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Annekatriin Niebuhr, Friso Schlitte

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Annekatriin Niebuhr
Institute for Employment Research (IAB)
Projensdorfer Straße 82 | 24106 Kiel | Germany

Friso Schlitte
Institute for Employment Research (IAB), Germany
Hamburg Institute of International Economics (HWWI)
Heimhuder Str. 71 | 20148 Hamburg | Germany
Phone +49 (0)40 34 05 76 - 666 | Fax +49 (0)40 34 05 76 - 776
schlitte@hwwi.org

HWWI Research Paper
Hamburg Institute of International Economics (HWWI)
Heimhuder Str. 71 | 20148 Hamburg | Germany
Phone +49 (0)40 34 05 76 - 0 | Fax +49 (0)40 34 05 76 - 776
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EU Enlargement and Convergence – Does Market Access Matter?

Annekatrien Niebuhr*, Friso Schlitte**

*Institute for Employment Research (IAB), Germany

**Hamburg Institute of International Economics (HWWI), Germany and Institute for
Employment Research (IAB), Germany

Abstract

Economic integration in Europe has been accompanied by concerns about the impact of integration on regional disparities in the EU. The purpose of this paper is to investigate the effects of the most recent EU enlargement on convergence among countries and regions in the EU27. Departing from a new economic geography framework, we focus on integration effects caused by changes in market access released by the reduction of trade impediments. Special attention is paid to the catching-up process of the new member states and the development of regional disparities within the Eastern European countries. The results point to a catching-up process of the new member states. However, at the same time regional disparities within the NMS increase. Changes in market access seem to foster these processes at the national and regional level since the Eastern European countries achieve highest growth of market potentials due to declining barriers to trade. Moreover, the more prosperous regions in Eastern Europe realize the strongest benefits. However, taking these integration effects into account does not significantly alter the findings of our convergence analysis.

JEL classification: C21, F15, R12

Keywords: Integration, market access, EU enlargement, convergence

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1 Introduction

The process of European integration and enlargement has always been accompanied by concerns about the implications of economic integration for regional disparities in the EU. EU enlargement is supposed to entail a profound impact on the location of economic activities in Europe. The integration of Central and Eastern European Countries might release diverse effects on EU regions, depending on their location and specialization. Economic convergence is one of the basic objectives pursued by the EU Commission. With the accession of the 10 new member states (NMS) in May 2004 and Bulgaria and Romania in 2007 income disparities in the EU increased considerably (see European Commission 2004). Cohesion policy, being the second largest item in the EU budget, has to be adjusted to this change in the scale of disparities. Information on the speed of convergence and the impact of integration effects on the convergence process is therefore of utmost importance for EU policy.

This analysis links two strands of literature dealing in some way with EU enlargement. The first group of studies considers the spatial pattern of integration effects released by the eastward enlargement of the EU. However, the empirical literature on integration effects tends to focus on the EU-wide impact on growth and country effects (e.g. Baldwin et al. 1997 and Breuss 2001). Only a few studies explicitly consider the impact on the regional level. Bröcker (1998), Brülhart et al. (2004) and Pfaffermayr et al. (2004) provide quantitative estimates of regional effects in Europe caused by economic integration of the Central and Eastern European Countries. The second group of investigations deals with the issue whether regional disparities within the EU tend to decline or deepen in the course of proceeding economic integration in Europe. Recently, the consequences of the last enlargement round for convergence have attracted attention. Tondl and Vuksic (2007) analyze the factors that make Eastern European regions catch up. Fischer and Stirböck (2004), Feldkircher (2006) as well as Paas and Schlitte (2008) investigate regional convergence in the enlarged EU.

This paper aims at providing empirical evidence on spatial effects of the EU enlargement, on the development of regional disparities and on the interaction of both in the EU27¹. The study deals with the issue whether enlargement via its impact on market access affects the spatial distribution of economic activity and differences in regional per capita income in the enlarged EU. More precisely, we investigate the question whether changes in market access released by declining impediments to cross-border trade support the catching up of lagging regions or whether they tend to work against convergence. Are there significant differences between regions in the EU15 and the NMS? Special attention is paid to the catching-up process of the NMS and the development of regional disparities within the Eastern European countries. Evidence provided by Quah (1996) as well as de la Fuente and Vives (1995) suggests that the catching-up of poor EU countries might go hand in hand with rising regional imbalances in

1 Though members of the EU27 Malta and Cyprus are not considered in the empirical investigation.

these countries. The analysis is restricted to integration effects arising from changes in market access. Thus we do not offer a comprehensive investigation of the spatial impact of integration and its consequences for cohesion because effects emerging from differences in specialization and factor mobility are not considered although they are likely to be important for this issue.

As theoretical fundament of the analysis we apply a new economic geography (NEG) model. NEG offers arguments why market access might be a decisive factor with respect to spatial integration effects and regional disparities. However, only some models allow considering both disparities among and within countries. We use a wage equation derived from the NEG framework to estimate the distance decay of demand linkages in the EU. This information is used to calculate changes in market access caused by a reduction of border impediments due to integration. The basic idea of the analysis is that these changes in the market potential of EU regions will in turn impact on regional per capita income. In order to investigate the effect of market access on regional disparities we carry out a convergence analysis and extend the corresponding regression model by our accessibility measures.

In our empirical analysis we find that the NMS realize significant increases in market potential through increased trade integration with the EU15 market. In contrast, the effect on the market potential in the EU15 is more or less negligible. Therefore, reduced border impediments between the old and the new member states should promote the catching-up of the NMS towards the EU15. However, taking into account neoclassical catching-up mechanisms and country specific growth factors, the change in market potential has hardly any effect on the growth of per capita income in the EU. Furthermore, we find that national macroeconomic differences seem to be more influential on regional growth rates than spatial spillovers. Taking national effects into account reveals that the catching-up of the NMS is accompanied by regional divergence processes within the individual countries of the NMS. Overall, this indicates that centripetal forces that drive agglomeration prevail at the sub-national level in the early stages of economic integration in the enlarged EU market.

The rest of the paper is organized as follows. Section 2 comprises a description of the theoretical framework of the study. We refer to a specific class of NEG models that allows determining the impact of integration on disparities within the integrating countries. In Section 3, the methodology is presented that is applied to determine changes in market access of EU regions caused by enlargement. Moreover, we outline the set up of the convergence analysis. Data and cross section are described in Scenario 4. The results of the empirical analysis are presented in Section 5. Section 6 concludes.

2 Theory

NEG offers a perfect theoretical framework for our analysis because these models consider both spatial effects of integration and the development of regional disparities. Based on corresponding approaches, Krugman (1993) and Krugman and Venables (1990) investigate the implications of integration for the spatial structure of economic activity in Europe. Integration affects the balance of centripetal and centrifugal forces via its impact on transport costs and thus might alter the spatial distribution of economic activities. The domestic market becomes less important, possibly resulting in a reallocation of resources from previous centers to new locations (see Fujita et al. 1999). Market size considerations based on NEG models suggest that central regions, i.e. regions along the common border of integrating countries might realize above average integration benefits since they achieve above average increases of their market potential. The relative geographical position of these regions is altered dramatically by integration, changing from a peripheral one on a national scale to a central one in the common market. Midelfart et al. (2003) argue that market access improvements benefit firms located in the centre of the EU rather than those in peripheral areas. The relative disadvantage of peripheral regions should therefore increase. However, most NEG models do not allow drawing precise conclusions as integration might not be sufficient to destabilize the existing spatial distribution of economic activity. Moreover, integration might work to the advantage of either central locations or peripheral areas.

As we are interested in the catching-up process on the national level as well as in convergence within the member states, the theoretical model should allow distinguishing these processes on different spatial scales. This, however, does not apply to most NEG models. Only a few theoretical studies can be used for this purpose. Krugman and Livas (1996), Paluzie (2001) and Monfort and Nicolini (2000) provide corresponding evidence by extending the standard 2-region NEG model to three or even four regions. Paluzie (2001) as well as Monfort and Nicolini (2000) show that integration might give rise to increasing disparities in the integrating countries. By contrast, in Krugman and Livas (1996) declining barriers to trade foster dispersion in the country opening to trade.² In the following section, we discuss the corresponding effects in more detail based on a similar model by Crozet and Soubeyran (2004).

2.1 A two-country, three-region NEG model

In order to investigate the impact of integration on the development of disparities within the acceding countries, we apply a two-country, three-region model proposed by Crozet and Soubeyran (2004). As the model is largely in line with the usual NEG set-up, we keep the description of the theoretical framework brief. In the model, there are three regions in two

2 A similar analysis by Behrens et al. (2007) suggests that integration will promote regional dispersion if intranational transport costs are relatively high. Their results point to the importance of transport and infrastructure policies in this context.

countries, the domestic country and the foreign economy (0). The domestic country has two regions, denoted (1) and (2). The regional economies consist of a monopolistically competitive industry and a perfectly competitive agricultural sector. Goods are traded among all regions.

Tastes of all consumers are described by a Cobb-Douglas utility function:

$$U = C_M^\mu C_A^{1-\mu} \quad \text{with} \quad 0 < \mu < 1 \quad (1)$$

where μ is the share of expenditures on manufactured goods, C_A is the quantity of the agricultural product consumed, and C_M is a composite of symmetric product varieties given by:

$$C_M = \left[\sum_{k=1}^K c_k^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \quad (2)$$

σ is the constant elasticity of substitution between any pair of varieties, and K is the number of varieties. Consumers have a love for variety. With increasing σ , the substitutability among varieties rises, thus the desire to spread consumption over manufactured goods declines. Utility is maximized subject to the budget constraint:

$$Y = C_A p_A + \sum_{k=1}^K c_k p_k \quad (3)$$

where Y is income, and p_A , p_k are prices of the agricultural product and the variety k of the manufactured commodity respectively.

Manufactured goods are traded among regions incurring iceberg transaction costs, i.e. a fraction of any product shipped, melts away and only a part ($1/T_{ij}$) arrives at its destination. The price of varieties produced in i and sold in j , ($p_i T_{ij}$), therefore consists of the mill price and transaction costs.³ Transaction costs differ across regions. The approach differentiates between cross-border transaction costs (T_{01} , T_{02}) and internal transaction costs (T_{12}) which apply to interregional domestic trade.

Utility maximization results in the following demand function for manufactured goods:⁴

$$c_{ij} = \frac{(p_i T_{ij})^{-\sigma}}{P_j^{1-\sigma}} \mu Y_j \quad ; \quad i, j = 1, 2, 3. \quad (4)$$

3 In contrast, trade of the agricultural product is assumed to incur no trade costs.

4 We omit the variety subscript k because of the symmetry of all varieties produced in region i .

c_{ij} is demand in region j for manufactured goods produced in region i . P_j is the price index for manufactured goods in region j , p_i is the mill price of varieties produced in i and T_{ij} are transaction costs which include distance related transport costs as well as trade barriers.

In the model by Crozet and Soubeyran (2004), there are two factors of production: mobile human capital H and immobile labor L . In agriculture, only labor is used as an input, whereas the manufacturing sector uses only human capital.⁵ There are increasing returns in the production of each individual variety of manufactured goods due to fixed costs. Each manufacturing firm has the same production function in which human capital enters as input. Total costs are given by:

$$h = \alpha - \beta q, \quad (5)$$

where q is output, α is fixed costs and β marginal costs per additional unit produced.

The price of a variety produced in i is given by a mark-up on marginal costs:

$$p_i = \left(\frac{\sigma}{\sigma - 1} \right) w_{iH} \beta \quad (6)$$

Because of increasing returns, each variety is only produced by one firm in one region. Thus regions do not produce the same set of products, but differentiated bundles of manufactured goods. The number of corresponding varieties is proportional to the human capital of the region. If human capital increases due to immigration, the number of supplied manufactured goods will rise. There is no international factor mobility. However, human capital is mobile between domestic regions. Human capital owners migrate towards the region that offers highest real wage $\omega_{iH} = w_{iH} / P_i^\mu$, i.e. the nominal wage deflated by the price index. Thus, there are two factors determining the mobility of human capital. Human capital owners migrate towards regions characterized by a relatively low price index for manufactured goods and a comparatively high remuneration of human capital. Depending on the interaction of centripetal and centrifugal forces, a real wage differential may either induce more human capital to move to the high wage region or lower the real wage in the destination region.

The effect that the geographic distribution of manufacturing and human capital has on wages can be discussed based on the nominal wage equation that gives the short-term equilibrium level of the nominal wage in region i :

$$w_{iH} = \frac{1}{\beta} \left(\frac{\sigma - 1}{\sigma} \right) \left[\frac{\mu \beta}{\alpha(\sigma - 1)} \left(\sum_{j=1}^N Y_j P_j^{\sigma-1} T_{ij}^{1-\sigma} \right) \right]^{1/\sigma} \quad (7)$$

5 By choice of units, the price of the agricultural product p_A equals the wage of farm labor w_A . Moreover, $w_A = 1$, since the agricultural product serves as a numéraire.

According to this equation, the nominal wage paid by manufacturing firms in region i increases with the number of nearby consumers, i.e. the available purchasing power, and declines with the number of competitors in locations with low transaction costs to region i . Backward and forward linkages might cause a spatial concentration of human capital and firms. A concentration of firms raises real wages in the corresponding region via a decline of the price index of manufacturing goods since many varieties are produced locally. Rising real wages increase the attractiveness of the location for human capital (forward linkage) and result in in-migration thereby increasing the size of the market. Large markets, however, in turn are attractive production sites for manufacturing and allow firms to reward human capital with higher wages (backward linkage). Thus there is a mechanism of cumulative causation which might result in spatial concentration of manufacturing and human capital. The distribution of firms and human capital across space depends on the relative strength of centripetal and centrifugal forces. The centrifugal force in this model is based on the exogenous location of agricultural workers and the desire of manufacturing producers to get away from competitors. The attractiveness of agglomeration for firms and human capital constitutes the centripetal force.

2.2 *Effects of integration*

The impact of integration on regional disparities in the domestic country depends, among other things, on the assumptions regarding cross-border transport costs. In the following, two cases are considered: Firstly, we assume that both domestic regions have same access to the foreign market ($T_{01} = T_{02}$). In the second case, region (2), i.e. a border region has better access to the foreign market ($T_{01} > T_{02}$).

Economic integration gives rise to two opposed forces.⁶ Due to integration the significance of foreign demand and supply is raised in the domestic country and this decreases the strength of both centripetal and centrifugal forces. On the one hand, a rising accessibility of the foreign market decreases the incentive to locate near domestic consumers for the domestic industry, since they represent a smaller share of total purchasing power now. The strength of the centripetal force related to domestic purchasing power declines in the course of integration. Domestic agglomeration is also weakened due to the increasing weight of foreign supply for domestic consumers. On the other hand, integration will result in an increased competition by foreign firms. The presence of foreign supply reduces the need to locate away from domestic competitors, thereby reducing the centrifugal forces. The simulations in Crozet and Soubeyran (2004) suggest that the effect on the centrifugal force dominates, and therefore agglomeration of manufacturing and human capital in one region is the likely outcome of integration.

⁶ We only consider the impact of trade liberalization and ignore effects resulting from free cross-border movement of labor and human capital.

Thus, the probability that domestic manufacturing concentrates in one region increases due to declining external trade costs. If we assume perfect symmetry of domestic regions ($T_{01} = T_{02}$), the corresponding location of industry will be indeterminate. However, if a border region has better access to foreign demand ($T_{01} > T_{02}$), its attractiveness relative to the domestic non-border region will rise in case of trade liberalization. When tariffs are low, the advantage of favorable access to the foreign market outweighs the negative effect arising from competition with foreign firms in the border region. According to Brülhart et al. (2004), a concentration of manufacturing in the non-border region is only possible in this case if a comparatively large number of manufacturing firms were located in that region in the pre-integration period. However, as shown by Crozet and Soubeyran (2004), the adverse effect of increased competition might dominate the impact of an improved accessibility of foreign demand if tariffs remain at a high level. Economic activity will be dispersed with an above average share of industry being located in the non-border region.⁷

2.3 Implications for EU enlargement

Two-region NEG models do not allow to draw clear-cut implications with respect to the effect of integration on regional disparities in the enlarged EU. Differences between prosperous old and poor new member states might decline after enlargement if the forces released by integration are strong enough to alter the current spatial structure of economic activities in Europe. However, the impact of integration on centripetal and centrifugal forces depends on various aspects and therefore enlargement might as well result in increasing disparities among EU member states.

As regards convergence within the NMS, the theoretical analyses suggest that, irrespective of differences in access to the foreign market, regional disparities in the acceding country might well increase. However, whether centripetal or centrifugal forces dominate depends on the degree of integration, i.e. the level of remaining barriers to trade. Moreover, we cannot derive clear-cut implications regarding winners and losers of enlargement based on the NEG model unless we assume differences in access to the EU15 market or differences in starting positions of the regions in the NMS. There are some indications that border regions in the Western part of the NMS as well as prosperous agglomerated regions might achieve above average integration benefits. The pull effects towards the low-costs access border regions in the West of the NMS are likely to be strong, especially if foreign demand is relatively large - like in the EU15 market.

To summarize, theoretical analyses do not allow to derive any unambiguous results with respect to the effects of enlargement on regional disparities in the EU27. The theoretical

⁷ See Brülhart et al. (2004) and Niebuhr (2008) for detailed analyses of the impact of enlargement on European border regions.

literature has not yet reached a consensus on the question whether integration gives rise to convergence or increasing disparities within countries that open up to trade. Therefore, empirical analysis is needed to shed some light on this issue. We apply convergence regressions and simulation analyses to provide some empirical evidence.

3 Methodology of the empirical analysis

3.1 Integration and market access

Point of departure of our empirical analysis is the nominal wage equation given by expression (7). This equation establishes a link between market access and the regional wage level. Thus, we might expect that changes in market access due to integration affect regional disparities in per capita income. We use the nominal wage equation to determine the distance decay of demand linkages in the EU. The estimated distance decay parameter enters into the calculation of changes in regional market access. The corresponding regression model is given by⁸:

$$\log(w_i) = \gamma_0 + \gamma_1 \log\left(\sum_{j=1}^J Y_j e^{-\gamma_2 d_{ij}}\right) + \varepsilon_i \quad (8)$$

with w_i as the nominal wage in region i and Y_j as income in region j . γ_3 is the distance decay parameter and d_{ij} is the distance (travel time) between the regions i and j . Equation (8) states that the regional wage level is affected by the weighted sum of purchasing power in all accessible regions. The weights of purchasing power decline with increasing distance between locations i and j . Wages are relatively high in locations close to high consumer demand (see Hanson 2005). Regional wages increase with purchasing power of neighboring regions and decline with rising transport costs to these locations.

We estimate the nominal wage equation for EU15 regions, using GDP per capita instead of nominal wages as dependent variable in order to determine the dimension of the distance decay. However, equation (8) represents only a very limited explanation of regional disparities. Local amenities or the sectoral composition of the regional economy are most likely additional factors that impact the spatial distribution of economic activities. To allow for such effects and to check the robustness of the estimated relationships between regions' market access and economic activity, the regression model given by equation (8) is extended by some control variables. Applied control variables comprise indicators for sectoral composition of regional economies and the presence of local amenities (see Niebuhr 2006 for details).

8 See Hanson (2005), Brakman et al. (2002), Mion (2004) and Niebuhr (2006) for empirical evidence on the nominal wage equation.

The results of the estimations based on cross sectional data for 1995 and 2000 are summarized in Table 1. The coefficient γ_1 suggests that market access has indeed a significant positive impact on per capita income of European regions. Secondly, the estimates of γ_3 indicate that the intensity of demand linkages halves over a range of roughly 180 minutes of travel time. Moreover, the distance decay as well as the impact of market access on regional per capita are fairly stable across time. The estimated coefficients hardly differ between 1995 and 2000.⁹

[Table 1]

With the information on the distance decay we calculate the market potential of region i in year t as follows:

$$MP_{it} = \sum_j Y_{jt} \cdot e^{-\lambda(d_{ij}+b_{ijt})} \quad (9)$$

where Y_{jt} is income in region j in year t , and b_{ijt} are travel time equivalents of border impediments in year t .

We deal with the effects of EU enlargement and associated increases in regional market access on regional convergence processes in the EU. Therefore, the focus will be upon the effects of integration between old and new member states as well as integration effects among the NMS. Despite the ongoing integration process within the EU15 and its impact on the spatial structure of economic activity in Europe integration effects in the old member states will be ignored. Thus, only the development of border impediments between EU15 countries and former candidate countries as well as border effects among the NMS matter in our simulation analysis. Furthermore, we are primarily interested in the effects of a reduction in impediments to cross-border trade. Therefore, the effect that growing income levels have on the regional market potentials will be ignored as well.

Since only the effects of declining border impediments between the EU15 countries and the NMS and the effects of reduced border impediments among the NMS are considered, b_{ijt} in equation (9) is defined as follows:

$b_{ijt} = 0$, if i and j are located in the same country or both in the EU15

$b_{ijt} > 0$, if i and j are located in two different new EU member states or in an old and a new member state

The effect of integration on market access is modeled via a manipulation of intra-regional travel time data which are also applied in the calculation of the market potentials. The raw

⁹ All corresponding regression results are available from the authors upon request. For a detailed description of the regression approach and estimates see Niebuhr (2006, 2008).

travel time data include waiting times at border crossings but do not account for other impediments to cross-border trade, such as tariffs and non-tariff barriers, e.g. technical standards, legal systems and so on. Thus, a perfect integration scenario is based on the raw travel time matrix, where apart from waiting times all other border impediments are set to zero in this case. The simulation of economic integration of the NMS is carried out in two steps. Firstly, travel time equivalents of border impediments are added to the raw travel time in form of a time penalty for crossing a national border. Secondly, proceeding economic integration is modeled by reducing the time penalties. Our assumptions regarding the level and decline of border impediments are based on a literature survey of corresponding studies.

Up to now, there are only a few estimates of border impediments and their development in the enlarged EU.¹⁰ Based on the information available in literature, we presume that trade impediments between EU15 countries and the NMS amount to a travel time equivalent of 450 minutes as compared to intra-EU15 trade. We assume that the accession of the NMS corresponds with a decline of this time penalty between 60 and 100 minutes. Apart from a uniform reduction of border impediments we also consider the case of an asymmetric integration between EU15 countries and the NMS. We analyze both a stronger reduction of border impediments between the EU15 and the NMS as compared to integration among the NMS and a more intense integration among the NMS relative to integration with the old member states. Thus, we consider the following scenarios regarding the intensity and development of border impediments between EU15 and the NMS:

1. Uniform reduction of border impediments by a travel time equivalent of 60 minutes
2. Asymmetric reduction of border impediments between the EU15 and the NMS as compared to integration among the NMS
 - a) More intense integration between the EU15 and the NMS as compared to integration among the NMS: reduction by 100 minutes between the EU15 and the NMS and by 60 minutes among the NMS
 - b) Less intense integration between the EU15 and the NMS as compared to integration among the NMS: reduction by 60 minutes between the EU15 and the NMS and by 100 minutes among the NMS

The effect of declining border impediments on market access for given regional purchasing power in t_0 is given by:

¹⁰ For a detailed description of corresponding empirical evidence see Niebuhr (2008).

$$\Delta MP_{i_1-t_0}^{BORDER} = \left[\log MP_{i_0^*} - \log MP_{i_0} \right] \quad (10)$$

$$= \left[\log \sum_j Y_{jt_0} \cdot e^{-\lambda(d_{ij}+b_{ijt_1})} - \log \sum_j Y_{jt_0} \cdot e^{-\lambda(d_{ij}+b_{ijt_0})} \right]$$

where $(b_{ijt_1} - b_{ijt_0})$ corresponds with the reduction of border impediments given in travel time equivalents in the scenarios outlined above (60 and 100 minutes respectively).

3.2 Integration and convergence

We apply the well-known concept of β -convergence in order to analyze the speed of convergence across regions in the EU (see Barro and Sala-i-Martin 1995). The concept of β -convergence is based on the traditional neoclassical growth model and postulates that poor economies grow faster than rich economies. If regions differ only in their initial income level and their capital endowment per worker, they will converge to the same level of per capita income. This is referred to as absolute β -convergence. However, if regions are marked by different steady states, i.e. differences in technology, economic structures or qualification of the work force, they will not converge towards the same income level. This is the concept of conditional convergence. We estimate both absolute and conditional convergence across EU25 regions between 1995 and 2004. Previous empirical analyses have shown that national effects play an important role in regional convergence processes in Europe saying that regional growth is determined by national macroeconomic factors (e.g. Armstrong 1995). Therefore, in our conditional convergence model national effects will be controlled by dummy variables for each of the member states. Additionally, applying country dummies allows distinguishing between regional convergence within countries and the catching-up process on the national level. We estimate the relationship between initial income levels and growth, using the following equation:

$$\ln\left(\frac{y_{i_1}}{y_{i_0}}\right) = \alpha_0 - \alpha_1 \ln(y_{i_0}) + \sum_{k=2}^{21} \alpha_k D_k + u_i \quad (11)$$

The term on the left-hand side of equation (11) is growth of per capita income from the base year t_0 to the year t_1 . Initial per capita income in region i is given by y_{i_0} and u_i is a disturbance term. D_k represents a dummy variable for the respective country k when national effects are taken into account. The annual rate of convergence β can be obtained from expression (12):¹¹

$$\beta = \frac{-\ln(1 - \alpha_1)}{t_1 - t_0} \quad (12)$$

¹¹ The half-life, i.e. the time that it takes to halve the initial income gap between two regions, is given by $\log(2)/\beta = 0.69/\beta$.

In order to investigate the effects of integration on regional convergence in the EU, we include into equation (11) the percentage change in regional market potentials caused by a reduction of border impediments $\Delta MP_{it_0}^{BORDER}$:

$$\ln\left(\frac{y_{it_1}}{y_{it_0}}\right) = \alpha_0 - \alpha_1 \ln(y_{it_0}) + \sum_{k=2}^{21} \alpha_k D_k + \alpha_3 \Delta MP_{it_0}^{BORDER} + u_i \quad (13)$$

Applying this approach for the estimation of β -convergence assumes regional growth rates to be independent from each other. Since the end of the 1990s various convergence studies have found evidence for spatial interdependencies of regional growth processes leading to specification errors in the classical β -convergence model (see Abreu et al. 2005). In order to control for spatial dependence we apply spatial diagnostic tests and Maximum Likelihood (ML-) estimation including a spatially lagged dependent variable on the right hand side – Spatial Lag Model (SLM) – or an error term including a spatial lag – Spatial Error Model (SEM) –, respectively, as suggested by Anselin (1988). Therefore, a spatial weights matrix W has to be applied in order to capture the structure of spatial dependence. To test for the sensitivity of the estimation results to changes of W we apply alternative specifications of the weights matrix: the inverse and the squared inverse of travel time as well as a binary and a higher order contiguity matrix based on travel time using different distance cutoffs.¹²

4 Data and regional system

We analyze integration effects and convergence in the enlarged EU across 802 regions, of which there are 643 situated in the EU15 countries and 159 in the NMS. The cross-section consists predominantly of NUTS-3 level regions. However, due to data restrictions NUTS-2 level regions as well as functional regions comprising several NUTS-3 units also had to be applied. Regions in Switzerland and Norway are subject to the calculation of regional market potentials in the EU but they are not included in the cross-sectional convergence analyses.¹³

For the calculation of market potentials in EU regions interregional distances between regions, measured by travel time in minutes between the centers of the regions, are used. Border impediments - tariffs and non-tariff barriers – are incorporated by means of a travel time equivalent in minutes which is added to the actual travel time between regions situated in different countries. It is assumed that integration results in a reduction of border impediments. The assumption with respect to border effects rests on information given in corresponding literature.

12 See LeGallo et al. (2003) for a more detailed discussion about the functional form of spatial weights matrices

13 A more detailed description of this cross section is given in the appendix.

Since the analysis regards exclusively changes in market access that is due to reduced border impediments - and not to income growth - initial GDP levels of 1995 are not altered in the simulation analysis. The analysis of regional convergence is conducted for the time between 1995 and 2004 applying GDP per capita data. All income data are measured in purchasing powers standards (PPS) and taken from the Eurostat database.¹⁴

5 Empirical results

The presentation of our empirical results is sectioned into three parts. The first part shows the spatial structure of integration effects obtained by our simulation analysis. In the following two parts, we present regression results on the regional convergence pattern in the EU and on the influence of integration effects on the speed of convergence.

5.1 *Enlargement and changes in market access*

As outlined in Section 2, theoretical models allow for different outcomes from integration effects on the spatial distribution of economic activities. A likely result, however, is that integration effects are relatively strong in regions of the NMS that directly adjoin the EU15 market, leading to above average wage increases in these regions. By contrast the impacts of a better market access to the NMS are likely to be small in the old member states. Analyses of enlargement effects on regional wage levels by Paffermayr et al. (2004) show a negligible impact on EU15 regions bordering new member states as compared to considerable wage increases in NMS regions sharing a common border with an EU15 state.

Figure 1 shows the relative change in market potentials in the EU27 regions based on Scenario 1 (uniform reduction of border impediments by a travel time equivalent of 60 minutes). The spatial structure of integration effects is most notably characterized by an East-West gradient. Regional market potentials in the NMS increase to a much higher extent than those in the old member states. Overall, the opening of the Western European economies towards Central and Eastern Europe is much more influential on market access in the NMS as compared to the EU15. If growing market potentials do indeed positively affect regional wage levels regions in the NMS, in particular those nearby EU15 countries will profit in terms of higher per capita growth. Thus, it can be expected that declining barriers to cross-border trade and associated changes in market access should be in favor of convergence between old and new member states.

[Figure 1]

¹⁴ The data in PPS are adjusted for differences in national price levels.

A more differentiated pattern of integration effects on regional market access in the NMS is presented in Figure 2. Some regions in the NMS profit much more from reduced border impediments in terms of increasing market access than others. In the simulation analysis changing market potentials in the NMS results from a higher accessibility to the EU15 market on the one hand and better economic integration with the other NMS on the other hand. However, the overall impact of the latter is relatively small due to the comparatively low purchasing power in the NMS. The largest effects can be observed in those NMS regions directly adjoining the markets of the prosperous regions in Southern Germany, Austria and Northern Italy. The simulated rise of regional market potentials amounts to nearly 20 % in Slovenian regions, to more than 13 % in the western part of Slovakia and up to 12 % in the western regions of Hungary and the Czech Republic. Also Estonia benefits in terms of increasing market access from being in the neighborhood of Finland. The relatively strong integration effects in Latvian regions are a combination relative proximity to Scandinavia and effects from integration with its Baltic neighbors. In Latvia, where nearly every region is a border region, benefits from higher accessibility to its neighbors from the NMS may be strong despite their relatively low purchasing power. Furthermore, the initial level of market potential in Latvia had been very low before the integration process started. Therefore, small accessibility changes have led to relatively large percentage changes in the market potential (e.g. 10.5 % in Latgale). By contrast, market potential growth in Poland, Bulgaria and Romania, which is clearly below 4 % in most of their regions, turns out to be comparatively small. Most of these regions are remote from the EU15 market. Also the regions in Poland bordering Eastern Germany and the regions in Bulgaria sharing a common border with the northern part of Greece do not realize large benefits as initial purchasing power in these parts of the EU15 are relatively low. Except for the Polish border region Zachodniopomorskie (4.5 %) market potential growth rates do not exceed the 4 %-level. Furthermore, the share of border regions in these countries is small compared to the other countries of the NMS. Therefore, effects from integration among the NMS are comparatively weak.

[Figures 2 to 4]

By comparing the results of the Scenarios 2a and 2b (see Figures 3 and 4) it can be distinguished the effects that come from a more intense integration between the NMS and the EU15 markets (Scenario 2a) and from a more intense integration among the NMS (Scenario 2b). Expectedly, Scenario 2a is more beneficial than Scenario 2b to regions in proximity to prosperous EU15 markets. In particular, this concerns regions in Slovenia, Czech Republic, Estonia as well as most regions in Hungary, Slovakia and Poland. By contrast, a stronger integration among the NMS, as in Scenario 2b, is more favorable to the regions of Bulgaria, Romania, Lithuania and Latvia, which are more or less out of range from large positive effects from reduced border impediments to the EU15. However, due to a comparatively low

purchasing power in most regions effects from a more pronounced decline in border impediment among the NMS remain comparatively small. The overall magnitude of the impact on the NMS as a whole is much stronger with a more intense integration in the EU15 market.

Overall, the results show that regional market potentials in the NMS are in total more affected by declining trade impediments to the EU15 market. In all three integration scenarios regions in the Czech Republic, Slovakia, Hungary or Slovenia benefit most. Since the regional income levels in these countries are already relatively high compared to the income levels in other regions of the NMS that are more remote from EU15 markets, economic integration may work against regional convergence across the NMS. In other words, regions in countries that are lagging most behind benefit less from reduced border impediments.

[Figure 5]

So far the results suggest that integration effects should promote the catching-up of the NMS towards the EU15. In order to investigate more systematically to what extent changes in market potentials could support the convergence process on the regional level in the EU we examine whether poor regions in the NMS tend to realize stronger increases in market potentials than rich ones. Figure 5 displays a scatter plot of regional income levels in 1995 and relative changes in market access in the NMS released by reduced border impediments based on Scenario 1. There is a positive relationship between growth of market access and regional income levels in 1995. This implies that relatively rich regions tend to profit more from integration effects in terms of increasing market access than poorer ones. Thus, it can be expected that - while generally supporting the catching-up of the NMS towards the EU15 - reduced border impediments between NMS and EU15 might promote increasing disparities within the NMS.

Overall, the pattern of changing market access suggests that economic integration between old and new member states is in favor of a general catching-up of the NMS. Such integration effects, however, work mainly in spatial proximity to the relatively prosperous markets of the EU15 and wear off with increasing distance. As a consequence, the catching-up of the (already) relatively prosperous regions in the south-west of the NMS may be favored disproportionately. If increasing market potentials turn out to affect regional growth rates in the NMS significantly, EU eastward enlargement may - at least temporarily - enhance income disparities among the NMS. Whether such integration effects effectively challenge regional convergence in the EU will be investigated in the next section.

5.2 Regional convergence in the enlarged EU

In this section, we investigate recent developments in regional convergence in the enlarged EU. Figure 6 shows a negative correlation between initial income levels and regional growth from 1995 to 2004. This indicates that relatively poor regions tend to grow faster than rich ones. Most regions of the NMS (marked in grey) are situated in the top left area of the plot showing relatively low initial income levels but relatively high growth rates. Thus, the catching-up of the NMS is a central feature in European growth pattern during that period. However, the scatter plot also indicates that regional growth and convergence pattern differ between the EU15 and the NMS. The convergence relationship in the enlarged EU might be driven by differences in income levels and growth between old and new member states. Therefore, we test the convergence hypothesis in separate models for the EU15, the NMS and the EU as a whole.

[Figure 6]

The results obtained from estimating equation (11) – not including integration effects and ignoring differences in steady-states – are presented in Table 2. There is a significant process of absolute convergence across regions in the EU. The estimated average annual rate β amounts to 1.92 % which implies a half-life of 36 years. A convergence rate of about 2 % has been observed in various convergence studies analyzing different cross-sections over longer time spans (e.g. Barro and Sala-i-Martin 1995). The estimated speed of absolute convergence is clearly less pronounced in the NMS and the EU-15. The respective rates of 1.24 % and 1.15 % imply half-lives of 56 years in the NMS and up to 60 years in the EU15.

Implementing country dummies into the models reveals a substantial influence of national effects on the convergence process in the EU. Hence, the convergence process between countries differs from regional within-country convergence. The inclusion of national effects reduces the speed of convergence to 0.46 % in the EU. However, while taking country effects into account has a relatively moderate impact on the convergence speed in the EU15, the rate of the NMS changes sign. Regional per capita incomes within the countries of the NMS actually diverge at an annual rate of 2.09 %. Thus, within the individual NMS, richer regions tend to grow faster than the poorer ones. Overall, the catching-up process in the EU-25 is predominantly a national phenomenon. Similar results are obtained by Paas and Schlitte (2008).

[Tables 2 and 3]

The results of Moran's I test show the presence of significant spatial autocorrelation in the residuals in all models except for the NMS-case where country dummies are applied. In order to identify the form of spatial autocorrelation – spatial error or spatial lag dependence – we

apply the decision rule by Anselin and Florax (1995) based on Lagrange Multiplier (*LM*-) tests.¹⁵ However, the tests do not allow for a clear cut conclusion about the form of spatial autocorrelation in our data.¹⁶ Therefore, we estimate both, the spatial error and the spatial lag model.

Applying SLM and SEM estimations without control for country-specific effects yields relatively low convergence rates of 0.79 % and 1.08 % in the EU as a whole and 0.68 % and 0.93 % in the EU15 which implies half-lives from 64 to 88 years and from 74 to 102 years respectively (see Table 2). Results from estimating the SLM do not show a significant convergence process in the NMS. Implementing spatial error dependence instead, the convergence rate for the NMS changes sign indicating divergence.¹⁷ Both spatial coefficients ρ (spatial lag coefficient) and λ (spatial error coefficient) are highly significant in all models ignoring national effects. Moreover, the Akaike Information Criterion (AIC)¹⁸ shows improved model-fits. Hence, regional growth rates seem to be spatially correlated leading to model misspecification in the OLS model. However, when country dummies are included, there is a very slow process of conditional convergence taking place in the EU-15, while income levels within the individual NMS diverge. Also, the model fits do not vary remarkably from the OLS models. Overall, estimations including country effects yield very similar results to those of the conditional OLS estimations. Therefore, spatial dependence is captured to a large extent by country dummies, indicating national differences to be more influential on regional growth than spatial spillovers. In other words, regions are more affected by national macroeconomic factors than by regional growth spillovers from neighboring areas.¹⁹ Similar results were found by Geppert et al. (2005) for regions in Western Europe and by Feldkircher (2006) or Paas and Schlitte (2008) for regions in the enlarged EU.

5.3 Convergence and the effects of integration

In order to investigate the impact of changing market access on the regional catching-up process in the enlarged EU convergence models are augmented by the inclusion of the simulated change in regional market potentials (equation 13). We included integration effects based on all three scenarios in the regression analysis. However, the regression results for the considered scenarios don't differ significantly and, thus, give no further insights. Therefore,

15 See Anselin and Florax (1995) for more details.

16 Additionally, the presence of non-normality detected by the Jarque-Bera test makes the LM-tests less reliable.

17 It should be noted that a direct comparison of β -coefficients between the SLM and OLS models is not quite possible since in contrast to the OLS estimation the estimated speed of convergence in the SLM also takes into account indirect and induced effects (see Abreu et al. 2005 or Pace and Le Sage 2006 for more details).

18 The R^2 in ML-estimations is only a pseudo measure and therefore not suitable for comparison to the model fit in OLS estimation. This requires information criteria, such as the AIC.

19 Applying different spatial weights matrices (see Scenario 3) has shown that the results are robust towards changes in the specification of the spatial weights. The results can be obtained upon request from the authors.

only the results including the effects of changing market potentials based on Scenario 1 are presented in this paper (see Tables 4 and 5).²⁰ There is a significant effect in the EU model without control for national effects. This indicates that the catching-up of the NMS is not only driven by differences in the marginal productivity of production factors, but also by accessibility. According to the estimation results a 1 %-increase in the regional market potential increases initial regional per capita income levels by 0.77 % in the OLS model, by 0.37 % in the SLM and by 0.88 % in the SEM. For instance, this implies that an increase in the regional market potential in Slovenia of up to 20 % (as in Scenario 1) would raise initial per capita incomes additionally by 15.3 %, 7.4 % or 17.7 % respectively.

[Tables 4 and 5]

Since the effects of declining border impediments through the EU enlargement process are only remarkable in the NMS, but not in the EU15 the lack of a significant effect in the EU15 model is not surprising. However, contrary to our expectations we do not find any effect of changes in regional market potentials released by reduced border impediments on per capita growth in the NMS model as well. This outcome, however, should be treated with caution since it may be affected in several ways by the assumptions made in the simulation analysis or by specification problems in our model. Firstly, the assumptions about the magnitude and uniformity of the reduction in border impediments may be inappropriate. It is very hard to quantify integration effects on impediments to cross-border trade. Furthermore, it is likely that integration effects are not identical at every border between two countries or regions but differ significantly. Bilateral trade relationships between some regions will improve faster than others. Secondly, our analysis keeps out growth dynamics. Relatively high income growth rates in the NMS will strongly affect regional market potentials. Therefore, economic integration in the NMS may lead to cumulative effects of increasing income levels and market potentials.

Furthermore, there are specification problems in the estimation models. As shown in Figure 5 there is a correlation between income levels and changes in market potentials. Therefore, we have to deal with pronounced multicollinearity. This will increase the variance of the slope estimators and thus affect inference on the change in market access (low t-statistic). The coefficient cannot be estimated with great precision. This problem becomes more severe for smaller sample sizes since this reduces the variation in the explanatory variables which in turn increases the variance of the estimators (see Wooldridge 2006). This is in line with the differences in the regression results we observe for the three cross sections: the t-statistic tends to decline with the sample size. We detect highest significance levels for the EU25.

²⁰ The results including effects from the alternative scenarios can be obtained upon request from the authors.

However, the results for the convergence parameter are almost unchanged. This suggests that the estimates of the convergence rate in the specification without market access are unbiased, indicating that the effect of the change in market access on convergence of per capita income is negligible.

The results of the estimations where country dummies have been employed, do not show significant effects of changing market potentials on growth in any of the models. Another look at Figure 2 also shows a national pattern in the spatial distribution of the simulated change in regional market potentials in the NMS. Therefore, national effects in changing market potentials and per capita growth interfere leading to lower t-values.

Overall, it can be expected that growing market access through reduced border impediments promotes the catching-up of the NMS towards the EU15. However, there is no evidence that integration effects have affected regional within-country convergence so far. Analyses of recent economic developments in NMS regions show that especially the capital cities have been outperforming other regions of the respective countries in terms of economic growth (e.g. Jasmand and Stiller 2005). Therefore, national growth rates in the NMS seem to be driven mainly by agglomeration processes. Similar developments of regional growth have been observed in cohesion countries during earlier enlargement rounds of the EU (see European Commission 2004). This might indicate, that at least in earlier stages of economic integration processes the effects of a decreased relative importance of the home market reducing the centripetal force might be dominated by the effects of increased international competition that decrease the centrifugal force.

6 Conclusions

Our analysis of integration effects has shown that regions in the NMS benefit more from reduced border impediments in terms of increased market potentials than regions in the EU-15. Even in EU15 regions that share a common border with a NMS effects on their market potentials are almost negligible. This can be explained by the comparatively low purchasing power in the NMS. Since increased market potentials are associated with rising wage levels trade integration through EU enlargement should support the catching-up process of the NMS towards the EU15. Due to the comparatively high purchasing power in the old member states integration effects between old and new member states are in total more influential on market potentials in the NMS than integration among the NMS. Expectedly, those regions in the NMS that are situated close to prosperous markets of the EU15 benefit most in terms of increasing accessibility. In particular, this is the case in Estonia, Slovenia, Czech Republic and the western parts of Hungary and Slovakia. Since income levels in most of these regions are already relatively high compared to the rest of the NMS such integration effects are not likely to support regional convergence across the NMS. Relatively poor regions in the eastern periphery of the EU might lag behind.

However, taking into account neoclassical catching-up mechanisms and country specific growth factors, the change in market potential has hardly any effect on the growth of regional per capita incomes in the EU. Furthermore, the regression analysis reveals that the catching-up process in the EU is mainly a national phenomenon implying that national macroeconomic differences seem to be more influential on regional growth rates than spatial spillovers. Taking national effects into account reveals increasing regional disparities within the countries of NMS. Thus, the catching-up of the NMS is accompanied by regional divergence processes within the individual countries of the NMS. Previous analyses show that national growth rates are dominated by agglomeration processes, in particular in the capital regions.

The theoretical model from Crozet and Soubeyran (see Scenario 2) suggests that the negative effect on the centrifugal force which is due to increased international competition is stronger than the negative effect on the centripetal force released by the decreasing relative importance of the home market to domestic firms. Hence, under the assumptions of this model the agglomeration of manufacturing and human capital is a likely outcome of integration. Our empirical analysis is not designed to verify the assertion of the theoretical model and does not allow for definite conclusions in that way. However, the observations that the EU enlargement has been accompanied by agglomeration processes within the NMS corresponds to theoretical implications of the model.

Perhaps it is too early to identify growth effects of changes in market access or other integration effects, such as factor mobility, might be more important for growth and convergence. Furthermore, measurement problems might play an important role in the estimation of the integration effects from reduced border impediments as well. The difficulties in assessing the magnitude of the reduction in barriers to cross-border trade and assuming a uniform reduction at all borders imply a considerable degree of uncertainty with respect to the exactness of the estimated integration effects. However, evidence provided by our analysis gives first insights on this issue which can be relevant for EU cohesion policy. Further research is necessary to obtain more comprehensive information on integration effects through EU enlargement.

References

- Abreu, M., De Groot, H. L. F., Florax, R. J. G. M. (2005): Space and Growth: A Survey of Empirical Evidence and Methods, in: *Région et Développement*, 21, 14-38.
- Anselin, L. (1988): *Spatial Econometrics: Methods and Models*. Kluwer Academic Publishers: Dordrecht, Boston, London.
- Anselin, L., Florax, R. J. G. M. (1995): Small Sample Properties of Tests for Spatial Dependence in Regression Models, in: Anselin, L., Florax, R. J. G. M. (eds.), *New Directions in Spatial Econometrics*, Springer: Berlin, 3-18.
- Armstrong, H. W. (1995): Convergence among Regions in the European Union, 1950-1990, in: *Papers in Regional Science*, 74 (2), 143-152.
- Baldwin, R.; Francois, J.; Portes, R. (1997): The Costs and Benefits of Eastern Enlargement: The Impact on the EU and Central Europe. *Economic Policy* 24: 127-176.
- Barro, R. J., Sala-i-Martin, X. (1995): *Economic Growth*. McGraw-Hill: New York.
- Behrens, K.; Gaigne, C.; Ottaviano, G.I.P.; Thisse, J.-F. (2007): Countries, regions and trade: On the welfare impacts of economic integration. *European Economic Review* 51: 1277-1301.
- Brakman, S.; Garretsen, H.; Schramm, M. (2002): *New Economic Geography in Germany: Testing the Helpman-Hanson Model*, HWWA Discussion Paper No. 172, Hamburg.
- Breuss, F. (2001): *Macroeconomic Effects of EU Enlargement for Old and New Members*, WIFO Working Paper No. 143, Vienna.
- Bröcker, J. (1998): How would an EU-membership of the Visegrád-countries affect Europe's economic geography? *Annals of Regional Science*, 32, 91-114.
- Brühlhart, M.; Crozet, M.; Koenig, P. (2004): Enlargement and the EU Periphery: The Impact of Changing Market Potential, in: *The World Economy* 27 (6), 853-875.
- Crozet, M. and Koenig-Soubeyran, P. (2004): EU Enlargement and the Internal Geography of Countries. *Journal of Comparative Economics*, 32 (2): 265-279.
- De la Fuente, A.; Vives, X. (1995): Infrastructure and education as instruments of regional policy: Evidence from Spain. *Economic Policy* 20: 13-51.

- European Commission (2004): A new partnership for cohesion. Convergence, Competitiveness, Cooperation. Third report on economic and social cohesion, Luxembourg.
- Feldkircher, M. (2006): Regional Convergence within the EU-25: A Spatial Econometric Analysis, in: Österreichische Nationalbank (ed.), *New Regional Economics in Central European Economies: The Future of CENTROPE*, Vienna, 101-119.
- Fischer, M., Stirböck, C. (2004): Regional Income Convergence in the Enlarged Europe, 1995-2000, A Spatial Econometric Perspective, ZEW Discussion Paper, No. 04-42.
- Fujita, M., Krugman, P., Venables, A. J. (1999): *The Spatial Economy*. MIT Press: Cambridge, MA.
- Geppert, K., Happich, M., Stephan, A. (2005): Regional Disparities in the European Union: Convergence and Agglomeration, Discussion Paper, 525, DIW, Berlin.
- Hanson, G. H. (2005): Market potential, increasing returns and geographic concentration, in: *Journal of international economics*, 67 (1), 1-24.
- Head, K.; Mayer, T. (2000): Non-Europe: The Magnitude and Causes of Market Fragmentation in the EU, *Weltwirtschaftliches Archiv*, 136, 284-314.
- Jasmand, S., Stiller, S. (2005). Capital Cities in the New EU-States - Current Trends and Economic Status quo, *Intereconomics*, 38 (5), 298-305.
- Krugman, P. (1993): Integration, Specialization, and Adjustment, NBER Working Paper No. 4559, Cambridge Massachusetts.
- Krugman, P., Livas Elizondo, R. (1996): Trade Policy and the Third World Metropolis, in: *Journal of Development Economics*, 49: 137-50.
- Krugman, P.; Venables, A. J. (1990): Integration and the competitiveness of peripheral industry, in: Bliss, C. (ed.), *Unity with diversity in the European economy: the Community's southern frontier*, Cambridge University Press, 56-77.
- LeGallo, J., Ertur, C., Baumont, C. (2003): A Spatial Econometric Analysis of Convergence across European Regions, 1980-1995, in: Fingleton, B. (ed.), *European Regional Growth*, Springer: Berlin, 11-53.
- Midelfart, K.-H., Overman, H.G. and Venables, A.J. (2003): Monetary Union and the Economic Geography of Europe, in: *Journal of Common Market Studies* 41 (5): 847-868.

- Mion, G. (2004): Spatial Externalities and Empirical Analysis: The Case of Italy, in: *Journal of Urban Economics* 56, 97-118.
- Monfort, P.; Nicolini, R. (2000): Regional convergence and international integration. *Journal of Urban Economics* 48: 286-306.
- Niebuhr, A. (2006): Market Access and Regional Disparities. *New Economic Geography in Europe*. *Annals of Regional Science* 40: 313-334.
- Niebuhr, A. (2008): The Impact of EU Enlargement on European Border Regions, in: *International Journal of Public Policy* (forthcoming).
- Paas, T.; Schlitte, F. (2008): Regional Income Inequality and Convergence Processes in the EU-25, in: *Italian Journal of Regional Science* (forthcoming).
- Pace, R. K., LeSage, J. P. (2006): Interpreting Spatial Econometric Models, paper presented at the North American Meeting of the Regional Science Association International, Toronto, CA, November 2006.
- Paluzie, E. (2001): Trade policies and regional inequalities. *Papers in Regional Science* 80: 67-85.
- Pfaffermayr, M.; Huber, P.; Wolfmayr, Y. (2004): Market Potential and Border Effects in Europe, WIFO Working Paper No. 235, Wien.
- Quah, D.T. (1996): Empirics for economic growth and convergence. *European Economic Review*, 40: 1353-1375.
- Tondl, G.; Vuksic, G. (2007): Catching up of Eastern European regions: the role of foreign investment, human resources and geography, in: Eisen, R., Diaz Cafferata, A. M., Neder, A. E., Recalde, M. L. (eds.), *Trade, integration and institutional reforms in Latin America and the EU*, Lang: Frankfurt, 65-90.
- Wooldridge, J. (2006): *Introductory Econometrics*, 3rd Edition, Thomson South Western.

Appendix

Cross section

EU27 – 802 regions (NUTS 2, NUTS 3, planning regions)

Austria:	35 NUTS 3 regions
Belgium:	43 NUTS 3 regions
Bulgaria*:	28 NUTS 3 regions
Czech Republic:	14 NUTS 3 regions
Germany:	97 planning regions (functional regions comprising several NUTS 3 regions)
Denmark:	15 NUTS 3 regions
Estonia:	5 NUTS 3 regions
Spain:	48 NUTS 3 regions (excluding Ceuta y Melilla, Canarias)
Finland:	20 NUTS 3 regions
France:	96 NUTS 3 regions (excluding Départements d'outre-mer)
Greece:	51 NUTS 3 regions
Hungary:	20 NUTS 3 regions
Ireland:	8 NUTS 3 regions
Italy:	103 NUTS 3 regions
Lithuania:	10 NUTS 3 regions
Luxembourg:	1 region
Latvia*:	6 NUTS 3 regions
Netherlands:	40 NUTS 3 regions
Poland:	16 NUTS 2 regions
Portugal:	28 NUTS 3 regions (excluding Açores, Madeira)
Romania*:	40 NUTS 3 regions, 1 NUTS 2 region
Sweden:	21 NUTS 3 regions
Slovenia:	12 NUTS 3 regions
Slovakia:	8 NUTS 3 regions
UK:	37 NUTS 2 regions

* not included in the regression analysis.

Only considered in the calculation of the market potentials:

Switzerland:	26 cantons
Norway:	19 fylke

Tables and figures

Table 1: Regression Results for Market Potential Function

	DEPENDENT VARIABLE: LOG (GVA PER CAPITA)	
	1995	2000
γ_0	6.54** (18.55)	6.57** (19.06)
γ_1	0.17** (10.28)	0.19** (11.05)
γ_3	0.0039** (4.61)	0.0040** (5.02)
Adj. R^2	0.86	0.87

Notes: t -statistics (in parentheses) are based upon White's heteroscedasticity-adjusted standard errors. The regression models include control variables, dummies for outlying regions, and some country-dummies.
 ** significant at the 0.01 level, * significant at the 0.05 level.

Table 2: Regional convergence, no national effects, no integration effects

	EU (728 observations)			EU15 (643 observations)			NMS (85 observations)		
	OLS	SLM	SEM	OLS	SLM	SEM	OLS	SLM	SEM
Const.	1.880** (15.92)	0.676** (6.25)	1.357** (7.70)	1.293** (7.61)	0.593** (3.85)	1.180** (5.78)	1.471** (3.71)	0.129 (0.36)	-0.680 (-1.30)
$\ln(y_{it_0})$	-0.158** (-12.83)	-0.069** (-6.40)	-0.093** (-5.19)	-0.098** (-5.56)	-0.059** (-3.82)	-0.081** (-3.72)	-0.105* (-2.32)	0.001 (0.02)	0.135* (2.30)
Rho/Lambda		0.953** (27.01)	0.966** (32.14)		0.941** (23.48)	0.944** (23.65)		0.740** (6.82)	0.857** (10.97)
Beta	1.92	0.79	1.08	1.15	0.68	0.93	1.24	-0.01	-1.41
Half-life	36	88	64	60	102	74	56		
AIC	-1064	-1334	-1315	-1004	-1231	-1229	-103	-120	-125
Diagnostics of the OLS Regressions									
Normality:	Jarque-Bera =246.60**			Jarque-Bera =231.00**			Jarque-Bera =16.23**		
Spatial error:	Moran's I =23.79**; LM =535.25**; RLM =60.62**			Moran's I =23.57**; LM =521.02**; RLM =43.86**			Moran's I =4.14**; LM =12.33**; RLM =15.05**		
Spatial lag:	LM =490.85**; RLM =16.22**			LM =478.08**; RLM =0.91			LM =21.19**; RLM =23.91**		

Notes: t -statistics (in parentheses) are based upon White's heteroscedasticity-adjusted standard errors.
 ** significant at the 0.01 level, * significant at the 0.05 level.

Table 3: Regional convergence, including national effects, no integration effects

	EU (728 observations)			EU15 (643 observations)			NMS (85 observations)		
	OLS	SLM	SEM	OLS	SLM	SEM	OLS	SLM	SEM
Const.	0.702** (4.09)	0.546** (3.27)	0.709** (3.86)	0.955** (5.73)	0.796** (4.88)	1.000** (5.52)	-1.384** (-3.14)	-1.403** (-3.67)	-1.405** (-3.04)
$\ln(y_{it_0})$	-0.040* (-2.28)	-0.035* (-2.11)	-0.041* (-2.15)	-0.066** (-3.88)	-0.061** (-3.77)	-0.071** (-3.79)	0.207** (4.32)	0.207** (4.48)	0.210** (4.16)
Rho/Lambda		0.328* (2.98)	0.596* (2.55)		0.343** (2.95)	0.635* (2.23)		0.040 (0.17)	-0.070 (-0.27)
Czech Rep.	0.055 (1.78)	0.039 (1.29)	0.039 (0.98)				-0.138** (-5.31)	-0.135** (-4.20)	-0.137** (-5.87)
Estonia	0.381** (6.12)	0.303** (4.08)	0.399** (4.04)				0.392** (7.26)	0.385** (4.78)	0.394** (7.60)
Hungary	0.209** (5.63)	0.161** (4.31)	0.182** (3.79)				0.128** (3.38)	0.126** (3.10)	0.131** (3.34)
Lithuania	0.284** (5.69)	0.209** (3.55)	0.281** (3.29)				0.271** (4.77)	0.265** (3.69)	0.273** (4.91)
Poland	0.174** (5.89)	0.143** (4.57)	0.167** (4.66)				0.114** (3.13)	0.113** (3.07)	0.115** (3.24)
Slovakia	0.228** (8.61)	0.185** (5.89)	0.224** (6.46)				0.140** (3.92)	0.138** (3.73)	0.140** (4.14)
Slovenia	0.178** (8.35)	0.156** (6.34)	0.171** (5.93)						
Austria	0.060** (4.70)	0.048** (3.65)	0.046* (2.36)	0.059** (4.69)	0.052** (4.05)	0.045* (2.17)			
Belgium	0.045** (3.16)	0.036* (2.46)	0.039 (1.89)	0.042** (2.89)	0.030 (2.00)	0.033 (1.53)			
Denmark	0.029* (2.13)	0.027 (1.97)	0.030 (1.78)	0.031* (2.20)	0.029* (2.07)	0.034 (1.85)			
Spain	0.154** (12.81)	0.130** (8.82)	0.150** (9.16)	0.147** (12.48)	0.120** (7.90)	0.142** (8.53)			
Finland	0.088** (5.57)	0.066** (3.76)	0.082** (3.11)	0.085** (5.40)	0.065** (3.73)	0.081* (2.82)			
France	0.007 (0.78)	0.007 (0.78)	0.000 (0.03)	0.005 (0.57)	0.004 (0.44)	-0.004 (-0.26)			
Greece	0.053 (1.62)	0.050 (1.57)	0.104 (1.17)	0.039 (1.21)	0.035 (1.11)	0.099 (0.86)			
Ireland	0.357** (8.20)	0.295** (6.06)	0.377** (5.55)	0.352** (8.02)	0.284** (5.74)	0.374** (5.11)			
Italy	-0.067** (-7.12)	-0.048** (-4.06)	-0.077** (-4.71)	-0.067** (-7.26)	-0.045** (-3.69)	-0.076** (-4.36)			
Luxemburg	0.281** (22.52)	0.283** (23.41)	0.306** (13.74)	0.297** (24.32)	0.298** (25.19)	0.326** (14.06)			
Netherlands	0.104** (7.82)	0.087** (5.95)	0.108** (5.64)	0.105** (7.89)	0.084** (5.60)	0.108** (5.51)			
Portugal	0.006 (0.28)	0.003 (0.14)	0.006 (0.18)	-0.009 (-0.45)	-0.014 (-0.71)	-0.009 (-0.28)			
Sweden	0.014 (1.01)	0.009 (0.65)	0.007 (0.40)	0.014 (1.05)	0.011 (0.79)	0.009 (0.45)			
UK	0.125** (8.85)	0.100** (6.21)	0.117** (5.72)	0.123** (8.64)	0.096** (5.72)	0.115** (5.25)			
Beta	0.46	0.40	0.46	0.76	0.71	0.82	-2.09	-2.09	-2.12
Half-life	152	173	151	91	98	85			
AIC	-1450	-1456	-1470	-1330	-1335	-1351	-152	-148	-148
Diagnostics of the OLS Regressions									
Normality:	Jarque-Bera =1195.00**			Jarque-Bera =1436.00**			Jarque-Bera =21.50**		
Spatial error:	Moran's I =7.45** LM =25.44**; RLM =16.61**			Moran's I =7.36**; LM =28.85**; RLM =27.05**			Moran's I =1.33; LM =0.06; RLM =1.45		
Spatial lag:	LM =12.75**; RLM =3.92			LM =12.50**; RLM =10.70**			LM =0.02; RLM =1.42		

Notes: *t*-statistics (in parentheses) are based upon White's heteroscedasticity-adjusted standard errors.

** significant at the 0.01 level, * significant at the 0.05 level.

Table 4: Regional convergence, no national effects, including integration effects

	EU (728 observations)			EU15 (643 observations)			NMS (85 observations)		
	OLS	SLM	SEM	OLS	SLM	SEM	OLS	SLM	SEM
Const.	1.601** (12.29)	0.556** (4.49)	1.161** (6.60)	1.316** (7.72)	0.598** (3.89)	1.192** (5.64)	1.513** (3.01)	0.076 (0.18)	-0.692 (-1.33)
$\ln(y_{t_0})$	-0.130** (-9.59)	-0.056** (-4.55)	-0.074** (-3.98)	-0.100** (-5.68)	-0.060** (-3.85)	-0.082** (-3.70)	-0.111 (-1.86)	0.007 (0.16)	0.138* (2.30)
ΔMP	0.765** (5.33)	0.369* (2.77)	0.884** (4.12)	-2.012 (-1.39)	-0.374 (-0.33)	-1.645 (-0.48)	0.065 (0.23)	-0.075 (-0.33)	-0.185 (-0.37)
Rho/Lambda		0.942** (23.73)	0.960** (28.82)		0.940** (23.57)	0.945** (23.86)		0.743** (6.96)	0.853** (10.48)
Beta	1.55	0.64	0.856	1.17	0.68	0.95	1.30	-0.08	-1.44
Half-life	45	108	81	59	102	73	53		
AIC	-1088	-1341	-1332	-1004	-1229	-1227	-101	-118	-123
Diagnostics of the OLS Regressions									
Normality:	Jarque-Bera =255.70**			Jarque-Bera =220.00**			Jarque-Bera =17.41**		
Spatial error:	Moran's I =23.63**; LM =520.66**; RLM =56.62**			Moran's I =23.67**; LM =513.39**; RLM =41.51**			Moran's I =4.28**; LM =11.71**; RLM =18.00**		
Spatial lag:	LM =475.94**; RLM =11.90**			LM =473.16**; RLM =1.28			LM =21.03**; RLM =27.32**		

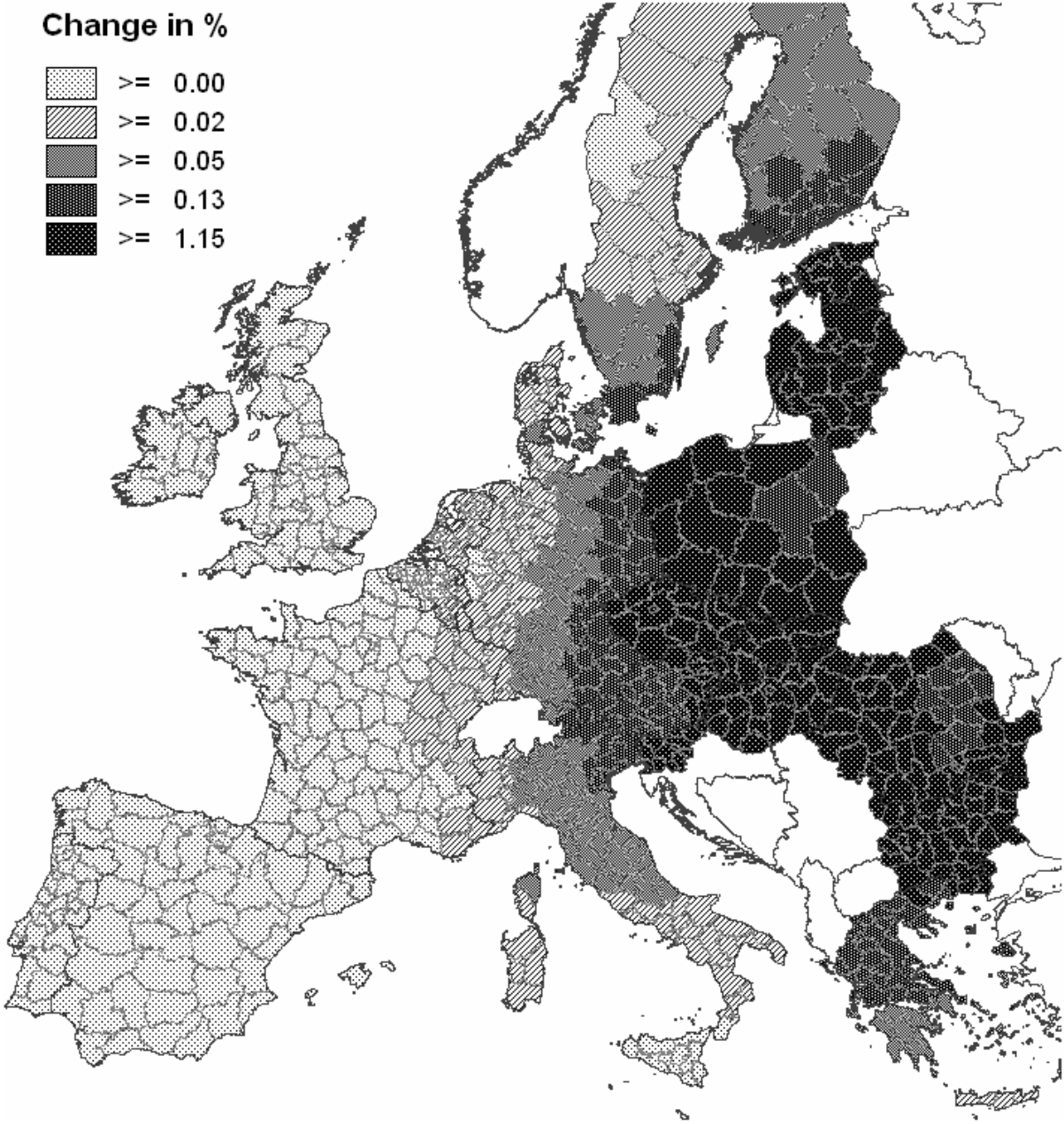
Notes: *t*-statistics (in parentheses) are based upon White's heteroscedasticity-adjusted standard errors.
 ** significant at the 0.01 level, * significant at the 0.05 level.

Table 5: Regional convergence, including national effects and integration effects

	EU (728 observations)			EU15 (643 observations)			NMS (85 observations)		
	OLS	SLM	SEM	OLS	SLM	SEM	OLS	SLM	SEM
Const.	0.702** (4.06)	0.546** (3.27)	0.709** (3.84)	0.986** (5.85)	0.828** (5.02)	1.024** (5.58)	-1.352** (-3.23)	-1.376** (-3.78)	-1.384** (-3.05)
$\ln(y_{t_0})$	-0.040* (-2.26)	-0.036* (-2.11)	-0.041* (-2.14)	-0.069** (-3.99)	-0.064** (-3.88)	-0.073** (-3.87)	0.218** (4.44)	0.218** (4.66)	0.222** (4.12)
ΔMP	-0.068 (-0.08)	0.151 (0.19)	-0.054 (-0.06)	-3.803 (-1.46)	-3.454 (-1.41)	-3.206 (-1.10)	-0.722 (-0.85)	-0.733 (-0.92)	-0.718 (-0.91)
Rho/Lambda		0.329** (2.97)	0.596* (2.55)		0.333** (2.86)	0.605* (2.50)		0.049 (0.21)	-0.079 (-0.29)
Czech Rep.	0.061 (0.71)	0.025 (0.30)	0.044 (0.44)				-0.201* (-2.53)	-0.199* (-2.48)	-0.200* (-2.76)
Estonia	0.386** (4.17)	0.291** (2.85)	0.403** (3.23)				0.329** (3.80)	0.318** (3.35)	0.331** (4.19)
Hungary	0.214* (2.70)	0.150 (1.92)	0.186 (1.96)				0.054 (0.67)	0.050 (0.67)	0.057 (0.78)
Lithuania	0.287** (4.34)	0.202* (2.71)	0.283* (2.84)				0.180 (1.62)	0.172 (1.57)	0.183 (1.80)
Poland	0.175** (4.86)	0.140** (3.68)	0.168** (3.87)				0.002 (0.02)	0.000 (0.00)	0.005 (0.04)
Slovakia	0.236* (2.17)	0.166 (1.53)	0.231 (1.86)				0.104 (1.95)	0.102 (1.99)	0.106* (2.14)
Slovenia	0.190 (1.25)	0.128 (0.87)	0.181 (1.05)						
Austria	0.060** (4.34)	0.047** (3.24)	0.046* (2.32)	0.086** (3.92)	0.076** (3.58)	0.063* (2.60)			
Belgium	0.045** (3.16)	0.036* (2.47)	0.039 (1.88)	0.038* (2.59)	0.027 (1.78)	0.031 (1.44)			
Denmark	0.029* (2.13)	0.027 (1.97)	0.030 (1.78)	0.031* (2.21)	0.029* (2.09)	0.034 (1.93)			
Spain	0.154** (12.82)	0.130** (8.83)	0.150** (9.16)	0.142** (11.69)	0.116** (7.60)	0.138** (8.21)			
Finland	0.088** (5.56)	0.066** (3.73)	0.082** (3.11)	0.085** (5.37)	0.066** (3.77)	0.080** (2.90)			
France	0.007 (0.77)	0.007 (0.80)	0.000 (0.03)	0.002 (0.16)	0.001 (0.07)	-0.006 (-0.46)			
Greece	0.054 (1.59)	0.049 (1.51)	0.104 (1.17)	0.049 (1.40)	0.044 (1.29)	0.097 (1.04)			
Ireland	0.357** (8.20)	0.295** (6.05)	0.377** (5.55)	0.347** (7.88)	0.282** (5.71)	0.368** (5.21)			
Italy	-0.067** (-7.11)	-0.047** (-4.03)	-0.077** (-4.71)	-0.068** (-7.28)	-0.047** (-3.80)	-0.077** (-4.66)			
Luxemburg	0.281** (22.19)	0.283** (23.11)	0.306** (13.69)	0.296** (23.74)	0.296** (24.65)	0.324** (14.41)			
Netherlands	0.104** (7.81)	0.087** (5.95)	0.108** (5.63)	0.101** (7.52)	0.082** (5.41)	0.105** (5.46)			
Portugal	0.006 (0.27)	0.003 (0.14)	0.006 (0.18)	-0.014 (-0.71)	-0.019 (-0.94)	-0.014 (-0.44)			
Sweden	0.014 (1.01)	0.009 (0.65)	0.007 (0.40)	0.013 (0.92)	0.009 (0.69)	0.007 (0.37)			
UK	0.125** (8.84)	0.100** (6.21)	0.117** (5.71)	0.119** (8.16)	0.093** (5.50)	0.112** (5.14)			
Beta	0.45	0.40	0.46	0.79	0.74	0.84	-2.19	-2.19	-2.23
Half-life	153	172	151	87	94	83			
AIC	-1448	-1454	-1468	-1332	-1336	-1351	-151	-147	-147
Diagnostics of the OLS Regressions									
Normality:	Jarque-Bera =1193.00**			Jarque-Bera =1377.00**			Jarque-Bera =21.21**		
Spatial error:	Moran's I =7.50**; LM =25.43**; RLM =16.76**			Moran's I =7.12**; LM =25.53**; RLM =21.66**			Moran's I =1.41; LM =0.07; RLM =2.06		
Spatial lag:	LM =12.78**; RLM =4.10*			LM =11.71**; RLM =7.84*			LM =0.04. RLM =2.03		

Notes: t -statistics (in parentheses) are based upon White's heteroscedasticity-adjusted standard errors.
** significant at the 0.01 level, * significant at the 0.05 level.

Figure 1: Market potential changes due to reduced border impediments in the EU (Scenario 1)



Market potential changes in the NMS due to reduced border impediments

Figure 2: Scenario 1

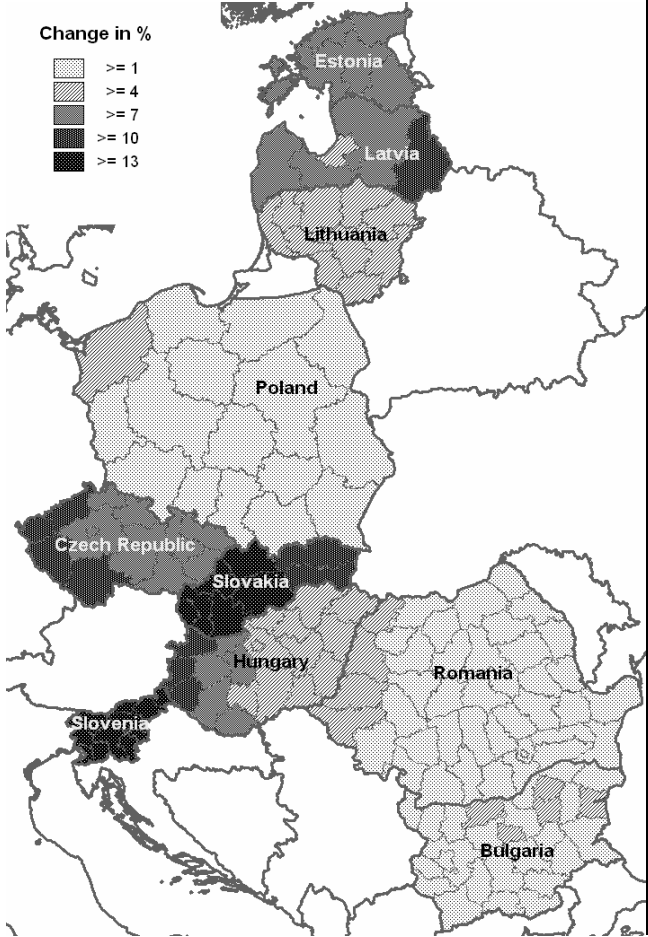


Figure 3: Scenario 2a

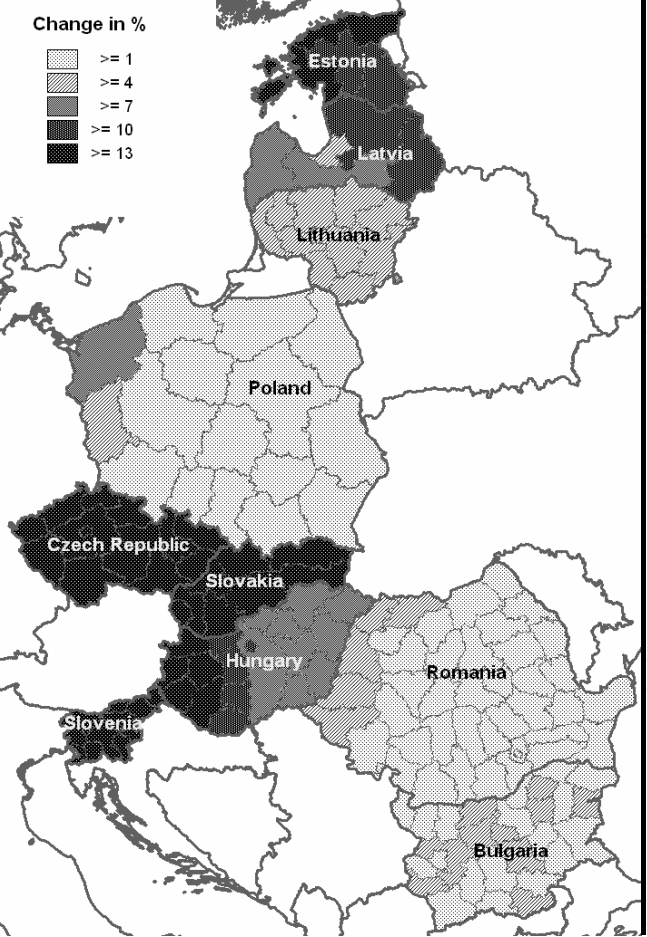


Figure 4: Scenario 2b

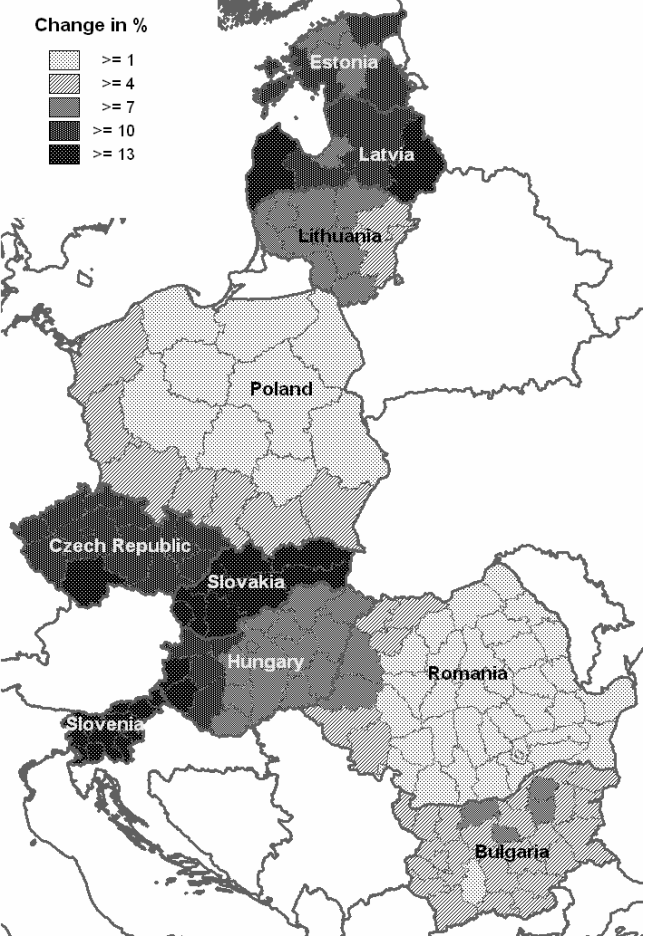


Figure 5: Regional income levels and relative changes in market access in the NMS

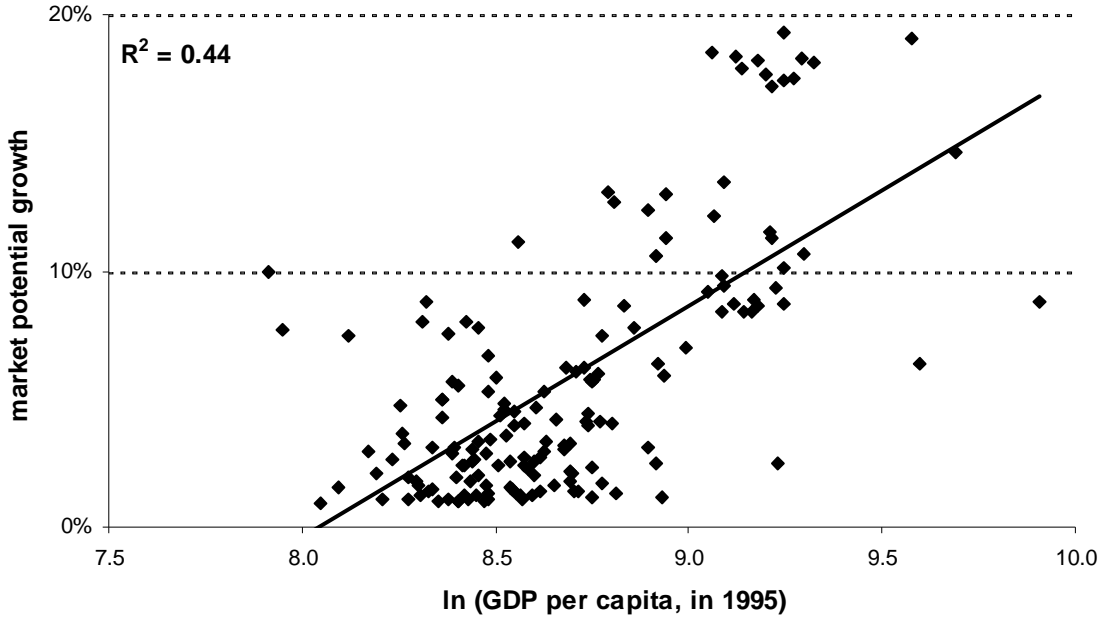
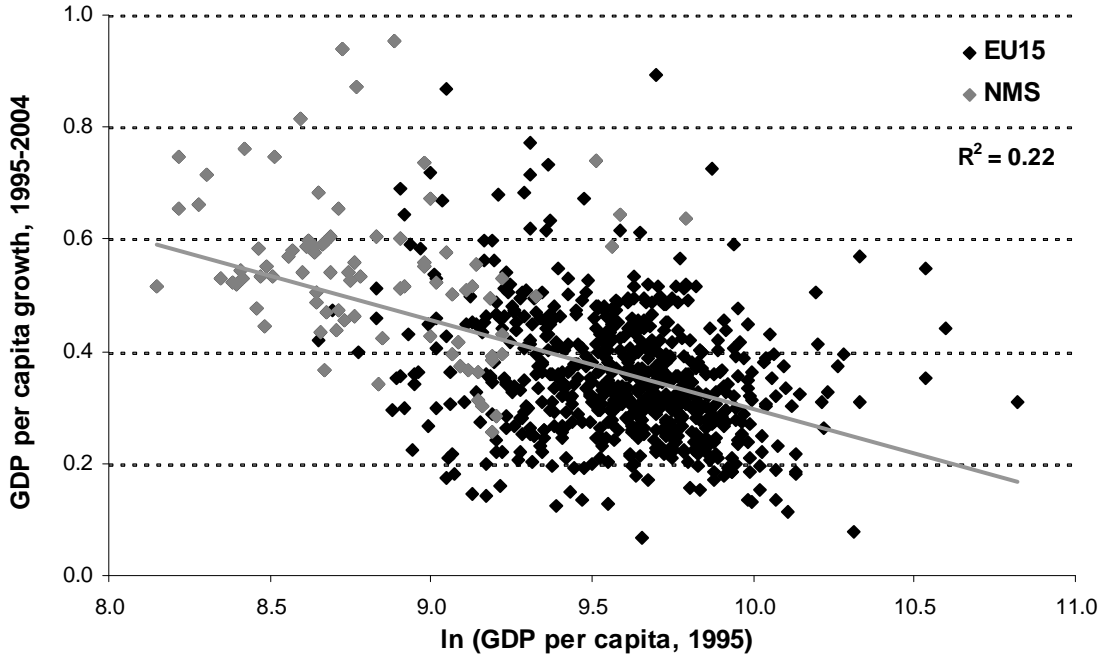


Figure 6: Initial income levels and growth in the EU, 1995 to 2004



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Hamburg Institute of International Economics (HWWI)

Heimhuder Str. 71 | 20148 Hamburg | Germany

Phone +49 (0)40 34 05 76 - 0 | Fax +49 (0)40 34 05 76 - 776

info@hwwi.org | www.hwwi.org