: 16.7%), implementation: 1957-1968.	
1960: EFTA-7 (AT, CH, DK, NO, PT, SE, UK) elimination of intra-EFTA-7 tariffs, (1961: free trade agreement FI-EFTA), implementation: 1960-1967.	1964-1967: Kennedy-Round average (relative) tariff reductions: 47% assumed implementation: 1968-1972
1973: First EC-enlargement (DK, IE, UK) → EC-9 a) elimination of tariffs between DK, IE, UK and EC-6, b) harmonization of external tariff, implementation: 1973-1978.	
1973: Free trade agreements between EFTA-6 and EC-9 elimination of tariffs between EFTA-6 members (AT, CH, IS, NO, PT, SE) + FI and EC-9, implementation: 1973-1978.	1973-1979: Tokyo-Round average (relative) tariff reductions: 30% assumed implementation: 1980-1985
1981: Second EC-enlargement (GR) → EC-10 a) harmonization of external tariff, b) elimination of tariffs between GR and EC-9, implementation: 1981-1985.	
1986: Third EC-enlargement (ES, PT) → EC-12 a) harmonization of external tariff, b) elimination of tariffs between ES and EC-10, implementation: 1986-1995.	1986-1993: Uruguay-Round average (relative) tariff reductions: 40% assumed implementation: 1994-1999
1993: Common Market (EU-12) 4 freedoms + flanking measures (common policies), instantaneous implementation assumed.	
1994: European Economic Area (EEA): "partly" implementation of four freedoms between EU-12 and EFTA-7' except CH (AT, FI, IS, LI, NO, SE), instantaneous implementation assumed.	
1995: Fourth EC-enlargement (AT, FI, SE) → EU-15 a) harmonization of external tariff, b) participation in Common Market, instantaneous implementation assumed.	

Only real integration is considered here. – [1)] Data on timing and structure of tariff reductions and tariff harmonization taken from Breuss (1983), El-Agraa (1994). – [2)] Tariff levels taken from Breuss (1983); * indicates missing values that were filled by assumptions (where possible based on the relative position of a country to a later point of time, for which data were available). Calculation of average tariff reductions based on the average tariff levels "before and after" according to WTO (1995).

We calculate the level of protectionism ($PROT_i$) of country i as sum of a weighted tariff (T_i) and weighted "trade costs" (TC_i):

$$PROT_i = T_i + TC_i \tag{3.1}$$

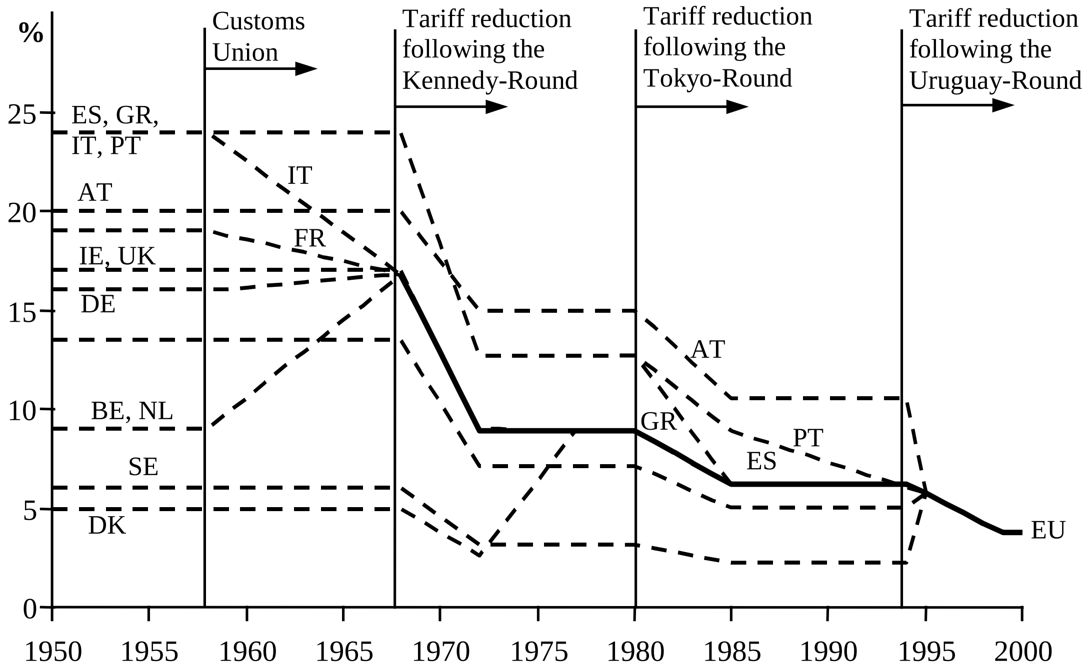
where $$T_i = \sum_j w_{ij} t_{ij} \quad \text{and} \quad TC_i = \sum_j w_{ij} tc_{ij} \tag{3.2}$$

with T_i = average tariff of country i (for industrial goods), TC_i = "trade costs" for trade with country i (tariff equivalent of Common Market effect, see below), t_{ij} = average tariff rate of country i for trade with country j (in percent), w_{ij} = share of country i*'s* trade (imports + exports) with country j in country i's total trade, tc_{ij} = tariff equivalent for trade costs between country i and country j in percent. For a description of the data see Table 1 and the appendix.

If the trade regimes of the countries are symmetric, then T_i also measures (at least approximately) other countries' protectionism against country i and TC_i also measures the average trade costs of an enterprise of country i. At least changes in the protectionism of each country should be highly correlated, if liberalization has been conducted on the principle of reciprocity. In this case the index (*PROT*) – although first a measure of country i's protectionism against the rest of the world – can also be interpreted as a more general measure of integration of the according country into the world economy.

In (3.2) the index j normally refers to a larger group of countries, to which the same trade regime applies. Limitations in data availability aggravate the calculation of our index. In particular, no time series for average tariff rates are available. We have only some point observations and some information on the average size and speed of the tariff reductions (see Table 1). In 1950, each of the EU member states had its own (generally applicable) external tariff w_{ij}. The development of the EC's and the countries' external tariffs since then has been determined by two independent and overlapping processes: 1) The harmonization of the EC's external tariff as a result of the Customs Union, which was implemented from 1957 to 1968. In 1968, the EC's external tariff amounted to 16.8 percent. Countries that joined the EC to a later point of time had to adjust their individual tariffs to the actual external tariff of the EC accordingly. 2) The external tariff (both of the EC and the countries that joined later) has been reduced as a result of the GATT-rounds (see Table 1). The resulting development of the EC's and the individual countries' external tariffs is shown in Figure 1. In 2000 the external tariff of the EU amounted to 3.6 percent, compared with 16.3 percent in 1950 (unweighted EU average).

Figure 1 – *External tariff of EU member states*

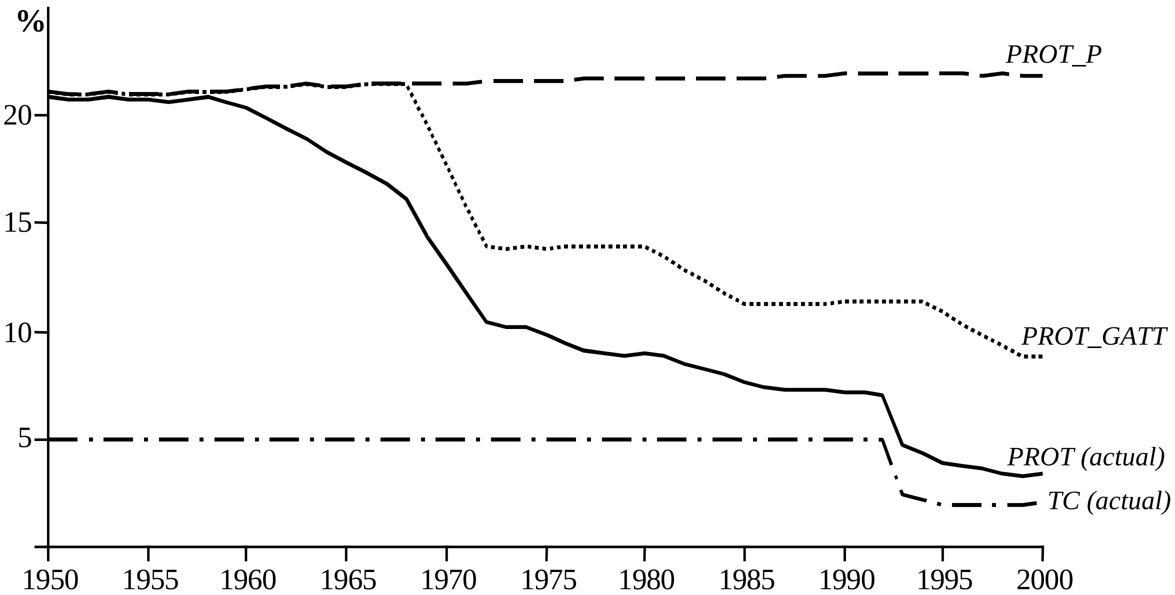


According to the “General-Most-Favoured-Nation treatment” (article I of GATT) this general external tariff applies (should apply) to 100 percent of trade, unless there are special agreements of regional integration (admissible under article XXIV of GATT). The “special agreements” of primary interest for us are those, which constitute the process of European integration. This process has gone beyond the GATT-liberalization by cutting intra-EU and intra-EFTA tariffs, as well as tariffs between EU- and EFTA-countries down to zero (see Table 1). The “when, against whom and how fast?” of the tariff reductions depend on the individual country’s integration history and cannot be outlined in detail here. The essential ingredients, however, are summarized in Table 1; the calculation of T_i for each individual country is somewhat cumbersome, but straightforward.

Finally, we need some measure to assess the progress in integration, achieved by the Common Market and the European Economic Area (EEA). This is accomplished by introducing “trade costs” (*TC*). We assume that the Common Market (the EEA) has caused a progress in integration, equivalent to a tariff reduction of 5 (2.5) percent in terms of our index. This means that tc_{ij} is equal to 5 percent over the whole period from 1950 to 1992, and then eliminated for the participants in the Common Market, respectively halved for participants in the EEA as of 1994. Of course, this assumed “trade cost” reduction is only a crude approximation for such heterogeneous effects as increased factor mobility, the abolishment of border controls, increased competition and reduced possibilities for price segmentation, harmonization of competition policy, faster enforcement of legal claims, standardization of technical standards and enhanced transparency. To be honest, we admit that TC_i is only little more than a dummy, scaled relative to the tariff reductions (and thus a tariff equivalent) and weighted by the according trade shares. The measurement of the impact of the Common market remains an important issue that is far from being solved, let alone the measurement of positive integration.

Summing up the two components T_i and TC_i, we finally obtain our index of protectionism for each country over the period 1950-2000 ($PROT_i$). Furthermore, we can also give comparable measures of the level of protectionism under two hypothetical scenarios: (1) $PROT\_P_i$ describes the (hypothetical) protectionist scenario of no integration at all since 1950; over the whole period it is equal to the country-specific external tariff at the level of 1950 plus trade costs of 5 percent. (2) $PROT\_GATT_i$ describes the (hypothetical) scenario with GATT-liberalization, but without any additional European integration; it is simply calculated by starting from the country-specific external tariff in 1950, accounting for the GATT tariff reductions and adding trade costs of 5 percent over the whole period. Figure 2 shows the development of the different indices for the (aggregate) EU, where the country-specific values have been weighted with shares in the EU's total trade (for country-specific results see Figure A1 in the appendix). The difference between $PROT_i$ and $PROT\_GATT_i$ is exclusively due to European integration, while the difference between $PROT\_GATT_i$ and $PROT\_P_i$ reflects only GATT-liberalization.

Figure 2 – *Indices of protectionism of the EU under different scenarios*



Finally, we multiply our index of protectionism (*PROT*) with (–1) to obtain an index of integration (*INT*):

$$INT_i = (-1)PROT_i$$

$$INT\_P_i = (-1)PROT\_P_i$$

$$INT\_GATT_i = (-1)PROT\_GATT_i \qquad (3.3)$$

This is merely a technical transformation which gives the coefficient of the variable a straightforward interpretation.

IV. Empirical Model and Results of Estimation

Specification of the empirical model

We start from a simple Cobb-Douglas production function with constant returns to scale $Y = AK^{\alpha}L^{1-\alpha}$, which can be written in intensive form as $y = Ak^{\alpha}$. In log-differences we have

$$\Delta \ln y_t = \Delta \ln A_t + \alpha\, \Delta \ln k_t \qquad (4.1)$$

where $y = Y/L$ = GDP per employee, A = total factor productivity (technological progress) and $k = K/L$ = physical capital per employee.[3] Of course, (4.1) is actually no deterministic relationship, but for simplicity of exposition, we omit stochastic error terms in the subsequent derivation.

As outlined above, integration could generate growth mainly via two channels: an increase in technological progress (*A*) and an increase in the accumulation of physical capital (*K*). In each case one has to distinguish between permanent and temporary growth effects. More formally, we have two competing integration-induced technology-led growth hypotheses

$$\Delta \ln A_t = \delta_{1A} + \varphi_{1A}\; INT_t \qquad (4.2a)$$

$$\Delta \ln A_t = \delta_{2A} + \varphi_{2A}\; \Delta INT_t \qquad (4.2b)$$

and two competing integration-induced investment-led growth hypotheses[4]

$$\Delta \ln k_t = \delta_{1K} + \varphi_{1K}\; INT_t \qquad (4.3a)$$

$$\Delta \ln k_t = \delta_{2K} + \varphi_{2K}\; \Delta INT_t \qquad (4.3b)$$

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[3] In a first approach human capital had also been included. The estimation results for human capital – measured by standard variables taken from the Barro-Lee (2000) or the De la Fuente-Doménech (2000) data set – were so disappointing (negative and/or insignificant) that we omit human capital here from the beginning of our analysis.

[4] Of course, this is a rather simple specification for $\Delta\ln k$. In fact, $\Delta\ln k$ might depend on $\Delta\ln y$ and thus be an endogenous variable, too. We will return to this point below.

Equations (4.2a) and (4.3a) correspond to the hypothesis of permanent growth effects and express the growth rate of A (k) as a function of an (exogenous) average growth rate δ_{1A} (δ_{1K}) and the level of integration (INT). A progress in integration (measured by an increase in INT) from time T-1 to T permanently influences the growth rate of A (k) for $t \geq$ T. Equations (4.2b) and (4.3b) correspond to the hypothesis of level effects and describe the more intuitive relationship between the level of A (k) and the level of integration. Here, the growth rate of A (k) is a function of an average growth rate δ_{2A} (δ_{2K}) and the progress in integration (ΔINT), which influences the growth rate only temporarily (in this static specification only in t = T). Note, that equation (4.3a) corresponds to the production function in the R&D-sector of the Romer (1990) model ($g_A = \phi H_A$), where the level of human capital employed in the R&D sector (H_A) has been replaced by the general expression for the degree of integration INT.[5]

Inserting (4.2a) and (4.3a) respectively (4.2b) and (4.3b) into equation (4.1) yields

$$\Delta \ln y_t = \delta_1 + \varphi_1 \; INT_t \tag{4.4a}$$

$$\Delta \ln y_t = \delta_2 + \varphi_2 \; \Delta INT_t \tag{4.4b}$$

where $\delta_1 = \delta_{1A} + \alpha_1 \delta_{1K}$, $\delta_2 = \delta_{2A} + \alpha_2 \delta_{2K}$, $\varphi_1 = \varphi_{1A} + \alpha_1 \varphi_{1K}$ and $\varphi_2 = \varphi_{2A} + \alpha_2 \varphi_{2K}$. One could also insert (4.2a) and (4.3b) into equation (4.1) to combine the permanent technology-led growth with the temporary investment-led growth hypothesis. We will also test this combination in our empirical analysis, but for the clarity of exposition we will focus on the two "strong", exclusive variants of the hypotheses, given by (4.4a) and (4.4b).

Finally, we also include a lagged endogenous variable to allow for a dynamic structure of the model and to avoid dynamic mis-specification. This has also intuitive appeal, as it models growth in a dynamic context and enables us to distinguish between short-run and long-run effects of integration.[6] To be more precise, this means that we regard equations (4.4) as equilibrium relationships, henceforth denoted by $\Delta \ln y_t^*$ and assume that the gap between the

[5] Romer considers only the two extreme cases of autarky and full integration. Assuming identical countries with the same R&D-production function ($g_A = \phi H_A$), the growth rate of the knowledge in each country (and of the world stock of knowledge) after full integration (both of trade and knowledge flows) is given by $g_A = \phi(H_A + H_A)$. Allowing intermediate forms of integration between autarky and full integration, this equation can be rewritten as $g_A = \phi(H_A + INT\, H_A)$. In autarky ($INT$=0) knowledge in each country grows (in isolation) at the rate $g_A = \phi H_A$; under full integration (INT=1) the growth rate is increased to $\phi(H_A + H_A)$. This means that the degree of integration determines the extent, to which knowledge creation in one country's R&D sector spills over to the other country and enhances the other countries growth of knowledge (and vice versa). Given the level of human capital, it follows that the growth rate of A ceteris paribus increases with the level of integration.

[6] Greenaway et al. (1998) were the first, who suggested a *dynamic* specification in *growth rates* to avoid dynamic mis-specification. Their approach differs from ours, as they use a dynamic version of the convergence specification, while we pursue a growth accounting approach.

actual value $\Delta\ln y_t$ and the equilibrium value $\Delta\ln y_t^*$ is reduced according to the following partial-adjustment mechanism:

$$\Delta\ln y_t - \Delta\ln y_{t-1} = \lambda(\Delta\ln y_t^* - \Delta\ln y_{t-1}) \tag{4.5}$$

Inserting equations (4.4) into (4.5) and rearranging terms, we obtain the following partial-adjustment model

$$\Delta\ln y_t = \delta_1^S + \varphi_1^S INT_t + (1-\lambda_1)\Delta\ln y_{t-1} + \varepsilon_{1t} \tag{4.6a}$$

$$\Delta\ln y_t = \delta_2^S + \varphi_2^S \Delta INT_t + (1-\lambda_2)\Delta\ln y_{t-1} + \varepsilon_{2t} \tag{4.6b}$$

where the parameter λ can be interpreted as speed of adjustment and the long-run effects (δ, φ) can be recovered by dividing the short-run parameters (δ^S, φ^S) by λ. To bring the model in an econometric form, a disturbance term (ε_t) has been added to the specification, of which we assume (so far) that it is well-behaved. Actually, ε_t is composed of more than one error term, as equations (4.1) to (4.5), from which (4.6) has been derived, do not represent deterministic relationships. The validity of the assumption, that ε_t is well-behaved remains a question which has to be answered empirically. The same is true for the dynamic form of the specification.

Model (4.6) describes a dynamic growth accounting relationship between per capita growth and integration, where factor accumulation has been omitted totally. This approach has been recently advocated recently by Temple (1999) for the case, where the total effect of a policy measure is of primary interest rather than the way in which the measure affects growth. Nevertheless, some estimate of the relative importance of each channel can be gained by including the accumulation of physical capital ($\Delta\ln k$) directly into equations (4.6), which yields

$$\Delta\ln y_t = \delta_{1A}^S + \varphi_{1A}^S INT_t + \alpha_1^S \Delta\ln k_t + (1-\lambda_1)\Delta\ln y_{t-1} + \varepsilon_{1t} \tag{4.7a}$$

$$\Delta\ln y_t = \delta_{2A}^S + \varphi_{2A}^S \Delta INT_t + \alpha_2^S \Delta\ln k_t + (1-\lambda_2)\Delta\ln y_{t-1} + \varepsilon_{2t} \tag{4.7b}$$

Compared with model (4.6) the (short-run) parameter of the variable *INT* declines by $\alpha^S\varphi_K^S$, which represents investment-led effects on growth. The remaining coefficient φ_A^S is associated with technology-led growth effects and an equivalent interpretation applies to the long-run effects. Our primary interest, however, refers to the overall effect of integration and this makes equation (4.6) the starting point of our analysis. Obviously, there is a problem in the comparison of the estimates of (4.6) and (4.7), because the estimate of (4.6) suffers from an omitted variable bias, if $\Delta\ln k$ is a relevant variable. We will return to this point below.

We begin with a univariate analysis and treat the EU member states as one economic unit. In a next step we extend the empirical model to a panel specification, where we allow for country-specific intercepts (fixed effects) δ_i^S . Thus, the empirical models tested below and the corresponding hypotheses can be summarized as follows:

Permanent effect: $$\Delta \ln y_{it} = \delta_{1i}^S + \varphi_1^S INT_{it} + (1-\lambda_1)\Delta \ln y_{i,t-1} + \varepsilon_{1i,t} \qquad \text{(model I)}$$

Temporary effect: $$\Delta \ln y_{it} = \delta_{2i}^S + \varphi_2^S \Delta INT_{it} + (1-\lambda_2)\Delta \ln y_{i,t-1} + \varepsilon_{2i,t} \qquad \text{(model II)}$$

with y = GDP per employee, INT = level of integration, ΔINT = progress in integration (see section two for details), i = the aggregate EU in the univariate case or i = 1, . . . , 14 (EU countries without Luxembourg) in the panel case; T = 1, . . . , 40 (1960-2000). In each equation we also include the growth rate of physical capital per employee ($\Delta \ln k_t$) to assess the relative importance of investment-led vs. technology-led growth (denoted by I*, II*). Data for real GDP (1990 prices[7], converted from national currencies into US-$ using 1990 PPPs from the OECD) and employment were taken from the National Accounts of the OECD. Capital stocks were calculated using a perpetual inventory method using investment data from the OECD (1990 prices, converted into US-$ using 1990 PPPs). A detailed description of the data is given in the appendix.

Before presenting the results of our estimations, some econometric aspects shall be outlined. In general, a partial adjustment model as described by models I and II requires stationary variables. Augmented Dickey-Fuller tests reject the null of a unit root for the variables $\Delta \ln y$, $\Delta \ln k$ and ΔINT at least at the 5 percent level for the aggregate EU. The variable INT, however, is nonstationary; the null of a unit root cannot be rejected at any conventional significance level. Similar results hold for the time series of the individual countries (see Table A1 in the appendix for the detailed results). These findings are a first severe objection against the hypothesis of permanent growth effects. There cannot be an equilibrium relationship between a stationary variable ($\Delta \ln y$) and a nonstationary variable (INT), at least not in the linear form as in model II. This confirms the results of Jones (1995a) that many determinates of the steady-state growth rate, postulated by endogenous growth models with scale effects, were stochastically trending upwards, while growth of GDP per capita and growth of total factor productivity (A) were stationary. To reconcile scale effects

[7] As we use national prices and a constant PPP conversion factor, our growth rates differ from that of the PWT, which are based on international prices. Nuxoll (1994) has first pointed out potential distortions in the PWT due

with these empirical facts one would have to assume that „whatever persistent effects have occurred have miraculously been offsetting" (Jones, 1995a, p. 499).[8] Given the large uncertainty involved in unit root tests, we will nevertheless test for permanent growth effects in our regression model below.

A further concern relates to the problem of an "omitted variable bias" in the estimates of models I and II (without factor accumulation). Size and the likely direction of the bias will have to be taken into account, when interpreting the results. But also the specification including factor accumulation (I^*, II^*) is not without problems, because causality may not only run from investment to growth, but also from growth to investment. Thus, growth of the capital stock ($\Delta \ln k_t$) is potentially endogenous and correlated with the error term; to avoid biased (and in the univariate case also inconsistent) parameter estimates, instrumental variable techniques will be applied.

Results of estimation

Table 2 shows the results of our estimation for the aggregate EU. The additional variable that appears in all specification is a level dummy (D^{70}) which accounts for the slowdown of growth in the 70s[9]. If we take the results of our unit root test serious, a econometric estimation of model I makes no sense. Just to confirm the results above, column one shows the results for model I. The variable *INT* appears significant at the 10 percent level but shows the wrong (negative) sign. The (weak) significance of the negative coefficient may be explained by a slight downward trend of growth over the whole period, that remains even after controlling for the structural break (mean shift) in the 70s by the level dummy D^{70}; as *INT* is trending upwards, this yields a negative coefficient. The results for *INT* (or lags of it), however, are robust against including a linear trend, using a static variant of model I, including the first difference ΔINT, changing the estimation period, or including capital accumulation $\Delta \ln k$: we always obtain an insignificant and/or negative coefficient. Given the results of the unit root

to the Gerschenkron effect and suggested to use national prices for the comparison of growth rates and international prices for the comparison of levels.

[8] Baldwin and Seghezza (1996) argue that pro-growth effects of integration may have been offset by the anit-growth effect of the expansion of the welfare state. In a more formal model, Todo and Koji (2001) propose costly international knowledge diffusion as possible reason, suggesting that growth did not improve because additional R&D labor was devoted to knowledge diffusion, rather than innovation.

[9] In our specification search, which was based on the models II and II^*, several level dummies for the 70s were tested. Controlling for outliers (oil price shock) the variable D^{70} yielded the highest t-value; there are, as always in econometrics, alternative choices that could also be justified.

tests this is no surprise. We conclude that the hypothesis of permanent growth effects is rejected for our sample.

Table 2 – *Results of estimation for the aggregate EU*

dependent variable: $\Delta\ln y_t$

variable	*model I*		*model II*		*model II** (IV[1])	
intercept	1.439	(1.67)	3.105^{***}	(7.24)	2.196^{***}	(4.06)
$\Delta\ln y_{t-1}$	0.305^{**}	(2.25)	0.242^{**}	(2.56)	0.233^{*}	(1.98)
INT_t	-0.104^{*}	(-1.79)				
ΔINT_{t-1}			1.011^{***}	(5.18)	0.806^{***}	(3.91)
$\Delta\ln k_t$					0.169^{*}	(1.87)
D^{70}	-0.866	(-1.56)	-2.054^{***}	(-7.12)	-1.417^{***}	(-3.83)
Durbin-Watson	1.956		1.770		1.605	
Jarque-Bera[2)]	4.336		0.322		0.495	
White[3)]	5.906		9.539		16.918	
Breusch-Godfrey[4)]	2.282		4.077		5.270^{*}	
σ[5)]	0.702		0.552		0.547	
$\bar{R}^2$[6)]	0.775		0.861		0.863	
Haumann-Wu[7)]					6.783^{***} (1)	
Sargan[8)]					6.701 (7)	
time			1960-2000			
ΔINT (long-run)			1.335		1.051	
$\Delta\ln k$ (long-run)					0.221	

Numbers in parentheses are t-values of the coefficients, respectively degrees of freedom of the test statistics. – growth rates ($\Delta\ln y$, $\Delta\ln k$) in percent. – ***, **, * indicate significance at the 1, 5 and 10%-level. – Outliers were eliminated from the estimation. Criterion: residual larger than double standard error of regression; in model I: 1975, 1976; in model II: 1974, 1975, 1976 (oil price shock). – [1)] Instrumental variable estimation; additionally to all exogenous variables, the following instruments were used for $\Delta\ln k_t$: $\Delta\ln y_{t-2}$, $\Delta\ln y_{t-3}$, $\Delta\ln y_{t-4}$, $\Delta\ln y_{t-5}$, $\ln k_{t-2}$, $\ln k_{t-3}$, $\ln k_{t-4}$,, $\ln k_{t-5}$. – [2)] H_0: normal residuals, Bera and Jarque (1980, 1981). – [3)] H_0: homoscedastic residuals, White (1980). – [4)] H_0: uncorrelated residuals; Breusch (1978), Godfrey (1978); performed with a lag length of two. – [5)] standard error of regression. – [6)] adjusted R^2. – [7)] Hausmann-Wu exogeneity test, H_0: $\text{plim}[n^{-1}(\Delta\ln k)'\varepsilon]=0$; Wu (1973), Hausmann (1978), χ^2-distributed with degrees of freedom, equal to the number of potentially correlated variables. – [8)] Sargan "validity of instruments" test, Sargan (1958) H_0: valid instruments; χ^2- distributed with seven p-k degrees of freedom, where p is the number of instruments, and k is the number of regressors.

We now turn to column two (model II), which shows the test of temporary growth (level) effects. All variables are significant at least at the 5 percent-level. In particular, the variable ΔINT_{t-1} enters significantly at the 1 percent level and shows the theoretically predicted sign. Its lagged variant (ΔINT_{t-1}) is used because it yields a higher t-value than the current variant ΔINT_t; if both variables are included, only the lagged one remains significant. This is plausible, as the effects of integration require some time to work out. Further lags were also tested, but turned out as insignificant. The coefficient of $\Delta INT_{t\text{-}1}$ indicates, that a progress in integration (in terms of an increase in our index *INT* by one percentage point) raises the growth rate (temporarily) by 1.01 percent in the short-run, i.e. in the subsequent period. Taken together with the coefficient of the lagged endogenous variable (0.242), this implies a cumulative growth effect of 1.34 percent in the long-run. Again, this is only a temporary effect on the growth rate; the high speed of adjustment (76 percent), implied by the coefficient of $\Delta \ln y_{t\text{-}1}$ suggests, that the whole effect is realized de facto within five years. Ceteris paribus the growth rate is back at its old level after this rather short period and the level of y has increased by 1.34 percent. As opposed to the static variant of model II (without $\Delta \ln y_{t\text{-}1}$), standard tests of the residuals indicate no mis-specification. The null hypotheses of normal (Jarque-Bera), homoscedastic (White) and uncorrelated residuals (Breusch-Godfrey) cannot be rejected.

In a next step we include the accumulation of physical capital (model II*). A Hausmann-Wu test rejects the null of exogeneity of $\Delta \ln k$ at the 1 percent-level, which confirms our theoretical expectations. To deal with this problem, we use an instrumental variable estimation, where all exogenous variables and further lags of $\Delta \ln y_{t\text{-}1}$ as well as lagged levels of k are used as instruments (the levels of k performed slightly better than the differences). A Sargan validity of instruments test cannot reject the null of valid instruments, not even at the 10 percent level. The results of the instrumental variable estimation are shown in the third column of Table 3. The variable $\Delta \ln k_t$ is significant at the 10 percent level and implies a long-run capital-elasticity of output of 0.22. This value is rather low, although not implausible; the weak significance may be due to measurement problems. Comparison of the results with those of model II (without $\Delta \ln k_t$, column two) shows the expected results: The coefficient of $\Delta INT_{t\text{-}1}$ falls from 1.01 to 0.806; its long-run effect declines from 1.34 to 1.05 or by a relative amount of 21 percent; as this is due to the inclusion of $\Delta \ln k$, approximately one fifth of the effect can be interpreted as investment-led growth and the remaining 80 percent as technology-led growth effect (see the discussion surrounding equation (4.7)). This interpretation is subject to one important qualification. As noted above, the estimates of model II suffer from an omitted variable bias, as the relevant variable $\Delta \ln k$ is excluded from the regression. Size and direction of a coefficient's bias depend on the size of the according coefficient and its partial correlation with the omitted variable (see Greene, 2001, p. 334). We thus may reasonably assume that the coefficient of $\Delta INT_{t\text{-}1}$ is biased upwards in model II.

However, it is difficult to guess how much of the increase in the coefficient of ΔINT_{t-1} from 0.806 (model II*) to 1.011 (model II) reflects the difference in the parameters (see equations (4.7)) and how much of it is caused by the bias. To be one the save side, we thus interpret the coefficient of ΔINT_{t-1} in model II as an upper bound, and its value in model II* as lower bound (no investment-led growth effects, only technology-led growth effects).

A slight objection against adequacy of model II is only raised by the LM test for serial correlation, which is significant at the 10 percent level; additional tests for serial correlation (Ljung-Box), however, cannot reject the null of uncorrelated errors. Given the satisfactory results of the other tests (Ljung-Box, White, Jarque-Bera), we do not interpret the LM-test as indication of mis-specification. Finally, we note that the hypothesis of permanent growth effects has also been tested in this specification with factor accumulation. With a t-value of 0.231 (0.273), the coefficient of the variable INT_t (INT_{t-1}) is far away from any relevant significance level.

A particular critical point so far concerns the aggregation of the 14 EU countries to one "artificial" economy; by ruling out the possibility of country-specific characteristics, we are likely to make invalid assumptions of parameter homogeneity. At best, we can hope to get good estimates of parameter averages. Consequently, we proceed with a panel approach, where we allow for country-specific intercepts (fixed effects). In interpreting the results, however, we will keep focussing on the consequences for the total EU, since the assumptions concerning the parameter homogeneity (of the slopes) remain rather restrictive.

Some additional comments on the econometric method are in order here. For dynamic panels, it is well known, that standard panel estimators (as the least square dummy variable estimator (LSDV) that uses mean centered variables) yield biased estimates (Nickel, 1981). Of the several dynamic panel estimators suggested, we use the GMM estimator by Arellano and Bond (1991) to obtain consistent and efficient estimates of our parameters. Thereby, the fixed effects are eliminated by using first differences; then an instrumental variable estimation of the differenced equation is performed. As instruments for the lagged difference of the endogenous variable – or other variables which are correlated with the differenced error term – all lagged levels of the variable in question are used, starting with lag two and going back to the beginning of the sample. Consistency of the GMM estimator requires lack of second order serial correlation in the residuals of the differenced specification. The overall validity of instruments can be checked by a Sargan test of over-identifying restrictions (see Arellano and Bond, 1991).

The results for the hypothesis of permanent growth effects are not shown here, as they are consistent with the model for the aggregate EU: INT_{it} was tested using several specifications (with, without ΔINT_{it}; with, without Δk_{it}; alternative estimation periods) and turned out insignificant and/or showed a negative coefficient.

Table 3 – *Results of panel estimation for the EU member states*

dependent variable: $\Delta \ln y_t$

variable	*model II*		*model II**	
	LSDV[1)]	*GMM*[2)]	*LSDV*[1)]	*GMM*[2)]
intercept[3)]	3.539	3.056	2.613	2.406
$\Delta \ln y_{i,t-1}$	0.215^{***} (5.49)	0.226^{***} (5.55)	0.190^{***} (4.89)	0.212^{***} (5.28)
$\Delta INT_{i,t\text{-}1}$	0.782^{***} (6.36)	0.775^{***} (5.82)	0.646^{***} (5.22)	0.703^{***} (5.33)
$\Delta \ln k_{it}$			0.187^{***} (4.93)	0.188^{**} (4.06)
D^{70}	-2.224^{***} (-10.72)	-1.564^{***} (5.07)	-1.641^{***} (-6.98)	-1.492^{***} (4.91)
F-Test	63.29^{***} (5, 555)	24.86^{***} (5, 568)	59.00^{***} (6, 554)	54.63^{***} (6, 567)
m_1[4)]		-12.55^{***}		-3.08^{***}
m_2[5)]		-0.73		-0.56
Sargan[6)]		417.48 (789)		425.46 (789)
time	1960-2000		1960-2000	
ΔINT (long-run)	0.996	1.001	0.798	0.892
$\Delta \ln k$ (long-run)			0.231	0.239

Numbers in parentheses are t-values, respectively degrees of freedom of the test statistics. – growth rates ($\Delta \ln y$, $\Delta \ln k$) in percent. – $^{***, **, *}$ indicate significance at the 1, 5 and 10%-level. – [1)] Least square dummy variable estimation, based on mean centered data. – [2)] one-step GMM estimator, based on first differences (Arellano and Bond, 1991); maximum lag length of instruments restricted to 20; t-values based on robust standard errors. – [3)] average of country-specific effects ($\tilde{\delta}_i^S$), which were recovered using the relationship $\tilde{\delta}_i = \bar{y}_i - \bar{x}_i \hat{\beta}$, where $\bar{y}_i$ and $\bar{x}_i$ are country-specific means and $\hat{\beta}$ are the estimated slope coefficients. – [4), 5)] tests for first-order (m_1) and second-order (m_2) serial correlation in the differenced specification; under H_0 of no serial correlation m_1 and m_2 are distributed standard normally. – [3)] Sargan validity of instruments test: under H_0 of valid instruments distributed χ^2 with p-k degrees of freedom, where p is the number of columns in the instrument matrix and k is the number of variables. – The level dummy D^{70} accounts for the slowdown of growth in the 70s, where it is assumed that all countries were affected equally. Time specific effects were included for 1974, 1976 to account for the oil price shock.

We turn to our tests for level effects. In order to get some idea of the sensitivity of the results with respect to the estimation method we show the results for both the LSDV and the Arellano-Bond (GMM) estimator. The left half of the Table shows the results for model II. It is interesting to note that the coefficients of the variables are robust against the estimation method: The GMM and the LSDV (slope) coefficients do not differ dramatically.[10] For theoretical reasons, however, the GMM results in column two are our preferred estimates. All coefficients are highly significant and the tests of model adequacy (serial correlation, Sargan) raise no objection against the model. Compared with our aggregate specification, the coefficient of the endogenous variable is de facto unchanged; the short-run coefficient of $\Delta INT_{t\text{-}1}$, however, is revised downwards to 0.775 (with a 95% confidence interval given by the range of 0.527 and 1.023); the long-run effect of a progress in integration amounts to 1.00 percent. As outlined more in detail above, the omission of $\Delta\ln k$ may cause an upward bias, so that we interpret this value as an upper bound.

Due to the long time series we had to use a restricted GMM estimator, where the maximum number of lagged levels to be included as instruments was set to 20. Even in this case our model has only little less than 800 variables, which is the (high) limit of the matrix size imposed by the software used. Fortunately, this turns out as no sensitive restriction: Adding more than approximately 15 lagged levels as instruments has de facto no effect on the results. Nevertheless, the model size poses us a problem, if we include capital accumulation in a next step. As $\Delta\ln k$ is potentially endogenous, we should use instruments for this variable, too. With a maximum lag-length of instruments of 20 as used so far, we obtain a model with more than 1500 variables, which exceeds our computational capacity. Therefore, we can only provide some approximate results. In a first approach, we treat $\Delta\ln k$ as exogenous variable and employ the GMM estimator with 20 lags as used so far. The according results (column four) for the long-run effect of $\Delta INT_{t\text{-}1}$ (0.892) suggest that some 11 percent of the total effect are due to induced investments. The LSDV results (column three), which should not be too severely biased, point at a share of investment-led growth in the total effect of 20 percent. Additionally, we estimated both models II and II* using the GMM estimator with the maximum feasible lag length of 8 for the instruments of both variables ($\Delta lny_{i,t\text{-}1}$, Δk_{it}), which yields us a relative importance of investment-led growth effects of 29 percent. In our aggregate specification we obtained a share of investment-led growth amounting to some 21 percent. Bearing this uncertainty in mind, we conclude that investment-led growth accounts for some 10 to 30 percent of the total effect. This can be checked against the results implied by the Baldwin-multiplier (see section two). In our case the estimated long-run capital-elasticity of output (α) amounts to 0.239. This implies a Baldwin multiplier of 1/(1-0.239) =

[10] This corroborates the results of the Monte Carlo studies by Judson and Owen, that „the LSDV performs as well or better as many alternatives when T=30“, i.e. for large T (Judson and Owen, 1999, p. 10).

1.314, and thus, a share of investment-led growth effects of some 24 percent. This is in line with our econometric results, although our high speed of adjustment (some 80 percent) can hardly be reconciled with the slow speed of convergence implied by the neoclassical model, which has been used by Baldwin. Also note, that the coefficient of the level dummy, which represents the average slowdown of growth from 1970 to 2000, falls only slightly after including $\Delta \ln k$; this confirms the view, that the lower growth rates since the 70s are mainly due to a "productivity slowdown", i.e. a decrease in the average growth rate of *A*.

Simulation of alternative scenarios

Using the results of our preferred specification (Table 3, column two), we have the following basic model for our simulation:

$$\Delta \ln \hat{y}_{it} = \delta_i^S + 0.226\,\Delta INT_{i,t-1} + 0.775 \Delta \ln \hat{y}_{i,t-1} - 1.564 D_{70}^N + e_{it} \tag{4.7}$$

where $\tilde{\delta}_i^S$ equals the estimates of the country-specific fixed effects and the hat (^) indicates predicted values. The residuals of model II (e_{it}) are included to reproduce the actual values of the growth rate in the baseline scenario; the residuals are thus interpreted as stochastic shocks that would have occurred under any scenario.[11] Our simulation is dynamic, i.e. we use the simulated value ($\Delta \ln \hat{y}_{i,t-1}$) for the lag of the endogenous variable. Equation (4.7) corresponds to our baseline scenario, which describes the actual development, including GATT-liberalization and European integration. Additionally, we simulate two alternative scenarios: the hypothetical scenario (1) of no integration at all since 1950, by using (4.7) and replacing ΔINT_{it} with the variable ΔINT_P_{it}, and the hypothetical scenario (2) of GATT-liberalization without European integration, using (4.7) and replacing ΔINT_{it} with the variable INT_GATT_{it}. The simulated growth rates can be easily used to simulate the levels, starting from the initial level of GDP per employee in 1959. Table 4 summarizes the results for the EU, which have been calculated on the basis of the country-specific results (see Table A2, Figure A2 in the appendix for details).

[11] For the comparison of the different scenarios, the inclusion of e_{it} is irrelevant. The same is true for the simulation of the levels of GDP per employee in 2000, because the country-specific residuals sum to zero.

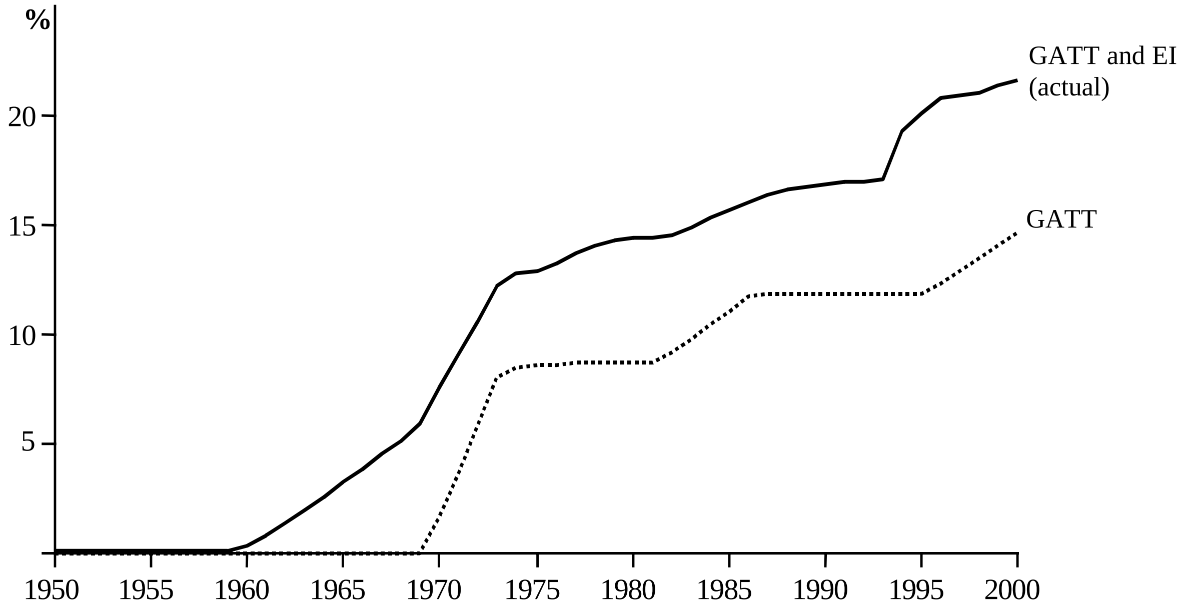
Table 4 – *Growth effects of global integration (GATT) and European integration (EI) for the EU member states (in total)*

	scenario (1) no integration	scenario (2) GATT, no EI	baseline scenario[1)] GATT and EI
GDP per employee 1959[2)]		14900	
GDP per employee 2000	36661	42044	44577
level effect of integration[3)]	–	14.68	21.59
average growth rate p.a. (1950-2000)	2.43	2.71	2.83
effect of integration on average growth rate	–	0.28	0.40
level effect of Common Market and EEA[4)]	–	–	3.13

Levels in US-$ per employee (1990 prices, 1990 PPPs). – [1)] actual values. – [2)] actual value; for Belgium and the Netherlands, the initial GDP in 1959 under scenarios (1) and (2) has been reduced by the effect of the Benelux-Customs Union, which is assumed the equal its effect on the index *INT*, multiplied with the long-run effect of the variable *INT*. – [3)] relative deviation of GDP per employee in 2000 from scenario (1) in percent. – [4)] in percent; simulation based on the reduction in trade costs from 1992 to 1995, which is (assumed to be) exclusively due to the Common Market and the EEA.

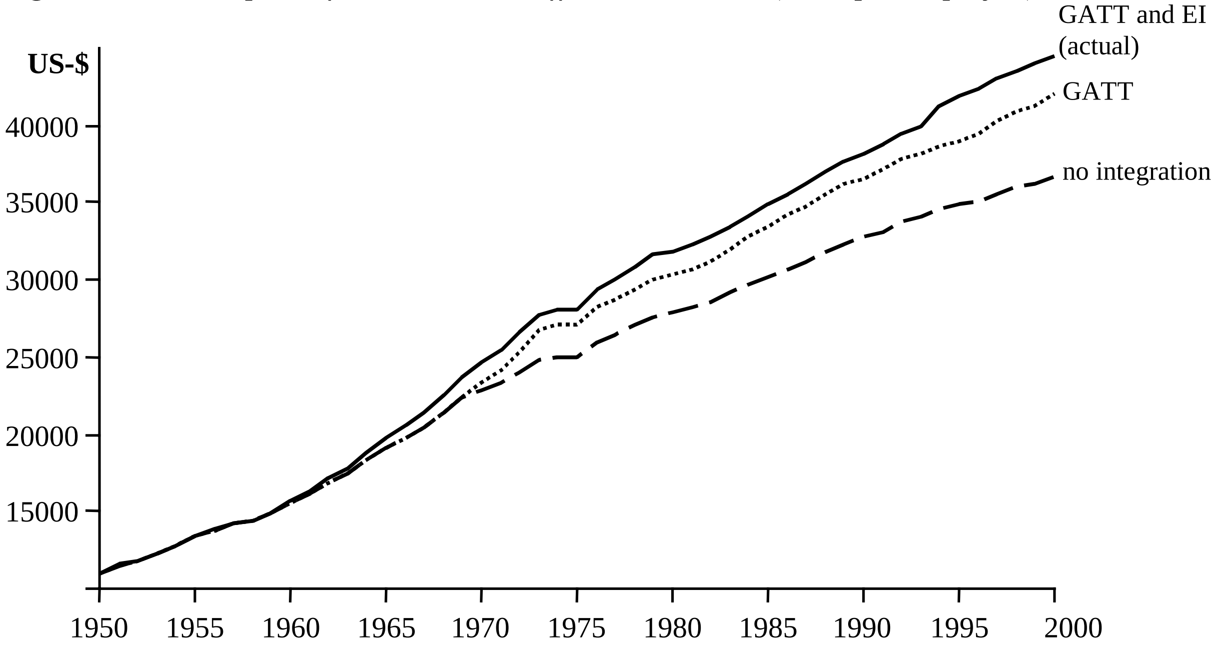
Summing up, we find that the postwar integration of the EU member states has induced significant level effects: If no integration had taken place since 1950, GDP per employee of the EU would have amounted to 36661 US-$ in 2000 (respectively 15255 US-$ in terms of GDP per capita). The actual level of 44577 US-$ (18549 US-$) exceeds this hypothetical value by some 21.6 percent, reflecting the total level effect of economic integration (both GATT-liberalization and European integration) since 1950. Interestingly, two third of this effect (14.7%) are due to GATT-liberalization, given the assumption that the EU member states had implemented the average GATT tariff reductions completely. Of course, this is only a static comparison for the year 2000, which ignores that European integration has led to an earlier realization of the effects that would have also been induced under the pure GATT scenario. The level effects, exclusively due to European integration, amount to some 6.9 percent, approximately half of which can be traced back to the Common Market and the EEA. Figure 3 illustrates these results.

Figure 3 – *Level effect of the EU's economic integration on GDP per employee (Cumulative deviations of GDP per employee from scenario without integration)*



As the EU's integration has been a continuous process that induced successive level effects, the growth path under the integration scenario appears steeper than under the protectionist scenario (see Figure 4). On average, growth has been higher by 0.4 percent p.a. over the period 1950 to 2000 as a result of integration. However, this is due to the permanent progress in integration and should not be confused with permanent growth effects of a once for all progress in integration.

Figure 4 – *Growth path of the EU under different scenarios (GDP per employee)*



So far, we kept focussing on the effect on the EU as a whole, as the assumption of homogeneous slope coefficients makes the derivation of the country-specific results somewhat mechanistic: Countries with the highest level of protectionism in the 50s have gained most. Table 5 gives an impression of the country-specific results in terms of GDP per capita of the EU countries in 2000 under the different scenarios. Due to the aforementioned reasons, the interpretation of the numbers should not be overstressed.

Table 5 – *GDP per capita of the EU member states in 2000 under different scenarios*

	scenario (1) no integration	scenario (2) GATT, no EI	baseline scenario[1)] GATT and EI
AT	16038	18346	20078
BE	17579	18839	19715
DE	17175	19424	20417
DK	19834	20611	21403
ES	11252	13534	14653
FI	16649	18471	19363
FR	16136	18675	19885
GR	8471	10189	10958
IE	18614	21215	22411
IT	14299	17198	18460
NL	17841	19120	19974
PT	9277	11158	12184
SE	17956	18805	19429
UK	15657	17844	18707
EU	15255	17495	18549

all values in US-$ per capita (1990 prices, 1990 PPPs), calculated by multiplication of the simulated values for GDP per employee with the participation rate (=employment/population) in 2000. – [1)] actual values.

V. Conclusions

Has economic integration spurred the EU's postwar economic growth? This paper provides strong evidence in favor of answering this question with "yes!". In line with Vanhoudt (1999), however, we do not find permanent growth effects of integration as earlier studies on this subject (Henrekson et al., 1997). Nevertheless, our subsequent tests for temporary growth effects, indicate that economic integration has induced considerable level effects: If no integration had taken place since 1950, GDP per capita of the EU would be approximately on fifth smaller today. In terms of growth this implies that without integration, the average growth rate per annum over the period 1950 to 2000 would have been lower by 0.4 percentage points. Our results suggest that the bulk of these effects (70 to 90 percent) can be traced back to increases in efficiency (technology-led growth), while integration-induced investment-led growth played only a rather small role. Its tempting to speculate that potentials for investment-led growth have not been fully exploited, and that this may have something to do with the often complained bureaucratized "nature" of the European Union, which impedes entrepreneurial activity, while increases in efficiency, mainly driven by market forces, were able to work themselves out more unhamperedly. Clearly, more research is needed on this subject. It is also interesting to note, that two third of the total level effect (15 percent) is due to GATT-liberalization. The level effect, exclusively accounted for by European integration, amounts to some 7 percent, half of which can be traced back to the Common Market and the European Economic Area. An important implication of our results for economic policy is that growth effects of integration are only of temporary nature. The growth stimulating effect of integration, achieved so far, holds no promise for the future performance. The continuation and deepening of Europe's economic integration, thus seems to be one important means (among others) for the EU, to continue its successful postwar growth performance in the twenty-first century.

Which conclusions can be drawn with respect to the growth models underlying our analysis? Most notably, our results are further striking evidence against endogenous growth models with scale effects. This does not necessarily support the neoclassical model. Although we do not use a convergence specification, the high speed of adjustment obtained can hardly be reconciled with the slow speed of convergence in the neoclassical model. Testing our model in a convergence framework might give a useful comparison. A careful conclusion we can draw is that – despite recent efforts to salvage scale effects in growth – endogenous growth models without scale effects might be a more promising line of growth theory.

Finally, two additional directions for future research shall be outlined. A question of great interest might be, whether small countries have gained more from integration, or – to put it differently – whether effects of integration have been asymmetric. Heterogeneous or threshold panels might be a good way forward to address this point, although their econometrics have still not been fully worked out for the dynamic case. A second aspects relates to the measurement of economic integration. In particular, improvements are required in the measurement of the Common Market, common policies and institutional elements. As positive integration is becoming increasingly important, its measurement and the estimation of its effects will become a challenging line of research in the empirics of economic integration.

References

Aghion, P. and Howitt, P. (1998) *Endogenous Growth Theory*. Cambridge: The MIT Press.

Arellano, M. and Bond, S. (1991) "Some Test of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, 58, 277-292.

Badinger, H. (2001) *Wachstumseffekte wirtschaftlicher Integration – theoretische Perspektiven und eine Schätzung der Wachstumseffekte der wirtschaftlichen Integration Europas*. Dissertation, Institut für Europafragen, Wirtschaftsuniversität Wien.

Balassa, B. (1961) *The Theory of Economic Integration*. London: Allen & Unwin.

Baldwin, R.E. (1993) "On the Measurement of Dynamic Effects of Integration," *Empirica*, 20(2), 129-144.

Baldwin, R.E. and Seghezza E. (1996) "Growth and European Integration. Towards an Empirical Assessment," *CEPR Discussion Paper*, No. 1393.

Barro, R.J. and Lee, J.W. (2000) "International Data on Educational Attainment: Updates and Implications," Working Paper no. 42, Center for International Development at Harvard University, April 2000 (http://web.korea.ac.kr/~jwlee).

Bera, J. and Jarque, C. (1981) "Efficient Tests for Normality, Heteroscedasticity and Serial Independence of Regression Residuals: Monte Carlo Evidence," *Economics Letters*, 7, 313-318.

Bera, J. and Jarque, C. (1982) "Model Specification Tests: A Simultaneous Approach," *Journal of Econometrics*, 20, 59-82.

Breusch, T. (1978) "Testing for Autocorrelation in Dynamic Linear Models," *Australian Economic Papers*, 17, 334-355.

Breuss, F. (1983) *Österreichs Außenwirtschaft 1945-1982.* Wien: Signum.

De la Fuente, A. and Doménech, R. (2000) "Human Capital in Growth Regressions: How Much Difference Does Data Quality Make?" *CEPR Discussion Paper*, No. 2466 (http://fuster.iei.uv.es/~rdomenec).

Durlauf, S.N. (2001) "Manifesto for a Growth Econometrics," *Journal of Econometrics*, 100, 65-69.

Eicher, T.S. and Turnovsky, S.J. (1999) "Non-Scale Models of Economic Growth," *The Economic Journal*, 109, 394-415.

Eicher, T.S. and Turnovsky, S.J. (2001) "Transitional Dynamics in a Two-Sector Non-Scale Growth Model," *Journal of Economic Dynamics and Control*, 25, 83-113.

El-Agraa, A.M. (1994) *The Economics of the European Community*. New York: Harvester Wheatsheaf.

GATT (1994) *The Results of the Uruguay Round of Multilateral Trade Negotiations: Market Access for Goods and Services, Overview of the Results*. Geneva.

Godfrey, L. (1978) "Testing Against General Autoregressive and Moving Error Models When the Regressors Include Lagged Dependent Variables," *Econometrica*, 46, 1293-1302.

Greenaway, D., Morgan, W. and Wright, P. (1998) "Trade Reform, Adjustment and Growth: What Does the Evidence Tell Us," *Economic Journal*, 108, 1547-1561.

Greene, W.H. (2000) *Econometric Analysis,* 4th edition. Upper Saddle River, New Jersey: Prentice Hall.

Grossman, G. M. und Helpman, E. (1991) *Innovation and Growth in the Global Economy*. Cambridge, Mass.: MIT Press.

Hausmann, J. (1978) "Specification Tests in Econometrics," *Econometrica*, 46, 1251-1271.

Henrekson, M., Torstensson, J., Torstensson, R. (1997) "Growth Effects of European Integration," *European Economic Review*, 41(8), 1537-1557.

Jones, C.I. (1995a) "Time Series Tests of Endogenous Growth Models," *Quarterly Journal of Economics,* 110(2), 495-525.

Jones, C.I. (1995b) "R&D-Based Models of Economic Growth," *Journal of Political Economy,* 103(4), 759-784.

Kortum, S. (1997) "Research, Patenting, and Technological Change," *Econometrica*, 65(6), 1389-419.

Landau, D. (1995) "The Contribution of the European Common Market to the Growth of its Member Countries: An Empirical Test," *Weltwirtschaftliches Archiv*, 131(4), 774-782.

Maddison, A. (1995) *Monitoring the World Economy 1820-1992*. Paris: OECD.

Nickell, S. (1981) "Biases in Dynamic Models with Fixed Effects," *Econometrica*, 49, 1417–1426.

Nuxoll, D.A. (1994) "Differences in Relative Prices and International Differences in Growth Rates," *American Economic Review*, 84(5), 1423-36.

Rebelo, S. (1991) „Long-Run Policy Analysis and Long Run Growth," *Journal of Political Economy*, 99, S. 500-521.

Rivera Batiz, L. and Xie, D. (1994) "Integration among Unequals," *Regional Science and Urban Economics*, 109(1), 337-354.

Rivera-Batiz, L.A. and Romer, P.M. (1991) "Economic Integration and Endogenous Growth," *Quarterly Journal of Economics*, 106(2), 531-555.

Romer, P.M. (1990) "Endogenous Technological Change," *Journal of Political Economy*, 98(5), 71-102.

Sargan, J.D. (1958) "The Estimation of Economic Relationships Using Instrumental Variables," *Econometrica*, 26, 393-415.

Segerstrom, P.S. (1998) "Endogenous Growth without Scale Effects," *American Economic Review*, 88, 1290-1310.

Solow, R.M. (1994) "Perspectives on Growth Theory," *Journal of Economic Perspectives*, 8(1), 45-54.

Temple, J. (1999) "The New Growth Evidence," *Journal of Economic Literature*, 37(1), 112-156.

Todo, Y. and Koji, M. (2001) "The revival of scale effects," Working paper, Faculty of Economics, Tokyo Metropolitan University.

Vanhoudt, P. (1999) "Did the European Unification Induce Economic Growth? In Search of Scale Effects and Persistent Changes," *Weltwirtschaftliches Archiv*, 135(2), 193-220.

Walz, U. (1997) "Dynamic Effects of Economic Integration: A Survey," *Open Economies Review*, 8(3), 309-326.

Walz, U. (1998) "Does the Enlargement of a Common Market Stimulate Growth and Convergence," *Journal of International Economics*, 45, 297-321.

Walz, U. (1999) *Dynamics of Regional Integration*. Heidelberg: Physica.

WTO (1995) *Trading into the Future*. Geneva.

Wu, D.M. (1973) "Alternative Tests of Independence Between Stochastic Regressors and Disturbances," *Econometrica*, 41, 733-750.

Young, A. (1998) "Growth without Scale Effects," *Journal of Political Economy*, 106(1), 41-63.

Appendix

Data Description

Y_{it} = real GDP in US-$ (1990 prices, 1990 PPPs), taken from OECD: *National Accounts*.

K_{it} = real capital stock in US-$ (1990 prices, 1990 PPPs), calculated using a perpetual inventory method: $K_t = K_{t-1}(1-\delta) + I_t$, with I_t = investment (gross fixed capital formation from OECD: *National Accounts*), δ ... depreciation rate (assumption: 5%). Initial level K_0 calculated as $K_{1955} = I_{HP55}/(g_{I,50\text{-}60})$ where I_{HP55} = Hodrick-Prescott filtered level of investment in 1955, $g_{I,50\text{-}60}$ = average growth rate p.a. of investment from 50 to 60 (see De la Fuente and Doménech, 2000).

L_{it} = employment in number of persons, taken from OECD: *Economic Outlook*.

INT_{it} = degree of integration in %, where $INT_i = (-1)\ PROT_i = (-1)[T_i + TC_i] = (-1)[\sum_j w_{ij}t_{ij} + \sum_j w_{ij}tc_{ij}]$ where $w_{ij} = TR_{ij}/\sum_j TR_i$, t_{ij} = tariff country i – country j and tc_{ij} trade costs country i – country j (see section two).

$TR_{ij,t}$ = real trade with country j in US-$ (1990 prices, 1990 PPPs), where $TR_{ij} = (IMP_{ij} + EXP_{ij})/2$. IMP_{ij} (EXP_{ij}) = imports from (exports to) country j, taken from IMF: Direction of Trade Statistics and converted into real figures using the implied deflators of the position "imports (exports) of goods and services" from the OECD: *National Accounts*. The deflation has been carried out to a obtain a consistent data set. For the calculation of the trade shares, however, the deflation is irrelevant, because for each country there is only a global trade deflator available, which refers to total trade.

i = 1, . . ., 14 (country index): Austria (AT), Belgium (BE), Denmark (DK), (West)-Germany (DE), Finland (FI), FR (France), Greece (GR), Ireland (IE), Italy (IT), Netherlands (NL), Portugal (PT), Spain (ES), Sweden (SE), United Kingdom (UK); Luxembourg had to be excluded due to missing data. The calculation of the aggregates for the EU is straightforward: Y, K, L are simply summed up. INT is calculated as weighted average of the country values, where shares in total EU trade were used as weights. Over the whole period 1950-2000, the "aggregate EU", which is used in our analysis, comprises the actual 15 (14) member states. – t = time index; basic data set: 1960-2000; where possible, data for 1950-1960 were approximated (e.g. by using corner point observations from Madisson (1995) and interpolation). – All data were converted into US-$ using 1990 PPPs from the OECD (EKS method).

Table A1 – *Augmented Dickey-Fuller Unit Root Tests for 1960-2000*

	$\Delta \ln y$	$\Delta \ln k$	INT	ΔINT
AT	-6.65^{***}	-2.52	-1.69	-4.07^{**}
BE	-8.18^{***}	-3.42^{*}	-2.21	-6.00^{***}
DE	-5.62^{***}	-4.19^{**}	-1.52	-4.01^{**}
DK	-6.31^{***}	-3.76^{**}	-0.20	-5.74^{***}
ES	-7.00^{***}	-2.22	-3.23^{*}	-3.43^{*}
FI	-4.54^{***}	-4.23^{*}	-2.05	-4.15^{**}
FR	-5.82^{***}	-3.35^{*}	-2.00	-4.78^{***}
GR	-5.07^{***}	-3.47^{*}	-3.10	-3.00
IE	-5.93^{***}	-3.23^{*}	-1.41	-3.23^{*}
IT	-5.49^{***}	-3.47^{*}	-2.29	-4.20^{***}
NL	-7.18^{***}	-2.98	-2.11	-5.11^{***}
PT	-5.49^{***}	-3.57^{**}	-0.89	-5.18^{***}
SE	-3.73^{**}	-4.13^{**}	-1.67	-5.66^{***}
UK	-5.96^{***}	-4.05^{**}	-1.28	-3.95^{**}
EU	-5.06^{***}	-3.62^{**}	-1.55	-4.28^{***}

Augmented Dickey-Fuller Unit Root Tests with deterministic trend; choice of lag-length based on Schwarz criterion. – $^{***}, ^{**}, ^{*}$ indicate significance at the 1, 5 and 10%-level.

Table A2 – *Growth effects of global integration (GATT) and European integration (EI) for the EU member states*

		scenario (1) no integration	scenario (2) GATT, no EI	baseline scenario[1] GATT and EI
AT	GDP per employee 1959[2]		11536	
	GDP per employee 2000	32181	36812	40288
	level effect of integration[3]	–	14.39	25.19
	average growth rate p.a. (1950-2000)	3.10	3.38	3.57
	effect of integration on average growth rate	–	0.28	0.46
	level effect of Common Market and EEA[4]	–	–	3.48
BE	GDP per employee 1959[2]		16855	
	GDP per employee 2000	45309	48577	50815
	level effect of integration[3]	–	7.17	12.15
	average growth rate p.a. (1950-2000)	2.44	2.58	2.64
	effect of integration on average growth rate	–	0.14	0.20
	level effect of Common Market and EEA[4]	–	–	3.74
DE	GDP per employee 1959[2]		16643	
	GDP per employee 2000	40154	45412	47732
	level effect of integration[3]	–	13.10	18.87
	average growth rate p.a. (1950-2000)	2.80	3.06	3.16
	effect of integration on average growth rate	–	0.25	0.36
	level effect of Common Market and EEA[4]	–	–	2.83
DK	GDP per employee 1959[2]		17305	
	GDP per employee 2000	38787	40308	41857
	level effect of integration[3]	–	3.92	7.91
	average growth rate p.a. (1950-2000)	2.01	2.09	2.17
	effect of integration on average growth rate	–	0.08	0.16
	level effect of Common Market and EEA[4]	–	–	3.51
ES	GDP per employee 1959[2]		10022	
	GDP per employee 2000	31089	37391	40483
	level effect of integration[3]	–	20.27	30.22
	average growth rate p.a. (1950-2000)	3.12	3.50	3.67
	effect of integration on average growth rate	–	0.38	0.55
	level effect of Common Market and EEA[4]	–	–	3.43
FI	GDP per employee 1959[2]		11751	
	GDP per employee 2000	36985	41032	43013
	level effect of integration[3]	–	10.94	16.30
	average growth rate p.a. (1950-2000)	2.94	3.15	3.25
	effect of integration on average growth rate	–	0.21	0.31
	level effect of Common Market and EEA[4]	–	–	2.97

Table A2 (continued) – *Growth effects of global integration (GATT) and European integration (EI) for the EU member states*

		scenario (1) no integration	scenario (2) GATT, no EI	baseline scenario[1] GATT and EI
FR	GDP per employee 1959[2]		15875	
	GDP per employee 2000	40272	46610	49629
	level effect of integration[3]	–	15.74	23.23
	average growth rate p.a. (1950-2000)	2.61	2.91	3.04
	effect of integration on average growth rate	–	0.30	0.43
	level effect of Common Market and EEA[4]	–	–	3.15
GR	GDP per employee 1959[2]		7161	
	GDP per employee 2000	22794	27415	29484
	level effect of integration[3]	–	20.27	29.35
	average growth rate p.a. (1950-2000)	2.98	3.37	3.52
	effect of integration on average growth rate	–	0.38	0.53
	level effect of Common Market and EEA[4]	–	–	3.39
IE	GDP per employee 1959[2]		10335	
	GDP per employee 2000	41785	47622	50307
	level effect of integration[3]	–	13.97	20.40
	average growth rate p.a. (1950-2000)	3.31	3.58	3.70
	effect of integration on average growth rate	–	0.27	0.38
	level effect of Common Market and EEA[4]	–	–	3.31
IT	GDP per employee 1959[2]		14294	
	GDP per employee 2000	39480	47484	50969
	level effect of integration[3]	–	20.27	29.10
	average growth rate p.a. (1950-2000)	2.61	2.99	3.14
	effect of integration on average growth rate	–	0.38	0.53
	level effect of Common Market and EEA[4]	–	–	2.97
NL	GDP per employee 1959[2]		17716	
	GDP per employee 2000	40650	43564	45509
	level effect of integration[3]	–	7.17	11.95
	average growth rate p.a. (1950-2000)	2.31	2.45	2.51
	effect of integration on average growth rate	–	0.14	0.20
	level effect of Common Market and EEA[4]	–	–	3.56
PT	GDP per employee 1959[2]		6846	
	GDP per employee 2000	19138	23019	25137
	level effect of integration[3]	–	20.27	31.34
	average growth rate p.a. (1950-2000)	2.66	3.04	3.22
	effect of integration on average growth rate	–	0.38	0.56
	level effect of Common Market and EEA[4]	–	–	3.88

Table A2 (continued) – *Growth effects of global integration (GATT) and European integration (EI) for the EU member states*

		scenario (1) no integration	scenario (2) GATT, no EI	baseline scenario[1] GATT and EI
SE	GDP per employee 1959[2]		16583	
	GDP per employee 2000	38337	40148	41481
	level effect of integration[3]	–	4.72	8.20
	average growth rate p.a. (1950-2000)	2.13	2.23	2.29
	effect of integration on average growth rate	–	0.09	0.16
	level effect of Common Market and EEA[4]	–	–	3.24
UK	GDP per employee 1959[2]		16868	
	GDP per employee 2000	33352	38011	39849
	level effect of integration[3]	–	13.97	19.48
	average growth rate p.a. (1950-2000)	1.57	1.84	1.94
	effect of integration on average growth rate	–	0.27	0.36
	level effect of Common Market and EEA[4]	–	–	2.68
EU	GDP per employee 1959[2]		14900	
	GDP per employee 2000	36661	42044	44577
	level effect of integration[3]	–	14.68	21.59
	average growth rate p.a. (1950-2000)	2.43	2.71	2.83
	effect of integration on average growth rate	–	0.28	0.40
	level effect of Common Market and EEA[4]	–	–	3.13

Levels in US-$ per employee (1990 prices, 1990 PPPs). – [1] actual values. – [2] actual value; for Belgium and the Netherlands, the initial GDP in 1959 under scenarios (1) and (2) has been reduced by the effect of the Benelux-Customs Union, which is assumed the equal its effect on the index *INT*, multiplied with the long-run effect of the variable *INT*. – [3] relative deviation of GDP per employee in 2000 from scenario (1) in percent. – [4] in percent; simulation based on the reduction in trade costs from 1992 to 1995, which is exclusively due to the Common Market and the EEA.

Figure A1 – *Indices of protectionism of the EU member states under alternative scenarios*

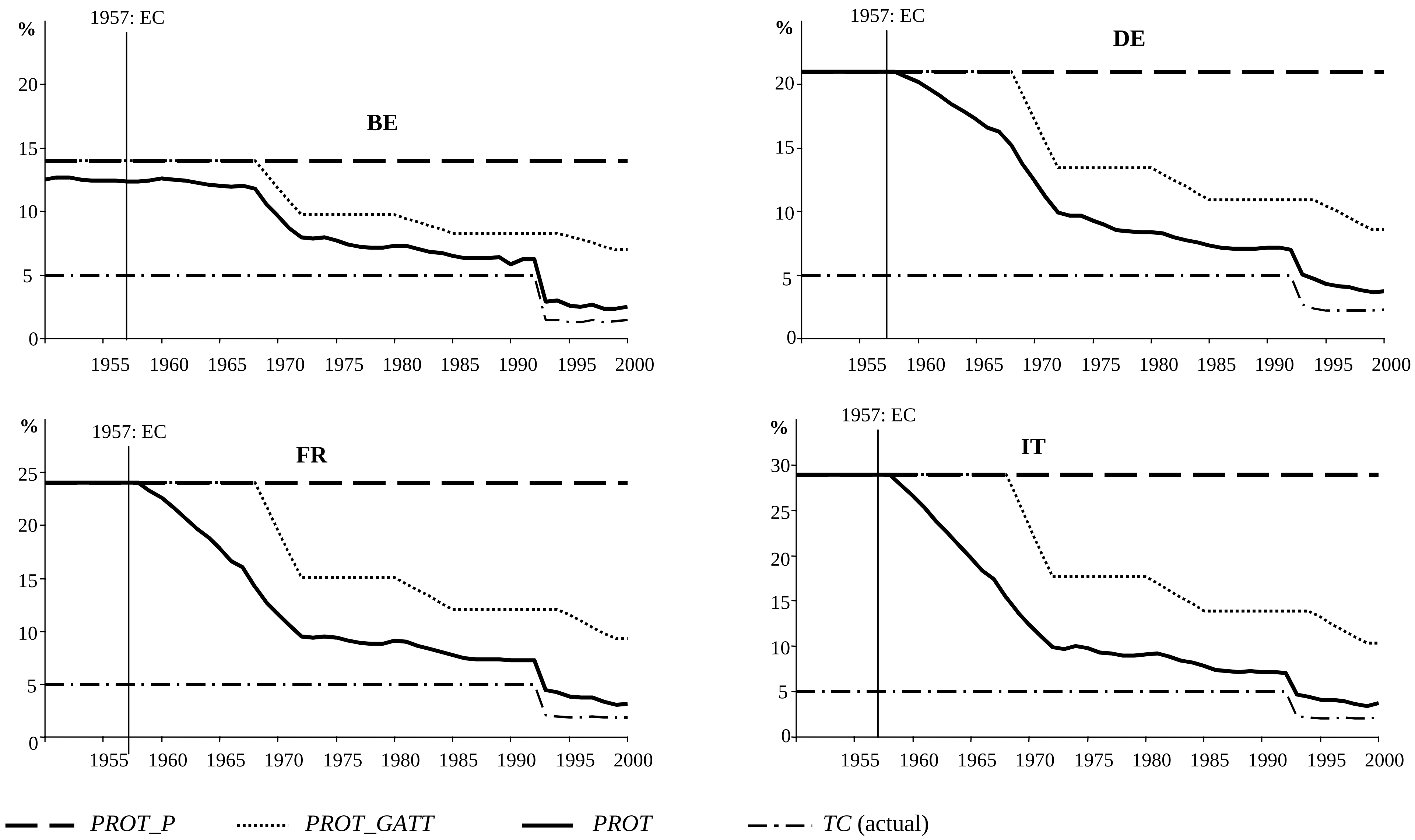


Figure A1 (continued) – *Indices of protectionism of the EU member states under alternative scenarios*

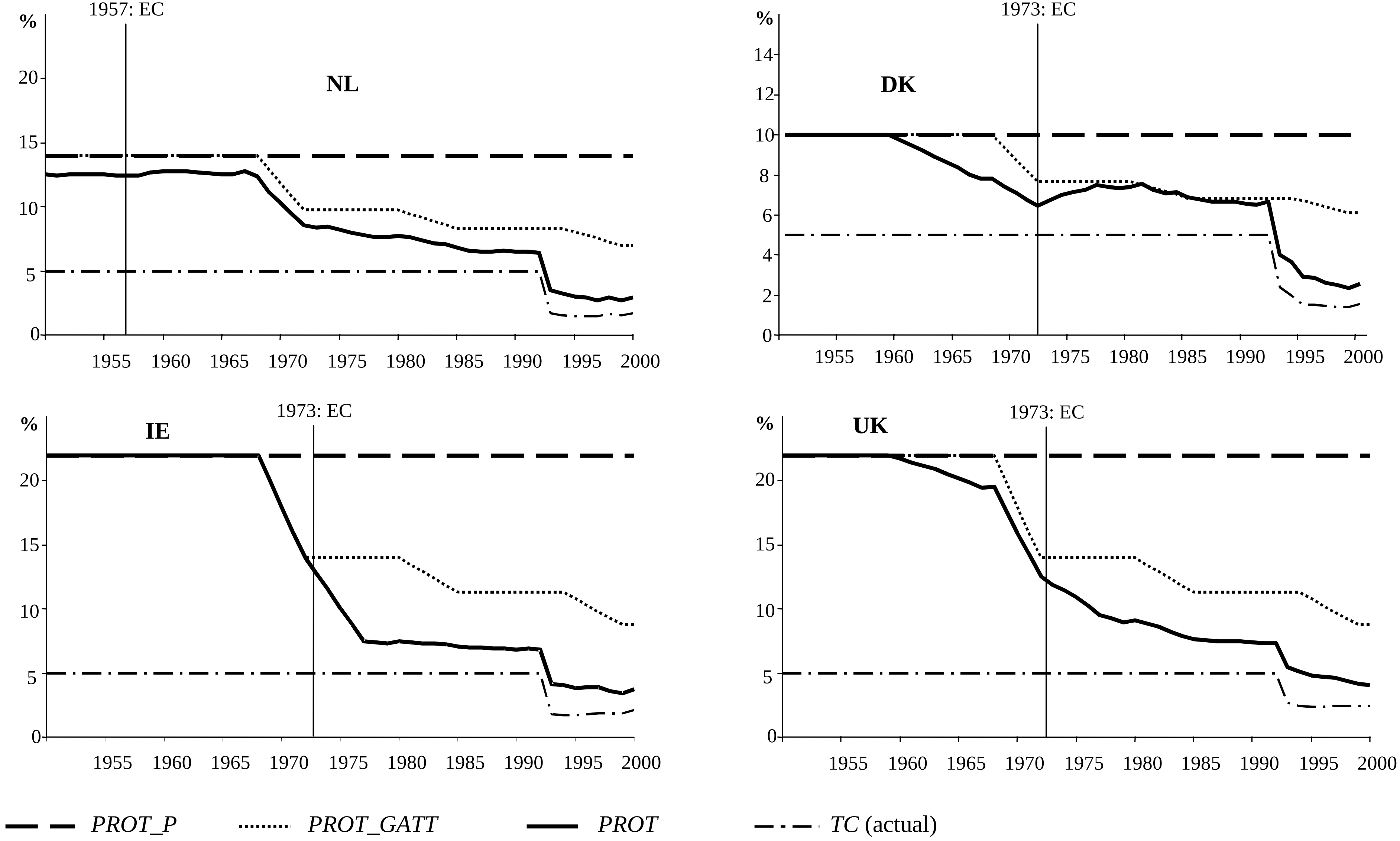


Figure A1 (continued) – *Indices of protectionism of the EU member states under alternative scenarios*

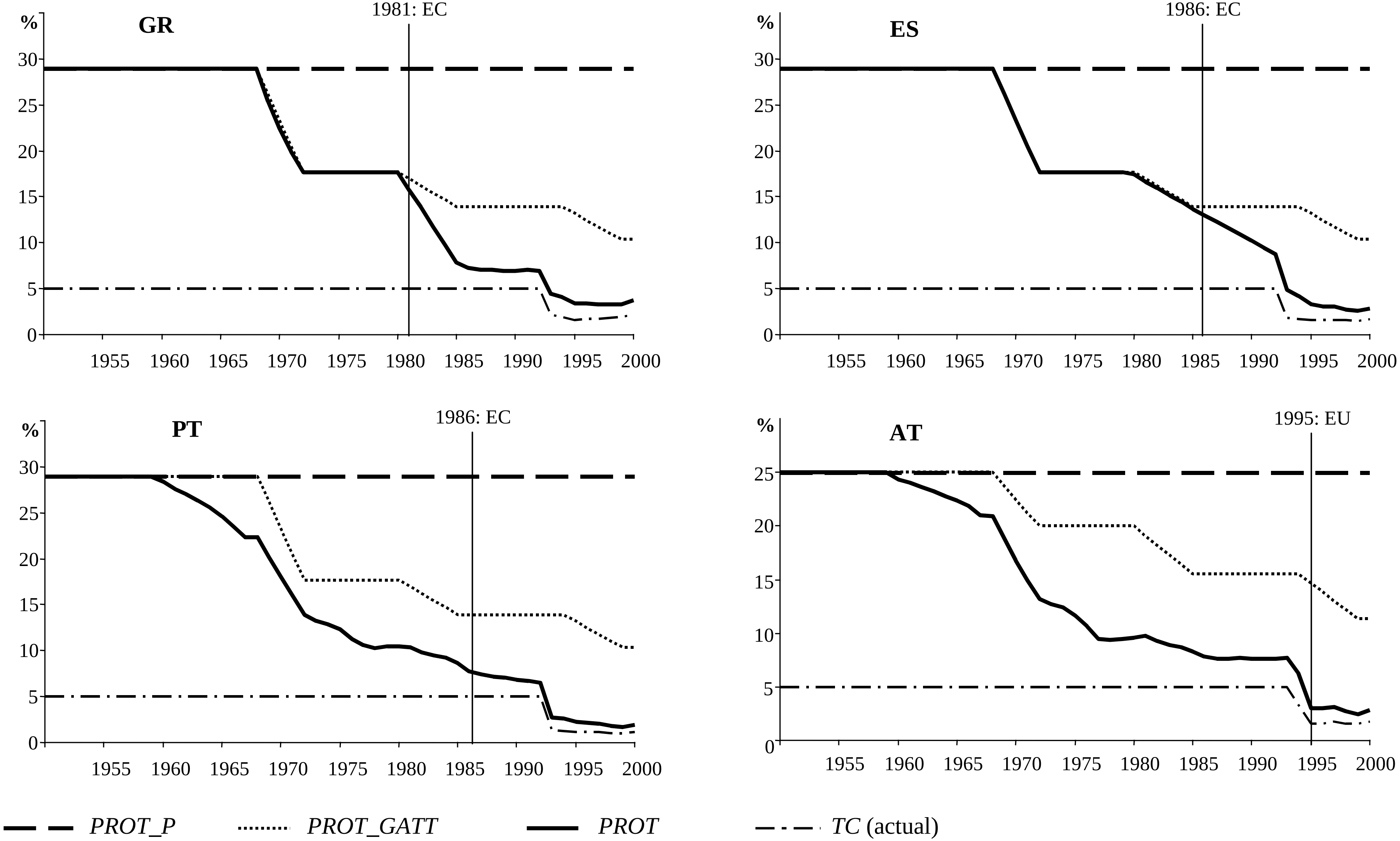


Figure A1 (continued) – *Indices of protectionism of the EU member states under alternative scenarios*

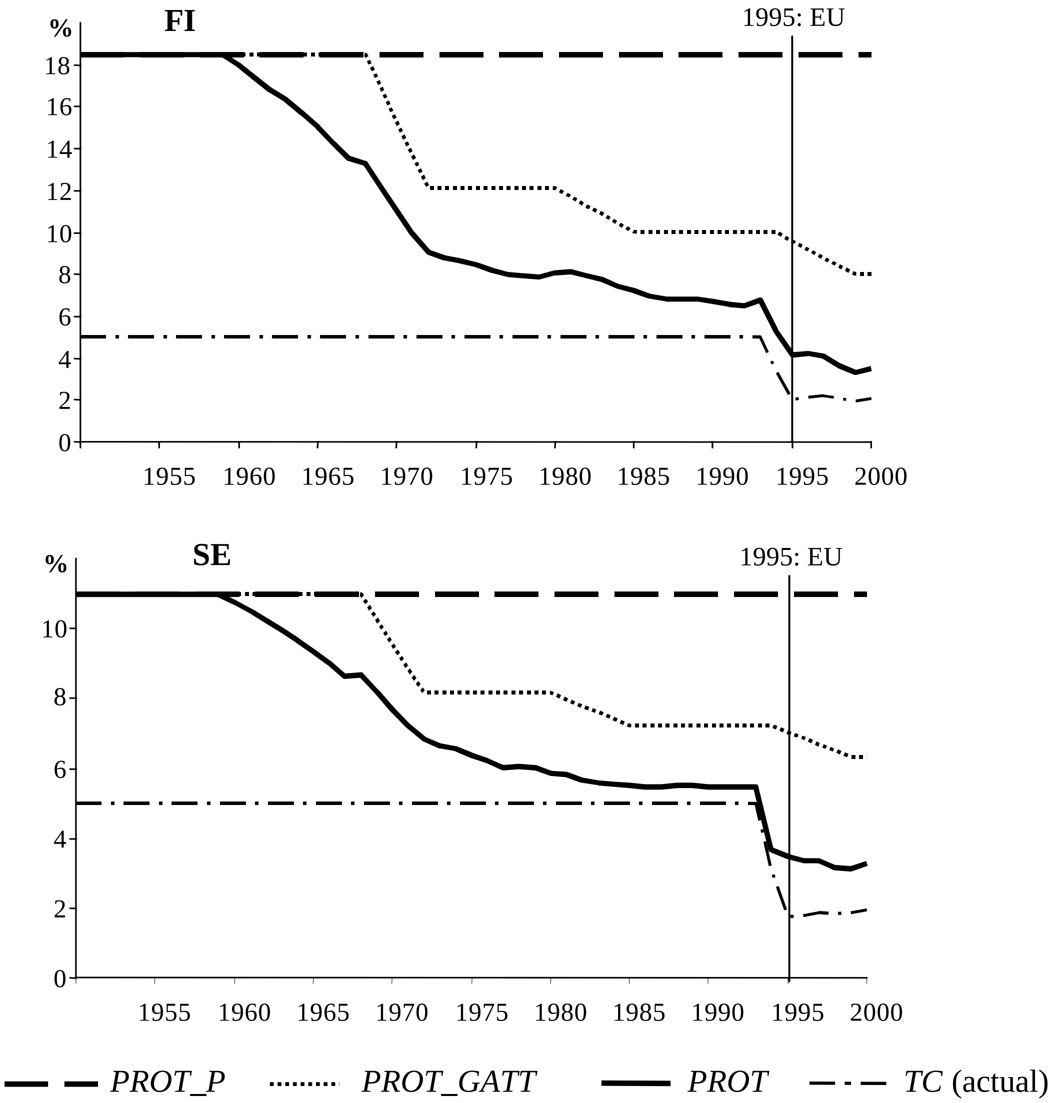


Figure A2 – *Level effect of the EU's economic integration on GDP per employee (Cumulative deviations of GDP per employee from scenario without integration)*

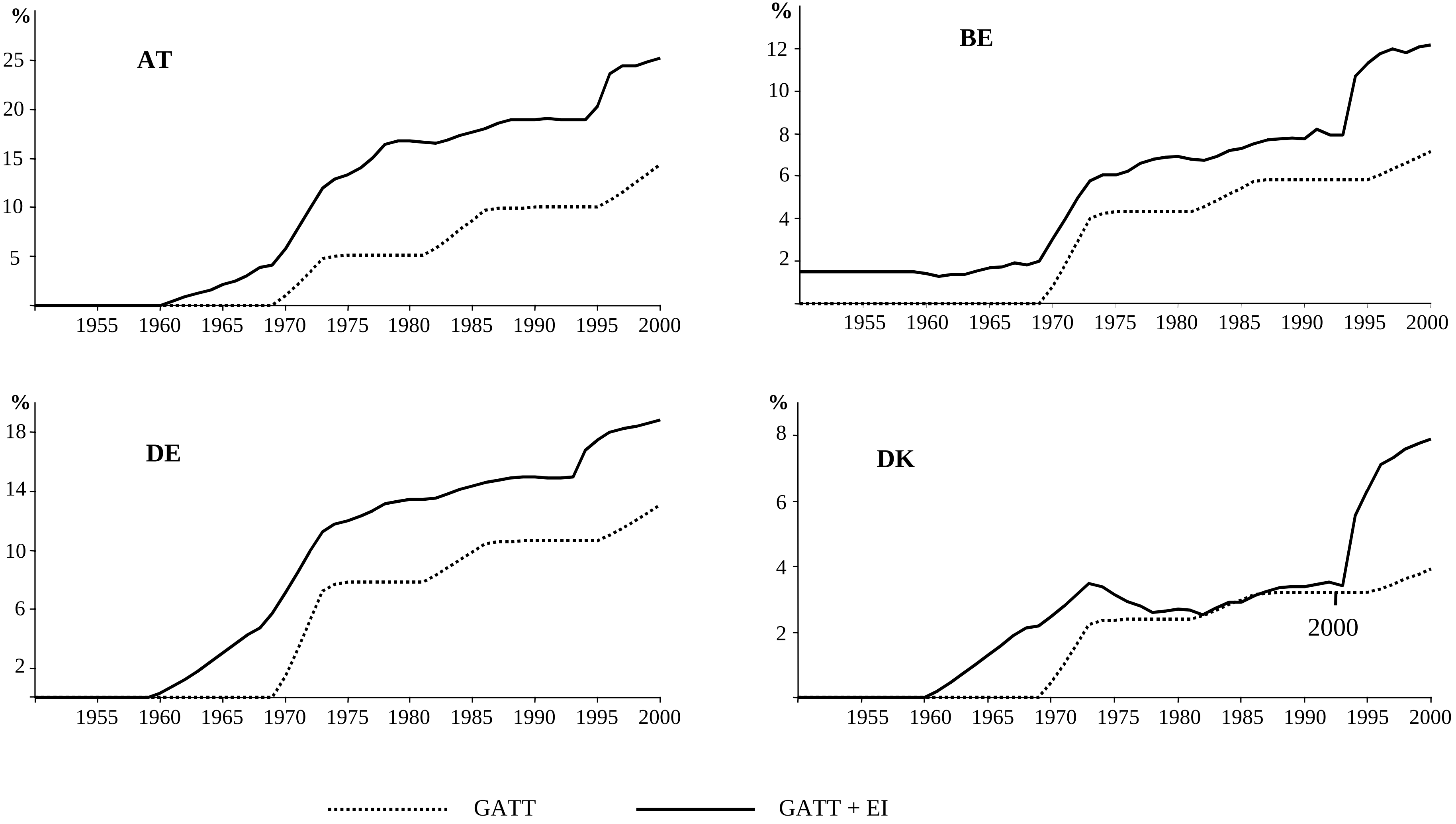


Figure A2 (continued) – *Level effect of the EU's economic integration on GDP per employee (Cumulative deviations of GDP per employee from scenario without integration*)

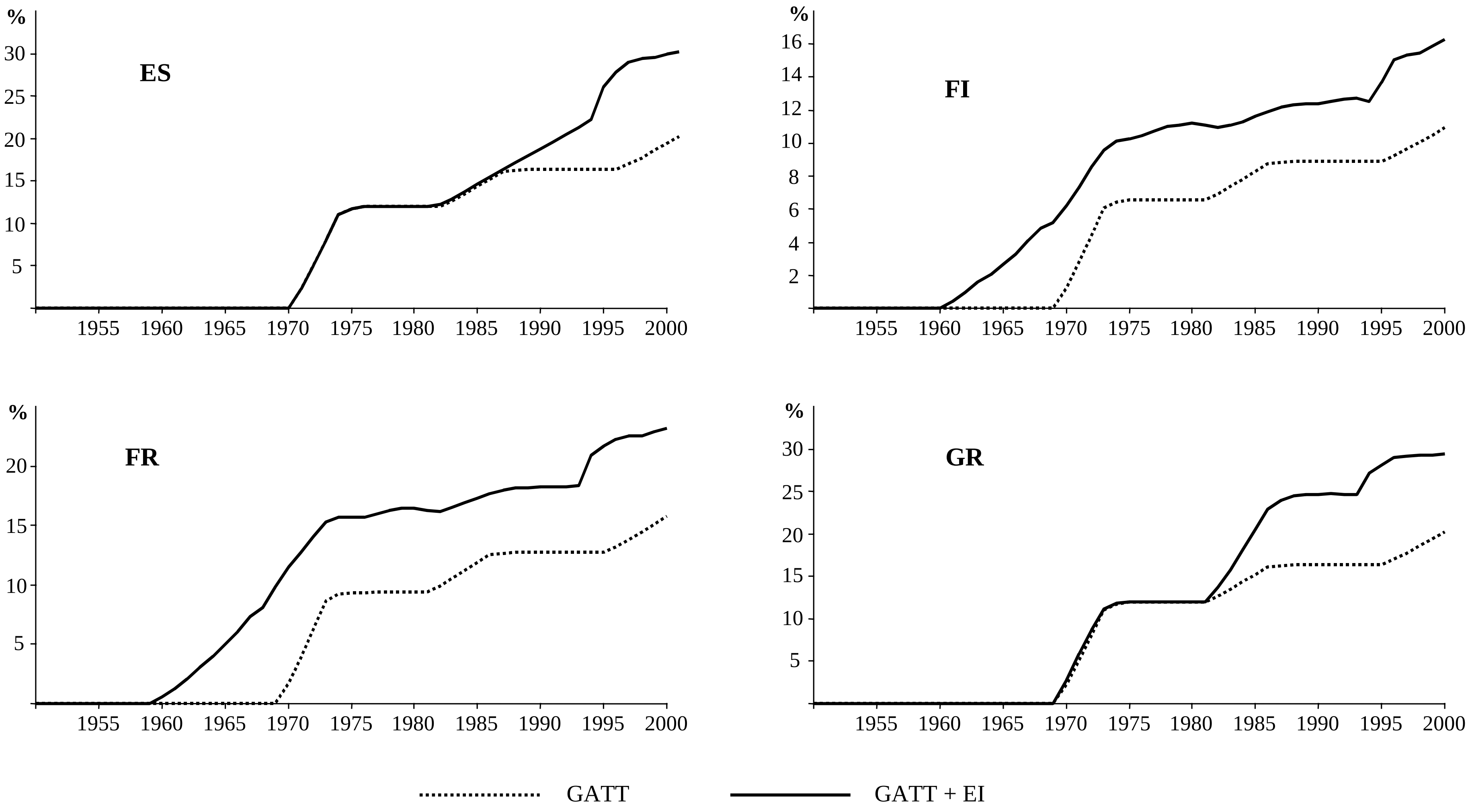


Figure A2 (continued) – *Level effect of the EU's economic integration on GDP per employee (Cumulative deviations of GDP per employee from scenario without integration*)

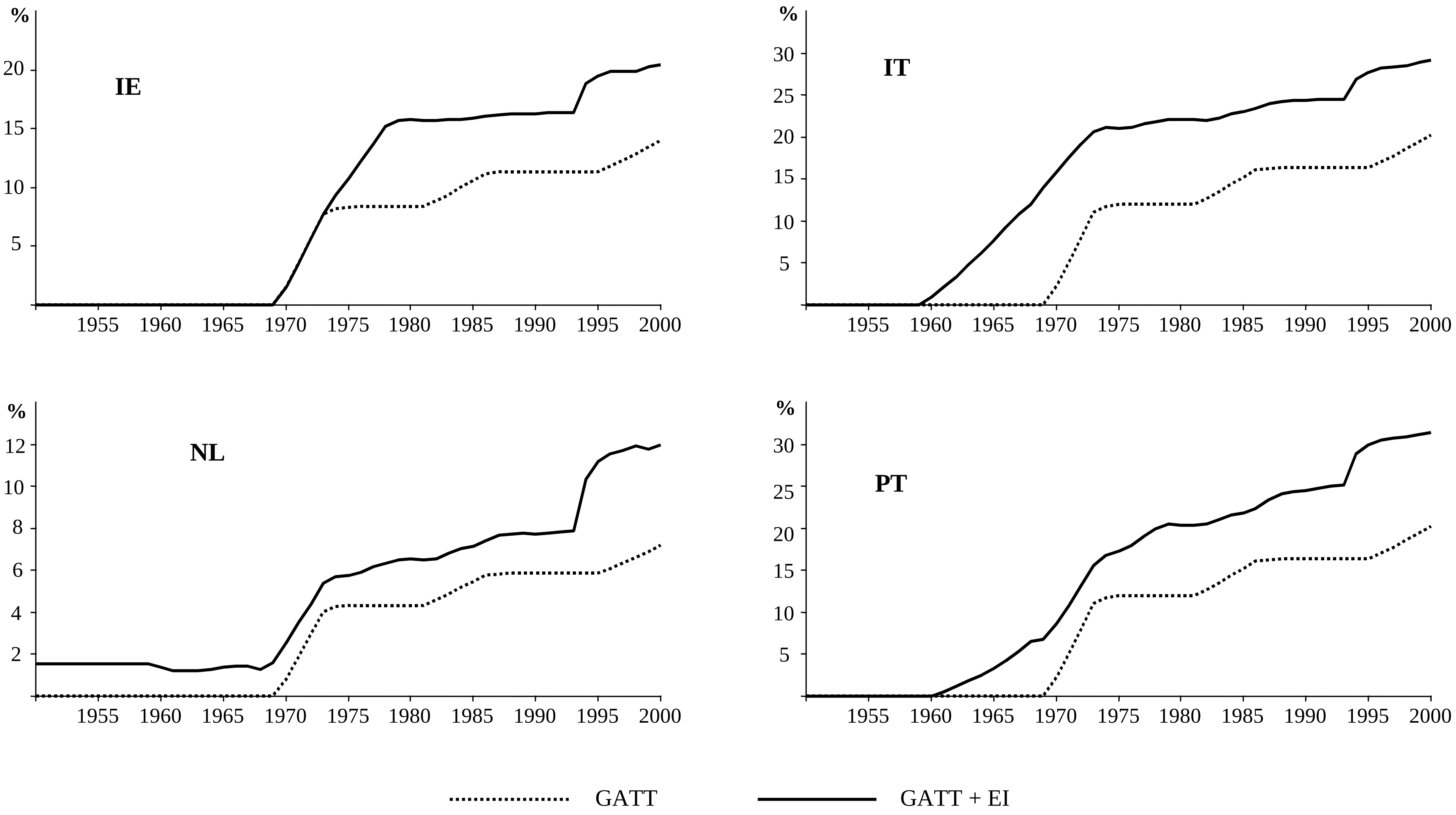
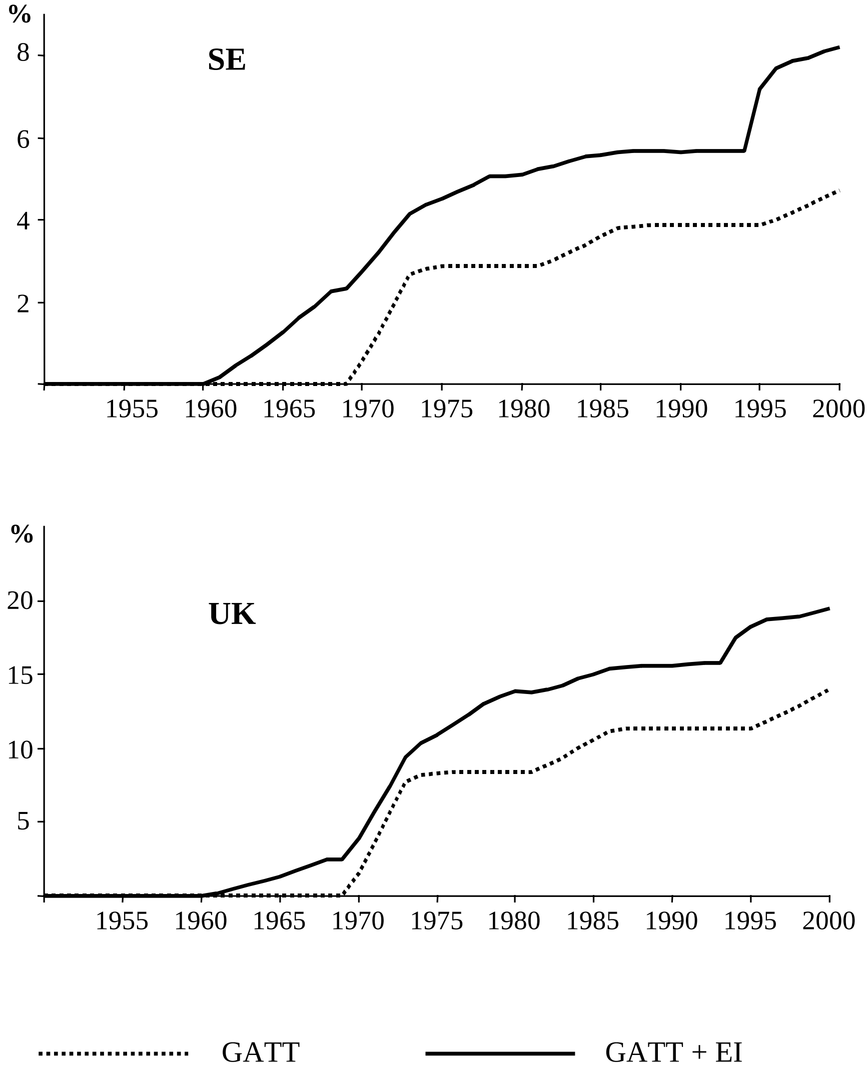


Figure A2 (continued) – *Level effect of the EU's economic integration on GDP per employee (Cumulative deviations of GDP per employee from scenario without integration*)



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