The scale of internal market and the growth effects of regional economic integration. The case of the EU

Tomasz Brodzicki*

August 2006

Abstract:

The recent enlargement of the European Union has led to a relatively significant increase in the size of the internal market. This has once again shifted attention to the issue whether the anticipated positive growth effects of economic integration are related to the scale of the integrated market.

In the present study we utilize several empirical approaches to assess whether increases in the scale of the internal market mainly due two a series of enlargements had a positive, distinguishable and statistically significant impact on the real GDP per capita growth rates of the EU Member States. The study is undertaken for a panel of 27 states (EU15 and twelve countries of the reference group) within a considerable period of 40 years (1960-1999). In contrast to the previous research the current study utilizes indices of relative scale of the integrating block in comparison to traditionally utilized absolute scale indices.

The empirical evidence seems to confirm the initial hypothesis. Increases of relative scale of the regional economic block in comparison to the size of domestic economies mainly due to consecutive enlargements seem to provide significant incentives and are beneficial to the growth-performance of the Member States. The incentives are obviously higher for smaller-scale economies. On the policy arena the deepening of the integration process seems to enhance the benefits associated with integration widening.

Keywords: economic growth, European economic integration, scale effects, cross-sectional analysis, dynamic panel data models, system GMM estimator

JEL codes: F15, F43, C23

Paper to be presented at the ETSG conference in Vienna, September 2006.

*** Contact information:**
Economics of European Integration Department, Faculty of Economics, University of Gdansk
Ul. Armii Krajowej 119/121, 81-824 Sopot, Poland
mail: brodzicki@ibngr.edu.pl

Acknowledgments

I am grateful to Anna Zielińska-Głebocka, Dorota Ciołek, Maria Blangiewicz, Włodzimierz Siwiński and Krystyna Strzała for helpful comments and suggestions.

1. Introduction

One of the most striking features of the regional economic integration process in the European Union is expansion of the block in many dimensions: from the outset in 1958 (creation of EEC-6) the block expanded significantly. Within the period 1960-1999 the number of Member States increased from 6 to 15, the total population increased from 173 to 377 million (2.2-fold) while the real GDP increased in real terms from 1.4 to 8 billion USD (5.6-fold). Within the same period an average real GDP per capita increased 2.6-times with the mean growth rate of real GDP per capita amounting to a considerable 2.8 per cent The growth performance varied significantly between the Member States, however, with apparent absolute beta-convergence taking place (at least at the level of national economies). The successive enlargements significantly expanded the absolute as well the relative scale of the blocks internal market. At the same time the widening of the integration process coincided with a gradual process of integration deepening, however, its dynamics hasn't been smooth. All in all with the period of 40yrs the nature of the Community changed significantly from an incomplete free trade-area to a fully-fledged internal market (despite the still-existing obstacles) with a single monetary and exchange rate policy introduced in the majority of the member states. Abolition of barriers to the free flow of goods, services and factors of production should amplify the possibility to utilize the benefits associated with larger internal market.

Both from theoretical perspective and the expansion of the size of the regional block cannot be fully neutral to the process of economic growth. In general one could expect the gains from membership in a regional integration arrangement (trade block) to rise with the absolute or relative size of the block (Baldwin 1993) - the character of the benefit being the major issue. Depending on the theoretical model it could lead to temporary increase in the growth rates (and thus cause a level effect – medium-term increase in the level of general welfare) or/and to permanent increase in the average growth rates (rate of growth effects) with tremendous consequences in the long-run. The so-called new growth theory models (in particular those with scale effects) can accommodate both effects while it is impossible in the traditional neoclassical framework.. It is worth to note, however, that Badinger (2003) points out that the existence of the permanent growth effect depends on rather implausible assumptions distant from the real-world facts.

The body of theoretical literature dealing with potential growth effects of economic integration in particular and the growth of open-economies in general is rather substantial. Review of this literature gives rather a blurred picture. Various modeling approaches lead to conflicting results and there is no agreement not only on the direction or the transition channels but on the mere existence of the growth effect of economic integration[1]. The matter being at least for the time being unresolved and the complexity of the process is rather unlikely to allow for creation of all-embracing model. One can observe, however, a tendency towards adopting more complex modeling approaches bringing the models closer to reality (for instance taking into account three economies within the structure of the model which allows for discriminatory effects of regional block formation).

Some of the theoretical models clearly refer to the scale of the integrated market and utilization of its potential as one of the sources of the growth effect. Bretschger and Steger (2004) claim that economic integration affects growth mainly through two different channels: the scale-effect

[1] One could mention the following: Baldwin (1989 and 1992), Baldwin and Forslid (2000), Bretscheger and Steger (2004), Deardorff and Stern (2002), Devreux and Lapham (1994), Haveman et al. (2001), Krugman and Venables (1993), Mazumdar (1996), Casella (1996), Rivera-Batiz and Romer (1991, 1994), Waltz (1997a, 1997b, 1998), Willenbockel (1998 and 2001), Badinger (2003), Bretschger and Steger (2004).

channel and the factor-reallocation channel. The effects of the factor-reallocation channel in their simple growth model are rather ambiguous while the scale of the integrating block of countries matters as its increase can lead both to rate of growth as well as level effects. It is worth stressing that in R&D based endogenous growth models the scale of the R&D sector plays a key role (for instance Rivera-Batiz and Romer 1991, Rivera-Batiz and Xie 1993, Feenstra 1996). In others the role of the scale of the economy more indirectly affects the growth performance of individual Member States.

Furthermore, majority of existing models generate asymmetric effects – the scale of the economy playing an important role similarly to the structure of the economy (Waltz 1997a, 1998). For instance Casella (1996) advocates that initially smaller economies are likely to benefit more from the integration process than the larger economies due to smaller relative scale.

From theoretical perspective both the absolute as well as relative scale of the integrating economies and of the internal market plays an important role. The subsequent analysis will be devoted to empirical investigation of impact of the relative scale of the internal market

The paper is organized as follows. Section 2 reviews the results previous of previous empirical studies on the growth effects of regional economic integration. The subsequent section describes the data set and the econometric framework and is followed by a discussion of the findings. The final section concludes.

2. Previous empirical research

Several empirical studies on the impact of economic integration on growth in general and of integration within the EU in particular have been conducted so far. The studies have utilized various econometric approaches. These have included: time-series analysis (e.g. Landau 1995, Vanhoudt 1999), standard growth regressions (e.g. Henrekson et al. 1996), panel data models (e.g. Torstensson 1999, Brodzicki 2003) as well as dynamic panel data models (e.g. Badinger 2001, Brodzicki 2005, 2006). Potential growth effects have been analyzed both directly and indirectly through investigation of potential linking channels.

As in the case of theoretical modeling, results of empirical studies conducted to date are rather inconclusive. Some studies point to existence of positive and statistically significant long-term effect of membership in the European Union either of direct or more frequently of indirect nature (two-chain effect, for instance Henrekson et al. 1996, Italianer 1994, and Torstensson 1999). However at the same time results of other studies speak against existence of significant (permanent) growth effects related to the membership in the EU (for instance Landau 1995, Badinger 2001, and Vanhoudt 1999). Some of the studies identify important level effects (for instance the aforementioned study of Badinger 2001).

Empirical results are sensitive and seem to depend to a large extent on: the chosen sample, methodological approach followed or adopted (cross-section analysis, time series analysis, panel data models) selection of conditioning set of variables, the use of variables for integration. The majority of empirical studies have utilized a simple dummy variable as a proxy for the membership in regional economic arrangement. Although straightforward the use of a dummy variable for membership especially in cross-sectional setting is unsatisfactory - a dummy variable cannot reflect the complex nature of the economic integration process – this applies in particular to the European Union with its distinctive non-linear deepening and widening (Brodzicki 2005, 2006). Thus the use of other, more complex proxies for different aspects of the integration process seems to represent an only solution Acknowledging this researchers have utilized a number of other economic integration variables among them these proxing for the impact of the scale of the internal market. For instance, Crespo-Cuaresma et al. (2002) have utilized absolute indices for scale of the integrated market as measured by logarithm of total population, real gross domestic product and labor force in panel data setting. The results they obtained, however, speak against the existence of statistically significant impact of the scale of the integrated economy on the growth of the EU Member States.

The insignificance of absolute scale of the internal market for growth of the MS is rather surprising and not in line with majority of formal theoretical models as well as general expectations. Does relative scale as postulated for instance by Baldwin (1993) matters? This is the question behind the following empirical analysis utilizing relative scale indices as proposed by Brodzicki (2003, 2005).

3. Empirics

3.1. The sample

The sample includes 27 national economies within the period 1960 to 1999. The sample along cross-sectional dimension can be divided into two subgroups – members of the European Union (EU 15) and the reference group of twelve highly or relatively highly developed economies – present member states of the OECD and Israel[2]. A pragmatic decision has been made to treat Germany as Federal Republic of Germany till 1990 – and than as unified Germany from 1991 onwards. The principal source of data is the Penn World Table (PWT) mark 6.1 (Heston et al. 2002). The data on human capital accumulation are taken from the Barro-Lee (2001) dataset (the major problem being that they are provided at 5yr intervals).

In the cross- sectional setting we have a total of 27 observations. For panel data models the period under analysis has been divided into eight consecutive subperiods of equal duration (5 years). It gives in total a balanced data set of 216 observations. In the dynamic setting, however, it has to be reduced to 189 observations.

3.2. Relative scale indices

Variables reflecting the scale of an integrated market typically enter estimated empirical models as logarithms of some absolute measures of the scale such as real gross domestic product, total population or geographic area. To our knowledge none of the empirical studies in the literature of the subject so far (apart from Brodzicki 2003, 2005) have utilized relative scale measures portraying the factor by which the integrating market exceeds the domestic market of the given member state. We have to stress here that to a certain degree these indices approximate the incentives for entrepreneurs who perceive the scale of large internal market through comparison to their respective national economy (off course this to a large extent depends on spatial perception of individual markets).

The two principal indices have the following structure:

$$[1]\ \text{EU\_SCALE(GDP1)}_{i,t} = \frac{\sum_i \text{GDP}_{i,t}}{\text{GDP}_{i,t}}$$

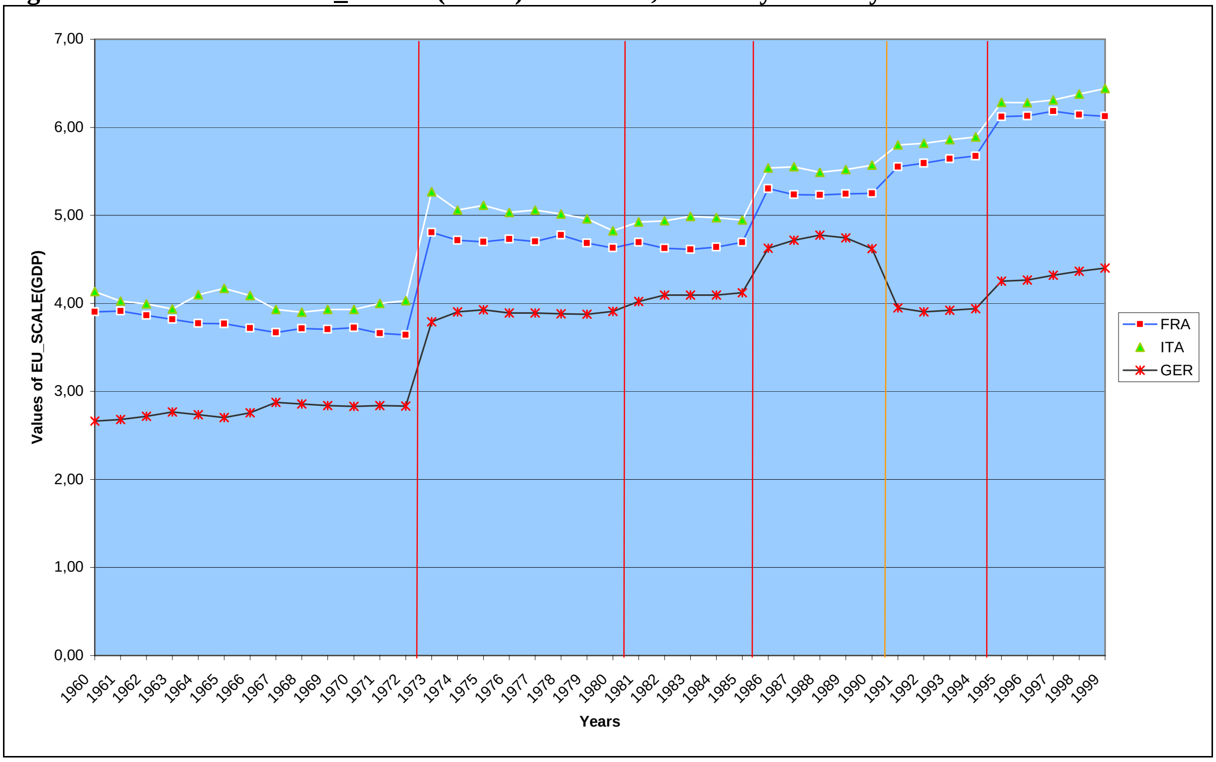
[2] These include: Australia, Canada, Japan, South Korea, New Zealand, the USA, Mexico, Switzerland, Turkey, Island, Norway and finally Israel.

$$[2]\ \ EU\_SCALE(GDP\,2)_{i,t} = \frac{\sum_{i} GDP_{i,t}}{GDP_{i,t}} - 1$$

GDP is measured as real GDP in constant prices. The second index, as can be clearly seen, takes out the impact of the domestic economy on the total scale of the integrated market. The indices for total population (EU_SCALE(POP1) and EU_SCALE(POP2) have the same and thus are not presented here. In cross-sectional setting the variables enter the regressions as 40yr-long averages of the indices and in the panel data setting these are respectively 5yr–long averages. It is worth to note that for the non-member states the value of the variables is zero.

It is probably worth to make some comments on the evolution of the indices. For instance the value of GDP based index EUSC_GDP2 for Germany, the largest economy in the EU15 group, rises from 1.66 in 1960 to 3.40 in 1999 while on the other extreme for Luxemburg it rises from 388 to 444 respectively. As expected, the relative scale indices for small economies are significantly higher than for the large countries. The index shifts up with consecutive enlargements and at the same time is affected by the rate of growth of the economy/total population. Despite of the general upward trend the index shows distinctive patterns for each of the analyzed Member States (refer to Figure 1) – for instance as could be expected when the growth rates of a country exceed the growth rate of the EU taken as a whole for a considerable period of time the values clearly fall.

Figure 1 The evolution of EU_SCALE(GDP2) for France, Germany and Italy



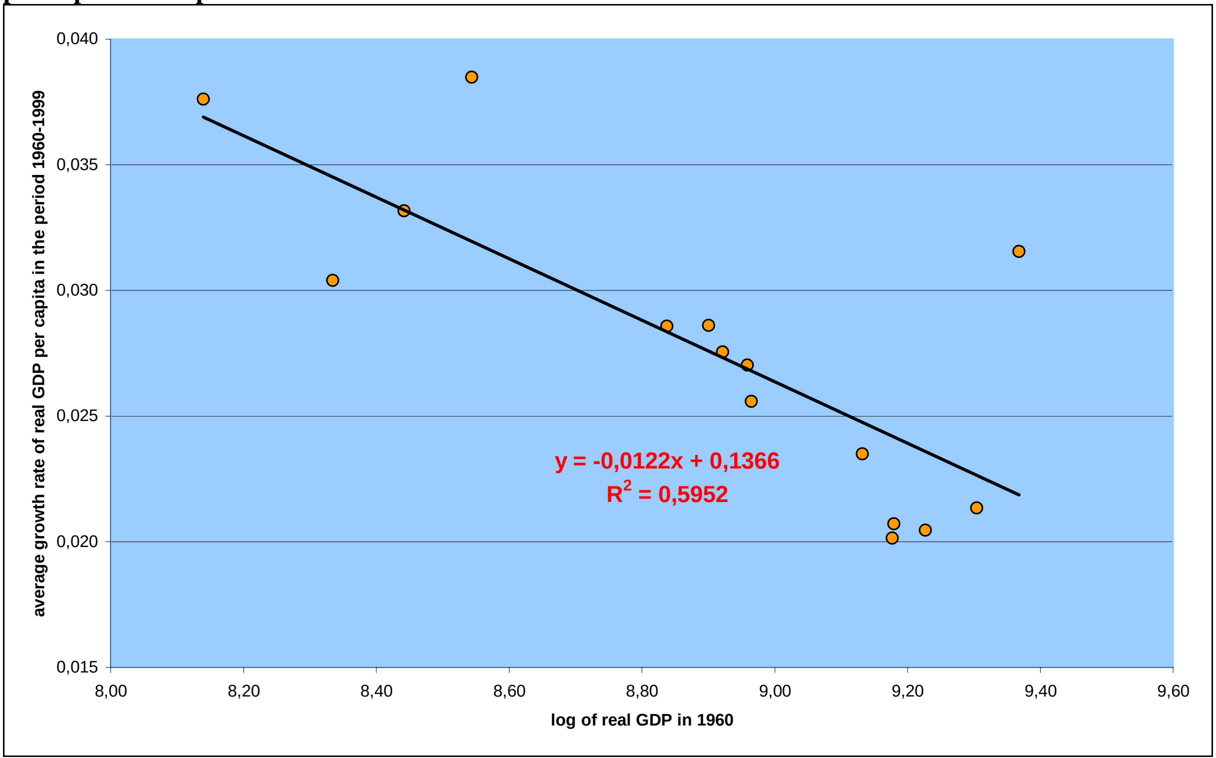
Source: Own calculations. Red vertical lines represent consecutive enlargements, the orange one – unification of Germany.

3.3. Preliminary analysis

From relative point of view, the smaller the scale of an economy the larger should be the benefits associated with its accession to a regional economic arrangement. Integration provides higher incentives to utilize the potential in economies of scale to companies utilized in small countries than those in the large ones. At the macro level, initially smaller countries should grow faster than the originally larger states. From theoretical point of view, at least from the point of view of endogenous growth models with scale effects, however, the initially larger economies should grow at a faster rate.

Just for illustrative reasons we have tried to investigate whether the average long-term growth rates of real GDP per capita correlate with the initial scale economies of the EU-15. The relation is clearly negative (Figure 2) and seems to be statistically significant. It is worth to note that the initial level of GDP per capita in 1960 was independent from the scale of the economy as measured by the real GDP per capita – in other words nor small nor large countries had an initial bonus in terms of level of development.

Figure 2 Relation between the initial scale of an economy in 1960 and average growth rate of real GDP per capita in the period 1960-1999



Source: Own calculations.

The relative scale indices for EU15 member states are affected to a large extent by consecutive enlargements of the block. From theoretical perspective accession of new member states increases the scale of the internal market and thus could lead to growth effects at least in the medium run. Brodzicki (2005) showed that there are no clearly distinguishable growth-effects at least in the medium run related to enlargements of the EU if one takes a look at the data and employs simple statistical methods. In this setting the medium-term outcome of enlargements is simply impossible to be distinguished from the impact of other factors – mainly external conditions such as adverse shocks to the global economy.

Results of the aforementioned study could have been biased, however, by the fact that the analysis was limited to EU15 states only. Thus the analysis has been supplemented (please refer to Table 2) by comparing the mean growth rates of current Member States of the EU (EEC) at a given stage of the integration process to other countries in the analyzed group. Furthermore, as the analysis could be biased through consecutive accessions of new MS we decided in the second step to keep both the EU-sample (original six MS) and the countries in the reference group (countries that haven't been full member states of the EU (EEC) within the analyzed period) constant. In both settings the results of the two means tests indicate a lack of statistical difference between the means for the MS and the reference group. The expected medium-term effects related to the increases in the scale of the internal market are not evident. The expected positive effect of membership in the EU is not evident as well.

The above analysis off-course can only be treated as initial and has been done for illustrative purposes only – the use of more elaborated techniques is necessary. We have to utilize more advances econometric tools. The subsequent econometric investigation has been divided into three consecutive steps: we commence with estimation of standard cross-sectional growth regressions (OLS) followed by estimation of traditional panel data models (fixed, random, pooled) and dynamic panel data models (system GMM).

3.4. Econometric estimation – cross sectional growth regression

In the first step of econometric analysis we estimate a set of standard cross-sectional growth models using traditional least squares estimator. The estimated empirical model takes the following form::

[3] $\Delta y_i = \alpha + \beta \ln y_{i,t_0} + \delta X_i + \chi INT_i + \varepsilon_i$ i=1,…,27, where:

α - constant term

Δy_i - dependent variable – average long-term rate of growth of real GDP per capita in the period 1960-1999

$\ln y_{i,t_0}$ - log value of initial GDP per capita level in 1960

X_i - vector of other explanatory variables (conditioning set)

INT_i - proxy for integration

ε_i - error term

In order to be able to compare the results with previous empirical studies we utilized a standard set of explanatory variables: log of initial level of GDP per capita and the conditioning set of the following variables: investment rate, government spending in relation to GDP, the openness ratio (total trade to GDP – broad liberalization proxy), rate of growth of population and a human capital proxy – log of the average years of schooling. The basic specification has been extended by a dummy-variable for the USA that clearly improved the general fit (the USA economy could be considered as a leading global economy with significantly different set of variables determining its growth rates).

The estimates obtained via the traditional OLS approach are presented in Table 3. In columns P1 to P5 we gradually develop the base specification. It is worth to note that apart from government spending all variables seem to have statistically significant impact on the dependant variable. For comparative reasons we decided not to eliminate this variable. In columns P6 and P9 the baseline specification has been extended by addition of relative scale variables – the long-term averages of the indices described above . It is worth to note that the openness index has been dropped as it was highly correlated with the relative scale indices (potential multicollinearity). In all the four cases the coefficients on the relative scale variables are positive and statistically significant at 1 per cent level. They are also of the same magnitude. The general fit as denoted by adjusted R^2 coefficient is high and the F ratios are clearly above the 95 per cent critical values indicating statistical significance of the regressions.

The use of the indices of relative scale of the internal market in the present setting could be said to be biased, however, as we take into account ‘only’ their long-term averages thus we do not take into account changes in the scale of the internal market. Furthermore, the OLS estimates are biased as we do not take into account the dynamic nature of the growth process. One of available solutions is to use panel data models instead as they combine time series and cross sections. According to Ciecieląg and Tomaszewski (2003) panel data models bring also a number of advantages to econometric estimation of a model in comparison to cross-sectional approach.

3.5. Panel data models

Acknowledging the bias in the OLS estimation of standard growth regressions we move to panel data models. We take into account and test three possible versions of models: fixed effects models, random effects models and the restricted (pooled) model with single overall constant term. In particular, we expected that statistically significant individual fixed effects will appear. In order not to make an a priori assumption on the character of the effects we utilize a formal decision procedure to choose the most appropriate version of the model[3]. In all the analyzed cases the procedure points to the pooled specification (OLS estimator) – in none of the models statistically significant fixed or random effects are present.

The estimation results are given in Table 4. As was the case in the above cross-sectional analysis, specifications F(1) to F(5) slowly develop the baseline specification. In the next four specifications relative scale indices are introduced on an individual basis. Once again the openness index has to be dropped out. It turns out that coefficients on relative scale variables both measured by total population and real GDP have positive signs and are statistically significant at least at the 5 per cent significance level. The relative scale of the internal market seems to matter for growth performance of individual Member States after controlling for some other growth-determining factors. The impact of consecutive enlargements leading to increase in both absolute and relative scale of the internal market is positive.

We have to acknowledge, however, that the obtained results could potentially be biased as once again the estimated models do not take fully into account the dynamic nature of the growth process itself. Therefore, in order to obtain more accurate results in the next subsection we construct dynamic panel data models and estimate them using more elaborated econometric techniques. Bond, Hoeffler and Temple (2001) proposed to use within this setting a more informative set of instruments provided within the framework of the system GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998). Following their recommendations we have decided to utilize this estimation technique (system GMM estimator is available in STATA's xtabond2 module). The use of system GMM estimator in comparison to GMM difference estimator (as utilized for instance by Badinger 2001, 2003) has been proven to produce more efficient estimates (Capolupo 2005).

3.6. Dynamic panel data models

The general structure of the estimated dynamic panel data model is the following:

[4] $\ln y_{it} = \alpha + (1-\beta)\ln(y_{i,t-1}) + \delta X_{it} + \chi INT_{it} + \eta_i + v_t + u_{it}$, where

$\ln y_{it}$ - log of real GDP per capita at year t

X_{it} - matrix of other explanatory variables (conditioning set, dependent on given specification)

INT_{it} - matrix of integration proxies

[3] The procedure frequently utilized in the empirical literature is based on the results of the following tests: F-test on fixed effects, the Breusch-Pagan LM test and the Hausman's specification test.

η_i - individual fixed effect for country i

v_t - individual fixed effect for period t

u_{it} - independent error term

The use of a two-step system GMM estimator, considered to give unbiased estimates in dynamic panel data setting (Bond et al. 2001), limits the total number of observations for each economy to 7. This gives the total data set of 189 observations.

Once again we first begin by estimation of the basis specification of the model (results are given in Table 5). In columns 1 to 5 the basic specification is gradually extended through addition of consecutive explanatory variables. We have to point out that at least at the 5 percent level of significance, all explanatory variables, apart from the rate of growth of population (N), have statistically significant influence on the growth rate of real GDP per capita. At the same time some of them display unexpected signs. This applies in particular to a human capital proxy – (LNAYS). It is worth to note that consecutive extensions to the basic specification lower the coefficient on lagged GDP per capita level – this implies a higher rate of conditional convergence when more structural variables are included. Coefficient on lagged GDP per capita is statistically significant at 1 per cent level and the variable seems not to be sensitive to changes in the set of explanatory variables. In all cases the impact of the investment rate on growth is statistically significant at the 1 per cent and the coefficient is estimated at 0.9. The impact of government spending as share of GDP (GOV) on growth in models D2 do D4 is statistically significant and as expected the coefficient has a negative sign. Greater openness of an economy as measured by the openness ratio (OPEN – value of trade to country's GDP) seems to beneficial to growth performance.

Finally, in models D6 and D7 the basic specification has been augmented with population-based variables EUSC_POP1 and EUSC_POP2 respectively. It is worth to note, that once again the OPENK variable was extracted from the base specification as it could biased the estimation of coefficients on variables of interest to us. The estimated coefficients suggest positive and statistically significant impact of relative scale at the 1 per cent level of statistical significance. In the subsequent four models (D8-D11) the modify baseline specification was extended with EUSC_GDP1 and EUSC_GDP2 variables. It turns out again that coefficients on relative scale variables measured by t real GDP have positive signs and are statistically significant at the 5 per cent significance level. The scale of the EU internal market relative to the size of the member-states' economies matters for growth. In other words, economic integration process within the framework of the EU seems to positively affect the growth rates of the Member States. There seems to be some empirical support for the existence of the scale-effect channel.

4. Conclusions

The objective of this paper was to assess whether the shifts in relative scale (size) of the internal market could be responsible for integration-related growth effects. It is worth to note that the paper has not been intended to provide a formal empirical proof of the scale-effects channel as such. A formal proof would require empirical investigation of a formalized theoretical model which hasn't been the case in this study.

The results we have obtained seem to support the hypothesis that enlargements of the European Union through increases in the scale of its internal market brought about positive growth effects. Their nature is however rather of temporary than permanent nature.

Furthermore, we can conclude that in comparison to empirical studies utilizing simple dummy variables for membership the use of more complex measures of integration can be perceived as important advancement by better depicting and taking into account the complexity of the process.

Several potential extensions of the study could be foreseen. First of all, the empirical analysis should be applied to other advanced regional economic integration blocks such as NAFTA or MERCOSUR thus allowing for generalization of the results. Furthermore, the sensitivity of the obtained results should be tested on an extended set of countries (the reference group). In addition, the absolute measures of scale should be tested against relative measures of scale in much direct way. More emphasis could be put on the interplay between the scale variables and distance to other markets thus spatial considerations envisaged by the new economic geography models could be formally introduced. Furthermore, the scale-effect channel could be empirically tested against other channels – such as trade-induced investment-led channel or the factor-reallocation channel. This would require empirically testing of an all-embracing theoretical model with a number of restricting structural constraints. Finally, new opportunities created by advances made in econometric methodologies should be fully utilized. As Capolupo (2005) puts it: '*since the empirics of growth is continuously improving its statistical tools and methods of analysis, we should expect further advances on this front'*. One of the envisaged extensions to the present study will be the use of elaborated stationarity tests for panel data models in order to shed more light on the long-term (permanent) nature of the growth effects.

References

Arellano M., Bond PP. (1991), Some Tests for Specification of Panel Data, *The Review of Economic Studies* Vol. 58, pp. 277-297.

Arellano M., Bover O. (1995), Another look at the instrumental variable estimation of error-components models, *Journal of Econometrics* Vol. 68, pp. 29-52.

Badinger H. (2001), *Growth Effects of Economic Integration – The Case of the EU Member States* (1950-2000), IEF Working Papers, Nr. 40, December 2001.

Badinger H. (2003) *Wachtumseffekte der Europeaischen Integration*, Research Institute for European Affairs Publication Series Vol. 21, Springer Wien NewYork.

Baldwin R. E. (1989) The growth effects of 1992, *Economic Policy*, pp. 248-281.

Baldwin R. E. (1992) Measurable Dynamic Gains from Trade, *Journal of Political Economy* Vol. 100(1), pp.162-174.

Baldwin R. E. (1993) *A Domino Theory of Regionalism*, NBER Working Paper no. 4465.

Baldwin R. E., Forslid R. (2000) The Core-Periphery Model and Endogenous Growth: Stabilizing and Destabilizing Integration, *Economica* Vol. 67, pp. 307-324.

Barro R. J., Lee J.W. (2001) International Data on Educational Attainment: Updates and Implications, Oxford Economic Papers, Vol. 53, pp. 541-563.

Blundell R., Bond PP. (1998) Initial conditions and moment restrictions in dynamic panel data models, *Journal of Econometrics*, Vol. 87(1), pp. 115-143.

Bond PP., Hoeffler A., Temple J. (2001) *GMM Estimation of Empirical Growth Models*, web site.

Bretscheger L., Steger T. M. (2004) The dynamics of economic integration: Theory and Policy, *International Economics and Economic Policy* Vol. 1/2004, pp. 1-16.

Brodzicki T. (2003) *In search for accumulative effects of European economic integration*, paper presented at the 2nd Annual Conference of the EEFS, May 2003, University of Bologna, Bologna.

Brodzicki T. (2005) *New Empirical Insights into the Growth Effect of Economic Integration within the European Union*, paper presented at the 4th Annual Conference of the EEFS, May 2005, University of Coimbra, Coimbra.

Brodzicki T. (2006) *Efekty akumulacyjne procesu regionalnej integracji gospodarczej na przykładzie Unii Europejskiej,* PhD dissertation, University of Gdansk, Poland.

Capolupo R. (2005) *The New Growth Theory and Their Empirics,* Discussion Paper in Economics, University of Glasgow no.04/2005.

Cassella A. (1996) Large Countries, Small Countries and the Enlargement of Trade Blocs, *European Economic Review*, Vol. 40, pp. 389-415.

Ciecieląg J., Tomaszewski A.(2003) *Ekonometryczna analiza danych panelowych*, Wydział Nauk Ekonomicznych UW, Warszawa.

Deardorff A. V., Stern R. M. (2002) EU Expansion and EU Growth, RSIE Discussion Paper no. 487.

Devereux M.B., Lapham B. J. (1994) The Stability of Economic Integration and Endogenous Growth, *Quarterly Journal of Economics,* Vol. 109, pp. 299-305.

Haveman J. D., Lei V., Netz J. PP. (2001) International Integration and Growth: A Survey and Empirical Investigation, *Review of Development Economics* Vol. 5(2), pp. 289-311.

Henrekson M., Torstensson J., Torstensson R. (1996) *Growth Effects of European Integration*, CEPR Discussion Paper Series no. 1465.

Heston A., Summers R., Aten B. (2002) *Penn World Table Version 6.1.*, CICUP.

Italianer A. (1994) Whither the Gains from European Economic Integration?, *Revue Économique*, Vol. 45 (3), May, pp. 689-702.

Krugman P., Venables A. (1993) *Integration, Specialization, and Adjustment*, NBER Working Paper no. 4559.

Landau D. (1995) The Contribution of the European Common Market to the Growth of Its Member Countries: An Empirical Test, *Weltwirtschaftliches Archiv* 13(4), pp. 774-782.

Mazumdar J. (1996) Do Static Gains from Trade Lead to Medium-Run Growth?, *Journal of Political Economy*, Vol. 104(6), pp. 1328-1337.

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

Rivera-Batiz L. A., Romer P. M. (1994) Economic Integration and Endogenous Growth: An Addendum, *Quarterly Journal of Economics* Vol. 109(1), pp. 307-308.

Rivera-Batiz Luis A., Xie Danyang (1993) Integration Among Unequals, *Regional Science and Urban Economics*, Vol. 23, s. 337-354.

Torstensson R. M. (1999) Growth, knowledge transfer and European integration, *Applied Economics* Vol. 31, pp. 97-106.

Vanhoudt P. (1999) Did the European Unification Induce Economic Growth? In search of Scale Effects and Persistent Changes, *Weltwirtschaftliches Archiv* Vol. 135(2), pp. 193-219.

Waltz U. (1997a) Growth and Deeper Regional Integration in a Three-Country Model, *Review of International Economics* Vol. 5(4), pp. 492-507.

Waltz U. (1997b) Dynamic Effects of Economic Integration: A Survey, *Open Economies Review* Vol. 8(3), pp. 309-326.

Waltz U. (1998) Does an enlargement of a common market stimulate growth and convergence?, *Journal of International Economics* Vol. 45, pp. 297-321.

Willenbockel D. (1988) Growth Effects of Anticipated Trade Liberalization and the Baldwin Multiplier, Economics Letters Vol.59, pp.231-235.

Willenbockel D. (2001) *Recent Developments in the Predictive Assessment of Dynamic Integration Effects: A Critical Apprais*al, in: C. Paraskevopoulos et al. (eds) *The Asymmetric Global Economy: Growth, Investment and Public Policy*. Toronto: APF Press, pp. 3-25.

Table 1 Economic impact of consecutive enlargements of the EU (EEC)

		I enlargement (1973)	II enlargement (1981)	III enlargement (1986)	IV enlargement (1995)
Population (in mln)	before	193.7	263.1	274.9	351.3
	after	258.0	272.8	323.4	400.5
	change (per cent)	+ 33.2per cent	+ 3.7per cent	+ 17.7per cent	+14.0per cent
Real GDP (in billions of USD)	before	2 703	4 134	4 701	6 088
	after	3 577	4 246	5 264	6 857
	change (per cent)	+ 32.4per cent	+ 2.7per cent	+12.0per cent	+ 12. 6per cent
Average real GDP per capita (pre accession =100)	before	100	100	100	100
	after	99.4	99.0	95.2	98.8
	change (per cent)	- 0.6 per cent	- 1.0 per cent	- 4.8 per cent	-1.2 per cent

Source: Own calculations based on PWT 6.1 and PWT 5.2.

Table 2 Average real GDP per capita growth rates in 5 subperiods and the results of the two means tests

	1960-1972	1973-1980	1981-1985	1986-1994	1995-1999
BEL	0.040	0.021	0.009	0.019	0.018
FRA	0.041	0.019	0.011	0.014	0.016
ITA	0.041	0.026	0.014	0.018	0.013
LUX	0.025	0.002	0.025	0.044	0.037
NDL	0.032	0.013	0.010	0.019	0.025
GER	0.032	0.016	0.012	0.012	0.011
DNK	0.034	0.005	0.026	0.010	0.017
GBR	0.020	0.007	0.023	0.017	0.020
IRL	0.032	0.027	0.013	0.042	0.065
GRC	0.067	0.012	0.000	0.006	0.024
ESP	0.060	0.008	0.007	0.022	0.014
PRT	0.058	0.013	0.002	0.033	0.034
AUT	0.040	0.025	0.014	0.021	0.018
FIN	0.039	0.020	0.020	0.003	0.036
SWE	0.030	0.012	0.020	0.005	0.022
AUS	0.027	0.010	0.010	0.017	0.026
CAN	0.029	0.020	0.011	0.008	0.024
CHE	0.028	0.002	0.008	0.004	0.010
ISL	0.035	0.035	0.004	0.003	0.031
ISR	0.051	0.009	0.005	0.024	0.004
JAP	0.079	0.019	0.021	0.026	0.007
KOR	0.053	0.047	0.054	0.062	0.018
MEX	0.030	0.027	-0.011	0.005	0.022
NOR	0.030	0.035	0.027	0.016	0.022
NZL	0.017	-0.010	0.019	0.003	0.011
TUR	0.028	0.011	0.017	0.014	0.013
USA	0.028	0.017	0.017	0.016	0.025
	1960-1972	**1973-1980**	**1981-1985**	**1986-1994**	**1995-1999**
EU av.	0.035	0.015	0.015	0.017	0.022
RG av.	0.039	0.017	0.014	0.015	0.018
difference	-0.004	-0.002	0.000	0.002	0.004
EU std. dev.	0.006	0.009	0.008	0.012	0.014
RG std. dev.	0.016	0.013	0.014	0.015	0.009
Statistical significance	**lack**	**lack**	**lack**	**lack**	**lack**
	1960-1972	**1973-1980**	**1981-1985**	**1986-1994**	**1995-1999**
EU-6 av.	0.035	0.016	0.014	0.021	0.020
RG-nm av.	0.036	0.018	0.015	0.017	0.018
difference	-0.001	-0.002	-0.001	0.004	0.002
EU-6 std. dev.	0.006	0.008	0.006	0.012	0.010
RG-nm std. dev.	0.017	0.016	0.016	0.016	0.009
Statistical significance	**lack**	**lack**	**lack**	**lack**	**lack**

Source: Own calculations. Tests carried out in STATISTICA.

Table 3 OLS estimates of long-run growth regressions

	(P1)	(P2)	(P3)	(P4)	(P5)	(P6)	(P7)	(P8)	(P9)
Intercept	0.094 (5.76)***	0.094 (5.62)***	0.109 (7.40)***	0.127 (9.31)***	0.155 (9.60)***	0.15 (9.40)***	0.15 (9.40)***	0.152 (9.33)***	0.152 (9.33)***
lny0	-0.01 (-5.58)***	-0.01 (-5.45)***	-0.012 (-7.32)***	-0.014 (-9.25)***	-0.018 (-8.91)***	-0.017 (-8.69)***	-0.017 (8.69)***	-0.017 (-8.61)***	-0.017 (-8.61)***
INV	0.0086 (2.78)***	0.007 (2.73)**	0.008 (3.74)***	0.007 (3.81)***	0.005 (3.00)***	0.005 (3.17)***	0.005 (3.17)***	0.005 (3.00)***	0.005 (3.00)***
GOV		0.00009 (0.052)	0.0008 (0.58)	0.0004 (0.34)	-0.0003 (-0.27)	0.0007 (0.58)	0.0007 (0.58)	-0.0007 -0.62	-0.0007 -0.62
N				-0.356 (-3.12)***	-0.334 (-3.32)***	-0.361 (-3.61)***	-0.362 (-3.62)***	-0.373 (-3.67)***	-0.373 (-3.67)***
OPEN			0.0007 (2.93)***	0.0006 (3.13)***	0.0007 (3.71)***				
lnAYS					0.006 (2.62)**	0.006 (2.45)**	0.006 (2.45)**	0.006 (2.47)**	0.006 (2.47)**
USAD			0.012 (3.13)***	0.012 (3.13)***	0.011 (3.23)***	0.009 (2.73)**	0.009 (2.73)**	0.009 (3.57)***	0.009 (3.57)***
EU_SCG1						0.0002 (3.70)***			
EU_SCG2							0.0002 (3.71)***		
EU_SCP1								0.0002 (3.57)***	
EU_SCP2									0.0002 (3.57)***
R2	0.610	0.610	0.749	0.831	0.876	0.876	0.876	0.872	0.872
R2^	0.577	0.559	0.689	0.780	0.830	0.830	0.830	0.825	0.825
SE	0.0048	0.0049	0.0041	0.0034	0.003	0.003	0.003	0.0031	0.0031
F	18.75	11.98	12.52	16.4	19.15	19.14	19.15	18.47	18.48
DW	2.33	2.34	1.94	2.1	1.69	2.13	2.14	2.13	2.13

Source: Own calculations. Estimation carried out in Microfit within the framework of a research grant BW no. 3480-5-0296-4.

Comments:

a) Value of t-statistic in brackets.
b) Number of observations – 27
c) Significant at *** - 1 per cent. ** - 5 per cent. * - 10 per cent level of significance.
d) R2^ - coefficient of determination adjusted for degrees of freedom
e) SE – standard errors.
f) Test F for statistical significance of specification.
g) In all cases the residual is spherical.
h) DW – value of DW test.

Table 4 Results of estimation of panel data models

	F(1)	F(2)	F(3)	F(4)	F(5)	F(6)	F(7)	F(8)	F(9)
CONST	0.1552 (8.43)***	0.1576 (8.35)***	0.1668 (8.44)***	0.1884 (8.60)***	0.2066 (9.02)***	0.2010 (9.16)***	0.2010 (9.16)***	0.1979 (9.02)***	0.1979 (9.02)***
LNGDP	-0.0186 (-9.53)***	-0.0187 (-9.53)***	-0.0199 (-9.43)***	-0.0219 (-9.61)***	-0.0225 (-9.94)***	-0.0219 (-10.17)***	-0.0219 (-10.17)***	-0.0216 (-10.03)***	-0.0216 (-10.03)***
INV	0.0019 (8.98)***	0.0019 (8.95)***	0.0019 (8.99)***	0.0019 (8.86)***	0.0020 (9.25)***	0.0020 (9.35)***	0.0020 (9.35)***	0.0020 (9.31)***	0.0020 (9.31)***
GOV		-0.0001 (-0.60)	-0.0001 (-0.77)	-0.0001 (-0.32)	-0.0001 (-0.47)	-3.13E-05 (-0.19)	-3.11E-05 (-0.19)	-4.28E-05 (-0.26)	-4.25E-05 (-0.26)
OPEN			4.61E-05 (1.53)	4.25E-05 (1.42)	0.0001 (2.07)**				
N				-0.3516 (-2.19)**	-0.4001 (-2.51)**	-0.4231 (-2.66)***	-0.4237 (-2.66)***	-0.4042 (-2.53)**	-0.4047 (-2.53)**
LNAYS					-0.0075 (-2.44)**	-0.0067 (-2.25)**	-0.0067 (-2.25)**	-0.0065 (-2.19)**	-0.0065 (-2.18)**
EUSC_POP1						2.03E-05 (2.54)**			
EUSC_POP2							2.04E-05 (2.54)**		
EUSC_GDP1								2.25E-05 (2.08)**	
EUSC_GDP2									2.26E-05 (2.08)**
Character of effects	POOLED	POOLED	POOLED	POOLED	POOLED	POOLED	POOLED	POOLED	POOLED
R^2	0.429	0.430	0.436	0.449	0.464	0.469	0.469	0.464	0.464
R^2adjusted	0.423	0.422	0.425	0.435	0.448	0.454	0.454	0.449	0.449
root MSE	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
F-test	79.89	53.22	40.76	34.16	30.12	30.79	30.79	30.14	30.14
F-test for significance of individual effects	1.25 [0.195]	1.31 [0.154]	1.47 [0.074]	1.28 [0.178]	1.10 [0.340]	1.22 [0.225]	1.22 [0.221]	0.89 [0.622]	0.89 [0.620]

Source: Own calculations. Estimations carried out by Maria Blangiewicz in STATA within the framework of a research grant BW n. 3480-5-0296-4.

Comments:

a) Dependent variable – average rate of growth of real GDP per capita calculated for 5yr-long subperiods
b) Number of observations - 216.
c) Significant at *** - 1 per cent. ** - 5 per cent. * - 10 per cent level of significance.
d) Values of R^2 and R^2adjusted
e) Value of t-statistic in brackets ().
f) Values in […] brackets – value of Prob for verification tests
g) Character of effects – based on the outcome of procedure: pooled, FE or RE
h) F-test – value of F-test for significance of specification for pooled and fixed-effects models.
i) In all cases the residuals are spherical.

Table 5 Estimation results of dynamic panel data models with two-step system GMM estimator

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
LNGDP	-0.0985 (-49.04)***	-0.0926 (40.69)***	-0.0919 (46.65)***	-0.1006 (47.79)***	-0.1120 (-77.76)***	0.8823 (79.66)***	0.8822 (79.67)***	0.8837 (64.09)***	0.8903 (66.31)***	0.881 (63.97)***	0.858 (63.90)***
INV	0.0095 (6.03)***	0.0091 (4.90)***	0.0094 (6.15)***	0.0085 (5.90)***	0.0094 (11.28)***	0.0086 (10.35)***	0.0086 (10.35)***	0.0088 (8.03)***	0.0105 (9.95)***	0.0092 (8.47)***	0.0091 (8.61)***
GOV		-0.0042 (-2.29)**	-0.0031 (-2.76)***	-0.0017 (-1.99)**	-0.0005 (-0.71)	0.0008 (1.15)	0.0008	-0.0009 (-0.84)	0.0001 (0.06)	-0.0015 (-1.47)	-0.0004 (-0.50)
OPENK			0.0002 (1.65)*	0.0004 (-2.53)**	0.0005 (3.49)***						
N				0.4418 (-0.49)	-0.2091 (-0.30)	-0.7075 (-1.19)	-0.7135 (-1.20)	-1.0465 (-1.22)	-1.2993 (-1.67)*	-1.1166 (-1.30)	-1.932 (-2.48)**
LNAYS					-0.0652 (-2.84)***	-0.0932 (-4.34)***	-0.0933 (-4.35)***		-0.0531 (-3.36)***		-0.0636 (-4.03)***
EUSC_POP1						0.0001 (5.37)***					
EUSC_POP2							0.0001 (5.41)***				
EUSC_GDP1								0.0001 (2.12)**	0.0002 (3.52)***		
EUSC_GDP2										0.0001 (2.08)**	0.0001 (2.02)**
F test	5189.4	6020.1	3494.6	965.7	3065.57	5871.84	5846.07	33448.0	39310.6	51477.4	61469.0
Hansen's test	26.42	26.53	26.11	24.54	24.82	15.56	15.55	23.68	23.27	22.39	23.24
AB test for AR(1)	0.007	0.007	0.007	0.004	0.006	0.004	0.004	0.006	0.005	0.005	0.005
AB test for AR(2)	0.234	0.300	0.282	0.262	0.237	0.229	0.229	0.253	0.232	0.259	0.251

Source: Own calculations. Estimations carried out by Maria Blangiewicz in STATA with the use of xtabond2 module within of the research grant BW no. 3480-5-0296-4.

Comments:

a) Value of t-statistic in brackets. In accordance with procedure proposed by Arellano and Bond t-statistics were calculated as a division of coefficients obtained from two-step system GMM estimation by mean errors of estimation of the same model estimated with one-step system GMM estimator.

b) Number of observations – 189; depending on model the number of degrees of freedom varies from 182 to 187.

c) Significant at *** - 1 per cent. ** - 5 per cent. * - 10 per cent level of significance.

d) In a dynamic setting the dependent variable is not the growth rate of real GDP per capita but the level of real GDP per capita. One of the explanatory variables is its lagged value. In order to obtain the convergence parameter we need to subtract one from the coefficient on lagged GDP per capita.

e) Test F for statistical significance of specification.

f) Hansen test of over-identifying restrictions. g) Arellano-Bond test for first and second order autoregression; Prob values given.