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# **HWWA Discussion Paper**

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HWWA Discussion Paper 330

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# The Impact of EU Enlargement on European Border Regions

## ABSTRACT

EU enlargement is supposed to entail profound impact on the location of economic activities in Europe. Although there is concern about the implications of enlargement for regional disparities in the EU, corresponding empirical results are still rare. The objective of this analysis is to provide empirical evidence on enlargement effects with a special focus on border regions in the EU27 since they are likely to play a critical role within the spatial dynamics initiated by integration. Departing from a three-region economic geography model we investigate whether changes in market access released by integration result in above-average integration benefits in border regions.

**Keywords:** Integration, market access, EU enlargement, border regions  
**JEL classification:** C21, F15, R12

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# 1 INTRODUCTION

EU enlargement is supposed to entail profound impact on the location of economic activities in Europe. Especially, the proceeding economic integration of Central and Eastern European Countries (CEECs) might release diverse effects on EU regions, depending on their location and specialisation. Although there is some concern about the implications of enlargement for regional disparities in the EU, corresponding empirical evidence is still rare. The economic literature on enlargement effects focuses on EU-wide impact on growth and country effects.<sup>1</sup> Bröcker and Jäger-Roschko (1996) and Bröcker (1998) provide quantitative estimates of regional effects in Europe caused by economic integration of the CEECs.<sup>2</sup> In recent studies, Brühlhart et al. (2004) and Pfaffermayr et al. (2004) investigate the consequences of changes in market access for EU regions due to the enlargement. Niebuhr (2004a) considers the impact of integration among Western European countries on EU15 border regions. Our analysis is closely related to the latter studies, however, we focus on the effects of enlargement on border regions in the EU27.<sup>3</sup>

Resmini (2003) notes that border regions are likely to play a critical role within the spatial dynamics initiated by the latest EU enlargement. With accession of 10 new member states the share of border regions in the total area of the EU has increased from 22% in the EU15 to more than 35% in the EU25. The percentage of EU population living in border regions rose from 15% to almost 25%. According to the European Commission (2001), especially regions along the former external EU border may experience distinct integration effects because of their proximity to the new member states. In general, these internal border regions are expected to benefit from economic integration in the medium and long term since increasing cross-border interaction and a favourable location in the enlarged EU market may initiate a dynamic growth process in these areas. However, in the short run the internal border regions might face pronounced adjustment pressures due to increased competition in product and labour markets. Regions with borders internal to the EU are not regarded by the Commission as principally disadvantaged, whereas external border regions, i.e. areas along external EU borders, are as-

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1 E.g. Baldwin et al. (1997), Lejour et al. (2001) or Breuss (2001).

2 The analysis by Aiginger and Pfaffermayr (2000) is relevant as well in this context since they investigate the concentration of economic activity in Europe in the 1990s when integration between Eastern and Western European countries had already started.

3 Lafourcade and Paluzie (2005) investigate the effects of integration on French and Spanish regions, focusing on differences between border and non-border regions as well.

sumed to be in a more difficult situation. This applies in particular to the regions along the eastern borders of the new member states.

This paper aims at providing empirical evidence on spatial effects of EU enlargement with a special focus on border regions in the EU27. The study deals with the issue whether enlargement via its impact on market access affects the spatial distribution of economic activity in the EU27. More precisely, we investigate the question whether internal border regions achieve above-average integration benefits due to their favourable access to foreign markets. Are there significant differences between regions in the EU15 and the new member states? Finally, are the external border regions in the new member states in danger of permanently lagging behind due to an unfavourable geographic location with respect to the EU market? The effects of integration among EU15 and CEECs are investigated for the period between 1995 and 2000. The analysis is restricted to integration effects arising from changes in market access released by declining impediments to cross-border trade. Thus we do not offer a comprehensive investigation of spatial integration effects because effects emerging from differences in specialisation and factor mobility are not considered.

With accession of the new member states in May 2004, most formal barriers to cross-border interaction have been removed. But, on the one hand, integration among EU15 and the CEECs had already started long before accession in the early 1990s with the implementation of the Europe Agreements. On the other hand, there is evidence of significant border impediments even among highly integrated EU15 countries (see e.g. Bröcker 1998, Head and Mayer 2000, Nitsch 2000). The findings by Sousa and Disdier (2002) as well as Manchin and Pinna (2003) indicate that even higher impediments, caused by technical regulations, deficits in cross-border infrastructure, institutional and administrative disparities as well as cultural and linguistic differences, might still exist between new and old member states. The objective of the paper is to estimate the impact of tariff reductions and the decline of non-tariff impediments between EU15 and CEECs on regional market potential and per capita income.

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, in particular when the impact on border regions is concerned. A recent model by Brühlhart et al. (2004) allows to derive specific implications for border regions. We estimate the relationship between market access and per

capita income derived from the NEG framework. The regression results are applied in a simulation analysis. The basic idea of the simulation analysis is that a reduction of border impediments due to integration affects the accessibility of markets in the enlarged EU. Changes in the market potential of EU regions will in turn impact on regional per capita income.

The rest of the paper is organised as follows. Section 2 comprises a short description of the theoretical framework of the study. In section 3 empirical evidence on the size and development of border impediments in the enlarged EU is summarised. The underlying regression model and the simulation methodology are presented in section 4. Data and regional system are described in section 5. The results of the regression and simulation analyses are presented in section 6. Section 7 concludes.

## **2 THEORETICAL FRAMEWORK**

A NEG model is applied to analyse specific integration effects arising in border regions due to changes of regional market access.<sup>4</sup> Krugman (1993) as well as Krugman and Venables (1990) investigated the spatial implication of European integration within the framework of NEG models. According to corresponding approaches, changes in access to foreign markets emerging in the course of integration might act as a force that results in an uneven development of economic activities within integrating countries. However, most models do not provide clear-cut conclusions since integration might work to the advantage of central locations or peripheral areas. Moreover, only a few approaches allow to analyse explicitly the implication of integration for border regions because an internal spatial structure of an integrating economy is usually not considered in theoretical models.

A three-region NEG model by Brülhart et al. (2004) allows to address the issue of integration effects in border regions. In this approach, there are three regions in two countries, the domestic country and the foreign economy (0). The domestic country contains an interior region (1) and a region that shares a common border with the foreign country, i.e. the border region (2). The economies consist of a monopolistically competitive

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4 See Niebuhr and Stiller (2004) for a more detailed presentation of corresponding models and their spatial implication as regards integration processes.



industry and a perfectly competitive agricultural sector. Goods are traded among all regions.

Utility maximisation results in the following demand function for manufacturing goods<sup>5</sup>:

$$(1) \quad c_{ij} = \frac{\gamma(p_i T_{ij})^{-\sigma}}{P_j^{1-\sigma}} \quad ; \quad i, j = 0, 1, 2$$

$c_{ij}$  is demand in region  $j$  for manufacturing goods produced in region  $i$ .  $P_j$  is the price index for manufactured products in region  $j$ ,  $p_i$  is the mill price of varieties produced in  $i$  and  $T_{ij}$  are transport costs. Manufactured commodities are traded among regions incurring iceberg transport costs, i.e. a fraction of any good shipped melts away and only the 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 transport costs.<sup>6</sup> The approach differentiates between cross-border transport costs ( $T_{01}$ ,  $T_{02}$ ) and internal transport costs ( $T_{12}$ ) which apply to interregional domestic trade. It is assumed that the border region has better access to the foreign market than the interior region ( $T_{01} > T_{02}$ ).

There are two factors of production: mobile human capital  $H$  and immobile labour  $L$ . In agriculture only labour is used as an input, whereas the manufacturing sector uses both labour and human capital for production. There are increasing returns in the production of each variety of manufactured goods. All manufacturing firms have the same production function. Fixed costs arise from the use of human capital, whereas marginal costs are due to labour input. 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 region's endowment with human capital. If human capital increases due to immigration, the number of supplied manufacturing goods will rise in that region. There is no international factor mobility. However, human capital is mobile between the domestic regions. Human capital owners migrate towards the region that offers the highest utility. Migration takes place according to the following indirect utility differential:

$$(2) \quad V_i - V_j = \gamma \ln(P_j / P_i) + (r_i - r_j) \quad i, j \neq 0$$

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

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

where  $r_i$  is the wage of human capital and  $P_j$  ( $P_i$ ) is the price index for manufacturing goods in region  $j$  ( $i$ ). Thus, there are two factors determining the mobility of human capital. Human capital owners migrate towards regions characterised by a relatively low price index for manufacturing goods and a comparatively high remuneration of human capital.

Integration, i.e. a decline of cross-border transport costs, gives rise to two opposed forces.<sup>7</sup> On the one hand, a rising accessibility of the foreign market increases the incentive to locate near foreign consumers for the domestic industry, i.e. to locate in the border region, because the importance of domestic demand declines relative to foreign demand. 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. Therefore the border region also gains attractiveness for mobile qualified labour since foreign supply of consumer goods becomes more important. On the other hand, integration will result in an increased competition from foreign firms, especially in border regions, thereby reducing the attractiveness of border regions as production sites.

To sum up, integration reduces both the strength of internal centripetal and centrifugal forces. According to the results of Brühlhart et al. (2004), the effect on the centrifugal force dominates. Consequently, the probability that domestic manufacturing concentrates in one region increases due to declining external trade costs. If we assume perfect symmetry of domestic regions, the corresponding location of industry will be indeterminate. However, if the border region has better access to foreign demand, its attractiveness relative to the internal domestic region will rise in case of trade liberalisation. A concentration of manufacturing in the interior region will only arise in case a comparatively large number of manufacturing firms is located in that region in the pre-integration period. From the perspective of the border region, the beneficial impact of an improved accessibility of foreign demand dominates the adverse effect of increased competition from neighbouring foreign firms.

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7 In the model, only the impact of trade liberalisation is considered. Effects resulting from free cross-border movement of labour and human capital are ignored.

### 3 SIZE AND DEVELOPMENT OF BORDER IMPEDIMENTS IN THE ENLARGED EU

Integration between EU15 and the CEECs has started already in the early 1990 with the Europe Agreements which aimed at establishing free trade among the corresponding countries via the removal of tariffs and quantitative restrictions.<sup>8</sup> According to Bröcker (1998), tariff barriers on EU imports from the Visegrád countries<sup>9</sup> had already been low at the mid of the 1990s. However, non-tariff barriers due to different technical standards and regulations are presumably more relevant in this context and their reduction will be more time-consuming. Moreover, barriers persist caused by cultural or institutional differences. Therefore, impediments to trade between old and new member states are far from being abolished with accession of the new member states in 2004. Bröcker assumes that full membership implies an equivalent tariff reduction of around 10 percentage points. As regards EU exports to the Visegrád countries, impediments have been probably even larger and might range up to 25 percentage points.

Empirical evidence of differences in the intensity of border impediments among old and new member states is still rather scarce. Bröcker (1996) argues that impediments to non-EU trade are considerably higher than those among EU countries. He estimates a distance equivalent of 600 kilometers (tariff equivalent of 32%), implying that EU trade is 2.8 times higher than non-EU trade. This estimate takes into account that there are specific impediments to trade with transformation countries. In a recent study, Sousa and Disdier (2002) investigate the effect of legal framework on trade flows between some Eastern European countries (Hungary, Romania, Slovenia) and the EU15 between 1995 and 1998. Their estimates point to significant border effects. The results imply that domestic regions in these countries trade on average 31 times more among each other than with foreign regions in EU or CEFTA countries.<sup>10</sup> Moreover, the border effect is stronger for trade with CEFTA countries than for EU countries. A comparison of their results with estimates by Bröcker (1998) for EU15 countries suggests that by the mid of the 1990s border effects between accession countries and EU15 countries were more important

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8 The agreements also contain provisions for trade in services and the mobility of people and capital.

9 Poland, Czech Republic, Slovakia and Hungary.

10 Members of the Central European Free Trade Agreement (CEFTA) are Bulgaria, Hungary, Poland, Czech Republic, Romania, Slovakia and Slovenia. Sousa and Disdier (2002) argue that the comparatively strong border effect with respect to CEFTA trade is due to the bilateral association agreements between CEECs and EU, which might result in a more rapid development of trade relations between CEFTA and EU15 countries compared with linkages within CEFTA.

than among EU15 members, as one might expect.<sup>11</sup> This is confirmed by findings of Manchin and Pinna (2003) for the five accession countries Hungary, Poland, Romania, Latvia and Cyprus. Their analysis deals with the question whether market fragmentation is more relevant in the CEECs area than within the EU15. They detect border effects between 25 and 220 depending on the approach adopted by the EU to remove technical barriers to trade.

Corresponding differences with respect to the intensity of integration are also reflected by so called integration factors applied in the study by Fürst et al. (1999) which are designed to reflect economic and political relationships between countries and expressed as a time penalty on travel time. The authors also estimate the development of the integration factors for different country groups. Decreasing time penalties between the EU and CEECs reflect the integration process. The study assumes that time penalties halved from 120 to 60 minutes between the mid of the 1990s and the accession date.

Brühlhart et al. (2004) analyse integration effects in EU15 regions that arise from enlargement via simulating changes in market access caused by declining border impediments. However, they model enlargement in a fairly simple way. In the analysis, a pre-enlargement situation, where only purchasing power of the old member states enters into market access, is compared with the integration case where also income of the CEECs is relevant for the market potential. In contrast, we use the information on the intensity and evolution of border impediments in the enlarged EU mentioned above to investigate the integration process between the CEECs and the EU15 countries in order to evade this all-or-none modelling of integration. We presume that trade impediments between EU15 countries and the new member states amount to a travel time equivalent of 450 minutes as compared to intra-EU15 trade. Following Bröcker (1998), we also investigate an asymmetric reduction of trade impediments among new and old member states. Accession is associated with an equivalent tariff reduction of 10 percentage points with respect to EU imports from CEECs. As regards EU exports to the CEECs, a decline of 25 percentage points is assumed. This corresponds with a decline of time penalties of roughly 100 and 230 minutes respectively in our analysis. Moreover, using the information given in Fürst et al. (1999), the effect of a uniform reduction of border impediments by 60 minutes between EU15 and CEECs is investigated. Finally, the case of an asymmetric integration between EU15 countries and CEECs is considered. We ana-

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11 Bröcker (1998) estimates factors of around 20 by which international trade is reduced compared with intranational exchange of goods for well integrated EU countries.

lyse both a stronger reduction of border impediments between EU15 and CEECs as compared to integration among CEECs (minus 100 minutes versus 60 minutes) and a more intense integration among CEECs relative to integration with the old member states (minus 100 minutes versus 60 minutes).

#### 4 REGRESSION AND SIMULATION FRAMEWORK

Firstly, we have to determine the relationship between economic activity and market access in order to simulate regional integration effects caused by a reduction of border impediments among EU15 and CEECs. We apply the so-called nominal wage equation to identify this link<sup>12</sup>:

$$(3) \quad w_j = \left[ \sum_{i=1}^J Y_i e^{-\tau(\sigma-1)d_{ij}} P_i^{\sigma-1} \right]^{1/\sigma}$$

with  $w_j$  as the nominal wage in region  $j$  and  $Y_i$  as income in region  $i$ .  $\tau$  is transport costs per distance unit and  $d_{ij}$  is the distance (travel time) between the regions  $i$  and  $j$ . Equation (3) 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  $j$ . Labour demand and wages are relatively high in locations close to high consumer demand (see Hanson 2000). Regional wages increase with income of neighbouring regions and decline with rising transport costs to these locations.

Regional data sufficient to generate robust regression results based on equation (3) are not available for a cross section that covers all EU27 regions.<sup>13</sup> Therefore, the determination of the relation between regional wages and market access rests on a cross section of EU15 regions. Moreover, we have to assume that the price index is equal in all regions ( $P_i = P$ ) to arrive at an estimable equation, since there is no consistent information on regional price levels in the EU. This implies that nominal instead of real market access is considered. Nominal market access is frequently used in empirical studies that

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12 See Hanson (2000), Brakman et al. (2002), Mion (2003) and Niebuhr (2004b) for empirical evidence on the nominal wage equation.

13 The problem of insufficient data availability for regions in the new member states pertains in particular to the availability of control variables necessary to ensure a robust estimation of the correlation between market access and regional per capita income.

investigate implications of NEG. Furthermore, we use GDP per capita as dependent variable  $z_j$ , thus considering that market access is a main influencing factor of spatial structures of per capita income. The regression model is given by:

$$(4) \quad \log(z_j) = \alpha_0 + \alpha_1 \log\left(\sum_{i=1}^J Y_i e^{-\alpha_2 d_{ij}}\right) + \sum_{n=1}^N \gamma_n X_{jn} + \varepsilon_j$$

A model including only market access as explanatory variable can only represent a limited explanation of regional disparities. In addition, local amenities and the sectoral composition of the regional economy are most likely to impact the spatial distribution of economic activities. To allow for such effects and check the robustness of the estimated relationships between a region's market access and per capita income, the regression model also includes some control variables  $X_{jn}$ . Applied control variables comprise indicators for sectoral composition of regional economies, the presence of local amenities, as well as dummies for countries and outlying regions if necessary (see appendix for details).

The coefficient of market access  $\alpha_1$  and the distance decay parameter  $\alpha_2$ , fixed by means of regression analyses, are used to generate market potentials and to investigate the effects of changes in market access on regional per capita income. The analysis deals with the spatial impact of integration among EU15 and CEECs released by declining border impediments which change market access of European regions. The period under consideration is limited to the phase after the mid of the 1990s due to data restrictions. Integration is modelled via a manipulation of the travel time matrix applied in the calculation of market potentials. Interregional travel time data by Schürmann/Talaat (2000) that are used in the regressions and the simulation analyses comprise specific border impediments. Cross-border travel time includes waiting times at border crossings. We base the perfect integration scenario on this travel time matrix, thus apart from waiting times all other border impediments are set to zero in this case. Furthermore, to simulate economic integration of the CEECs, we add travel time equivalents of border impediments to the raw travel times which diminish according to results of studies surveyed in section 3.

The market potential of region  $j$  in year  $t$  is given by:

$$(5) \quad MP_{jt} = \sum_i Y_{it} \cdot e^{-\alpha_2(d_{ij}+b_{ji})}$$

where  $Y_{it}$  is income in region  $i$  in year  $t$ ,  $\alpha_2$  is the distance decay parameter determined in the regression analysis and  $d_{ij}$  is the distance between the regions  $i$  and  $j$ .  $b_{ijt}$  are travel time equivalents of border impediments in year  $t$ . In this analysis, only the effects of declining border impediments between EU15 countries and CEECs and among new member states are considered. Thus:

- $b_{ijt} = 0$ ,                      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

We consider the following scenarios regarding the intensity and development of border impediments between EU15 and CEECs in the period between 1995 and 2000:

1. Uniform reduction of border impediments by a travel time equivalent of 60 minutes
2. Asymmetric reduction of border impediments by travel equivalents of 100 and 230 minutes
  - a) Reduction by 100 minutes with respect to EU15 imports from CEECs and 230 minutes as regards EU exports to CEECs
  - b) Reduction by 230 minutes with respect to EU15 imports from CEECs and 100 minutes as regards EU exports to CEECs
3. Asymmetric reduction of border impediments between EU15 and CEECs as compared to integration among CEECs
  - a) More intense integration between EU15 and CEECs as compared to integration among CEECs: reduction by 100 minutes between EU15 and CEECs and by 60 minutes among CEECs
  - b) Less intense integration between EU15 and CEECs as compared to integration among CEECs: reduction by 60 minutes between EU15 and CEECs and by 100 minutes among CEECs

The effect of changes in market access between  $t_0$  and  $t_1$  on per capita income is given by:

$$\begin{aligned} \log\left(\frac{z_{jt_1}}{z_{jt_0}}\right) &= \alpha_1 \left[ \log MP_{jt_1} - \log MP_{jt_0} \right] \\ (6) \end{aligned}$$

$$= \alpha_1 \left[ \log \sum_i Y_{it_1} \cdot e^{-\alpha_2(d_{ij}+b_{jt_1})} - \log \sum_i Y_{it_0} \cdot e^{-\alpha_2(d_{ij}+b_{jt_0})} \right]$$

The overall change  $\log(z_{jt_1} / z_{jt_0})$  caused by the change in market access can be partitioned into the effect of reduced border impediments and the effect resulting from the development of regional income. In order to isolate the effect of declining border impediments, the change in  $z$  is determined for given regional income in  $t_1$  as well:

$$\begin{aligned} \log\left(\frac{z_{jt_1^*}}{z_{jt_1}}\right) &= \alpha_1 \left[ \log MP_{jt_1^*} - \log MP_{jt_1} \right] \\ (7) \end{aligned}$$

$$= \alpha_1 \left[ \log \sum_i Y_{it_1} \cdot e^{-\alpha_2(d_{ij}+b_{jt_1^*})} - \log \sum_i Y_{it_1} \cdot e^{-\alpha_2(d_{ij}+b_{jt_1})} \right]$$

Thus we consider changes in market access caused by regional income growth in EU27 regions between 1995 and 2000 and the effect on market access that is solely due to the decline of border impediments. Results are compared for EU15 countries and new member states as well as for different types of regions: internal and external border regions as well as non-border regions in order to investigate whether border regions achieve above or below average integration benefits. Internal border regions are defined as regions that share a common border with a foreign EU region. External border regions are those EU regions along the external EU border. Changes in regional market access and per capita income are estimated for the period 1995-2000.



## 5 DATA AND REGIONAL SYSTEM

### 5.1 Variables

Dependent variable in the regression analysis is log per capita GDP in 1995 and 2000 given for a cross section of 158 European regions. In the regression analysis, regional income, i.e. purchasing power, is approximated by GDP in 205 European regions. Indicators for the sectoral composition of regional economies are based on GVA data by NACE-CLIO R6 classification (agricultural, forestry and fishery products, manufactured products, building and construction, market services, non-market services). The shares of regional GVA in agriculture, manufacturing et cetera, are used as control variables. The data were taken from Cambridge Econometrics' European regional databank and the Regio databank of Eurostat. Information on local amenities (e.g. length of the seashore, mean annual sunshine radiation, concentration of cultural sites), used for additional controls was taken from the databank generated in the course of the Study Programme on European Spatial Planning (SPESP).<sup>14</sup> The simulation analysis, i.e. the calculation of different market potentials, is based on GDP data for the period 1995 to 2000. Data for the calculation of market potentials are available for a cross section of 943 EU27 regions.

### 5.2 Distance Measurement and Border Impediments

Interregional distance between EU27 regions is measured by travel time in minutes between the centres of the regions. A specific problem refers to internal distances that enter into the market potential formula. Internal distance is modelled as proportional to the square root of the region's area.<sup>15</sup> We determine the internal distance of region  $i$  in minutes of travel time as:

$$(8) \quad d_{ii} = 0.75 \cdot \sqrt{A_i},$$

where  $A_i$  denotes the area of region  $i$  in  $\text{km}^2$ .

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<sup>14</sup> See Bundesamt für Bauwesen und Raumordnung (Eds.): Study Programme on European Spatial Planning. Final Report. Forschungen 103.2., Bonn 2001.

<sup>15</sup> This methodology is frequently applied in the corresponding literature. See e.g. Head and Mayer (2000).

Our analysis deals with the effects of EU enlargement on regional market access and per capita income in the EU27. Therefore, we ignore the proceeding integration process among the EU15 countries, although this has definitely an ongoing impact on the spatial structure of economic activity in Europe as well. Within the analysis, the development of border impediments between EU15 countries and former candidate countries as well as border effects among CEECs matter for market potentials. As quantitative information on border effects between these countries is scarce (see section 3), we cannot adopt bilateral border impediments in the simulation analysis. The assumption with respect to border effects rests on corresponding information given in Bröcker (1998) and Fürst et al. (1999). Accordingly, we assume that integration results in a reduction of border impediments (given as a time penalty in minutes) between the mid of the 1990s and 2000 between 60 and 230 minutes (see section 3 for details).

### **5.3 Regional System**

Within the framework of the analysis, three cross sections have to be distinguished. Two of them are relevant for the regression analysis: One cross section concerns the dependent variable and comprises 158 EU15 regions. The second cross section consists of all regions the income of which is included in the market potential of the regression analysis, in total 205 European regions. These cross sections largely correspond with the NUTS 2 level in the EU15. Exceptions concern in particular Denmark (3 former NUTS regions), Belgium, Germany (NUTS 1 level) and Sweden (NUTS 3 level). East German regions, Départements d'outre-Mer (France), Açores, Madeira (Portugal), Ceuta y Melilla, Canarias (Spain) are not considered because of data restrictions. Norway (19 Fylke) and Switzerland (7 Grossregionen) are included in the calculation of market potentials. With respect to the left hand side of the regression model given by equation (4), Sweden, Norway and Switzerland could not be considered because of data restrictions. Due to restricted data availability, we cannot determine the relationship between market access and per capita income for an EU27 cross section.

However, the simulation analysis refers to EU27 regions. The calculation of corresponding market potentials considers income in EU27 regions plus regions in Norway and Switzerland. Market access is defined with respect to the enlarged European market. We are primarily interested in changes in market access due to a decline of border impediments between EU15 and CEECs, not in the absolute level of market potential.

The third cross section relevant for the simulation analysis consists of 943 EU27 regions, mainly on NUTS 3 level. We choose NUTS 3 level, i.e. fairly small observational units, for the calculation of market potentials and the estimation of integration effects to ensure an adequate definition of border regions. For some countries NUTS 2 regions as well as functional regions consisting of several NUTS 3 units had to be applied due to data restrictions.<sup>16</sup>

## 6 EMPIRICAL RESULTS

### 6.1 Regression Results

The results of the regression analysis based on equation (4) are summarised in Table 1. Only estimates of the coefficients relevant for the simulation analysis and the years 1995 and 2000 are presented. In all regression models, control variables and dummies for outlying regions are included.<sup>17</sup> The coefficients  $\alpha_1$  and  $\alpha_2$  are highly significant with expected signs. The results suggest that market access has a positive effect on per capita income of European regions. The coefficient  $\alpha_2$  can be interpreted as a spatial discount factor that determines the changes in the weight of purchasing power with increasing travel time between regions. The estimates imply that the intensity of demand linkages declines by 50% over a range of roughly 180 minutes of travel time. We apply averages of the coefficients  $\alpha_1$  and  $\alpha_2$  given in Table 1 in the simulation analysis of per capita income.

#### [Table 1]

We also apply nonlinear instrumental variables estimation to address a possible endogeneity problem, i.e. right hand side variables, such as regional income are not exogenous, potentially causing inconsistent estimates. Historical data on regional GVA and population, lagged by 10 years, are used as instruments for contemporary income. Unreported results of nonlinear instrumental variables regressions will closely resemble the NLS results summarised in Table 1, if we choose starting values close to the NLS coefficients. We also test for spatial error autocorrelation and estimate spatial econometric models in

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<sup>16</sup> A more detailed description of this cross section is given in the appendix.

<sup>17</sup> Outlying regions are defined as those observations the standardised residuals of which exceed the value 2.5. Results for the included control variables are available from the author upon request.

case of a misspecification as indicated by spatially autocorrelated residuals.<sup>18</sup> Results of Moran's *I* test on spatial autocorrelation in Table 1 indicate that the regression models are misspecified due to ignored spatial effects. In order to check the consequences with respect to the coefficient of market access, spatial error and spatial lag models are estimated. We only refer to the estimates of the spatial error models because they achieve a better fit than the spatial lag models. In the spatial approach, the coefficient of market access ranges between 0.15 and 0.18. Differences between spatial estimates and coefficients of the NLS regression are thus fairly small. Altogether this suggests that taking into account the spatial autocorrelation does not change the implications regarding the relevance of the market potential with respect to per capita income.<sup>19</sup>

## 6.2 Spatial Effects of Enlargement

Figure 1 shows the simulation results for different groups of regions based on scenario 1 (uniform reduction of border impediments by a travel time equivalent of 60 minutes). According to the results, regions in the CEECs tend to obtain higher increases in market access than EU15 regions during the second half of the 1990s. However, this applies to border regions only. The estimates indicate that the above average growth of market potential in CEEC border regions as compared to corresponding EU15 regions is not caused by income growth. Internal as well as external border regions in CEECs achieve an above average raise in their market potential since the impact of declining border impediments is relatively pronounced. The effects of integration account for a much larger share of the overall change in market access in these regions compared to border regions in the EU15. Growth of market potential conditional on economic integration is higher in internal border regions (7.9%) than in non-border areas of the CEECs (4.4%). This is in line with the implications of the theoretical model. But the strong increase in market potential of external border regions (8%) conflicts with the prediction of the model because we would expect areas along the external border of the EU27 to have rather poor access to purchasing power of the enlarged EU. At least in parts, the favourable findings for external border regions are caused by the low base level of market potential. The main features of the region type specific results in scenario 1 apply to the simulation evidence of all scenarios.

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18 A binary contiguity matrix was applied as spatial weights matrix.

19 Unreported regression results are available from the author upon request.

### [Figure 1]

The spatial structure of integration effects is most notably characterised by an East-West-gradient (Figure 2). This corresponds with evidence provided by Pfaffermayr et al. (2004). Regions that achieve the highest growth of market potential are those located in the CEECs directly adjoining the EU15 market. Some areas along the eastern borders of Poland and Romania significantly lag behind as regards integration benefits in the new member states. The pattern might also explain the rather favourable results for external border regions in the old member states. Corresponding regions are mainly located in Finland and Greece. As a result of their location in the eastern part of the enlarged EU, these regions realise comparatively high growth of market access due to enlargement. In contrast, for regions in the western periphery of the EU, enlargement is virtually of no relevance to their market potential.

### [Figure 2]

Table 2 summarises the effects of integration on per capita income for the different scenarios, focusing on the CEECs. As already indicated by the previous results, there is no significant impact on income in EU15 countries. On average, the relative change of GDP per capita is well below 1% in the EU15 in all scenarios. Largest effects in the EU15 emerge in some Austrian regions with increases up to almost 2%. Referring to the impact on CEECs, relative income changes on the country level range from 0.4% for Romania to 13.2% for Slovenia in scenario 2b, the assumptions giving rise to the strongest impact on CEECs among all scenarios. Countries in the periphery such as Romania, Bulgaria and Lithuania achieve only a modest growth of market access and per capita income, whereas member states located closer to the centre of the EU27-market, e.g. Slovenia and the Czech Republic realise above average benefits. Moreover, the size of the countries seems to correlate with integration induced change in GDP per capita. For small countries proximate to the centre of the western European market (e.g. Slovenia), we estimate higher income growth than for relatively large new member states such as Poland that also shares a common border with the EU15. This might reflect that small countries due to an above average significance of border regions are marked by a relatively strong outward orientation and more favourable access to foreign markets. There is also considerable variation with respect to the performance of different region types across the CEECs. In Poland, the pattern is in accordance with the implication of our NEG model with the internal border regions obtaining highest income effects and

the external border regions lagging behind. In contrast, external border regions in Bulgaria and Estonia obtain most pronounced income changes due to reduced border impediments in some scenarios. These country specific patterns as regards the region type effects could be caused by differences concerning the location with respect to the EU27 market. In other words, depending on the position of a country relative to the centre of the EU market external border regions might achieve above or below average integration benefits.<sup>20</sup>

### [Table 2]

Figure 3 summarises the market potential effects of different integration scenarios on new and old member states. It is evident that the assumptions regarding the decline of border impediments have significant impact on the overall effect. However, the EU15 realises only small benefits in all scenarios, whereas the change of market access in the new member states is significantly affected by the assumption concerning magnitude and symmetry of reduction of border impediments. The new member states gain most in scenario 2b since we assume a pronounced reduction of border impediments by 230 minutes travel time equivalents with respect to EU15 imports from the CEECs in this case, whereas for EU15 exports to the new member states, impediments decline by 100 minutes only. In scenario 2a, turning around the assumption of an asymmetric reduction with respect to EU15 and CEECs, the EU15 countries realise highest increase in market access. However, the impact remains negligible with 0.4%. In the scenarios 3a and 3b, we consider asymmetric reduction of border impediments among EU15/CEECs on the one hand and between CEECs on the other hand. The differences between both cases point to the importance of the EU15 market for the new member states. The change in market potential of the CEECs will be higher, if we assume a more pronounced decline of border impediments between EU15 and CEECs. Assuming more intense integration among the new member states as compared to integration with the EU15 results in a smaller increase of market access of the CEECs. Therefore reduction of border impediments among old and new member states is more important for the CEECs than integration among each other.

### [Figure 3]

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<sup>20</sup> As regards the impact on external border regions in Estonia, their favourable access to the Finnish market might significantly influence the pattern.

Finally, we compare our results with corresponding evidence provided in two recent studies of the impact of enlargement on regional market access in Europe. Brülhart et al. (2004) analyse the effects of enlargement on EU15 regions applying a similar methodology. Ranging from 0.48% to 2.77%, the income effects in EU15 regions in their study considerably exceed our estimates. The differences can at least partly be traced back to the modelling of enlargement in the simulation analysis. The assumptions by Brülhart et al. (2004) are extreme since before enlargement the CEECs and their purchasing power are non-existent, whereas after integration the income of the new member states impacts on the EU15 without any border impediments. Therefore the findings should be understood as an upper limit of corresponding integration effects. Pfaffermayr et al. (2004) investigate the impact of enlargement on both EU15 regions and some new member states. Concerning the results for the EU15, their results point to changes in per capita income up to 0.61%, which are more in line with our evidence. However, with growth rates up to almost 63% the effects in the new member states are much more pronounced in their study than in our analysis. As Pfaffermayr et al. (2004) also assume a more gradual decline of border impediments with some hindrances remaining after enlargement, differences between the estimates are likely to be caused by methodological issues, such as the regression method.<sup>21</sup>

## 7 CONCLUSIONS

Our findings suggest that there are pronounced differences among regions in the enlarged EU as regards the integration effects resulting from changes in market access. The simulation analysis indicates that the new member states benefit more from enlargement than EU15 countries. Thus, the impact of enlargement will be in support of cohesion, if we consider effects on market potential and corresponding income changes. Moreover, some results are in line with the implications of our theoretical model since border regions indeed realise higher integration benefits than non-border regions. However, relatively high income changes in regions along the external EU borders are in contrast to the theoretical framework. The NEG model should predict below average income effects due to declining border impediments in external border regions because of their peripheral location. The surprisingly strong impact of enlargement on market potential of ex-

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<sup>21</sup> Pfaffermayr et al. (2004) estimate a linearised regression model and therefore have to make assumptions regarding the distance decay parameter. In contrast, we estimate the impact of distance on the intensity of demand effects.

ternal border regions might be partly caused by the extremely low level of market potential before integration. Moreover, a location at an external EU border might not always coincide with the most unfavourable access to the centre of the European market.

Results for the different scenarios point to the importance of our assumptions regarding the reduction of border impediments. Corresponding evidence suggests that the EU15 market is more important for the new member states than purchasing power in the CEECs. The change in market potential of the CEECs will be higher, if we assume more pronounced decline of border impediments between EU15 and CEECs than among CEECs. Integration among old and new member states is more important for benefits of the CEECs and therefore cohesion in the enlarged EU than integration among the new member states. However, altogether the income effects of enlargement due to increasing market access remain small, irrespective of scenario assumptions. Only some CEEC regions along the former external EU15 border achieve significant effects on GDP per capita. Of course, the absolute magnitude of effects has to be interpreted with much caution. We investigate only one specific impact of European integration. Other integration effects, e.g. the impact of increasing factor mobility or specialisation, might be more important and work in an the same or an opposite direction as regards differences between border and non-border regions as well as EU15 countries and CEECs.



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## APPENDIX

### A1. CROSS SECTIONS

Three cross sections are applied in the analysis. For the regression analysis two of them are relevant: One cross section concerns the dependent variable and comprises 158 EU15 regions. The second cross section consists of all regions the income of which is included in the market potential, in total 205 European regions. With respect to the simulation analysis a third cross section is relevant that covers the entire EU27. For the simulation of integration effects we mainly refer to the NUTS 3 level.

#### EU27 – 943 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:	5 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:	133 NUTS 3 regions

Only considered in the calculation of the market potentials:

Switzerland:	26 cantons
Norway:	19 fylke

## A2. DATA

### **Eurostat Regio Data (NUTS 2 and NUTS 3 level)**

- Gross domestic product (1995 to 2000)
- Gross domestic product per capita (1995 to 2000)
- Sectoral composition: shares of sectors in total GVA of region - NACE-CLIO R6 classification: agriculture, manufacturing, building and construction, market services, non-market services (1995-2000)

### **Data from the Study programme for European Spatial Planning (SPESP)**

- Seashore: Length of seashore in percentage of region's perimeter,
- Sunshine: Mean annual sunshine radiation in kWh/m<sup>2</sup>,
- Emission: Emissions of acidifying gases – 3 classes,
- Hazard: Natural hazards – 7 risk classes (earthquakes, volcanic activity, tidal waves, snow avalanches, slope instability),
- Protected areas: Designated or protected areas – 5 classes,
- Cultural sites: Number of registered monuments/cultural sites,
- Density of cultural sites: Number of cultural sites by total area.
- Tourist pressure: Ratio of yearly tourist stays by total resident population 1997/98

Missing regional data for Denmark and Norway were completed by data from the corresponding national statistical offices.

## Tables and Figures

**Table 1: Regression Results for Market Potential Function**

	DEPENDENT VARIABLE: LOG (GDP PER CAPITA)	
	1995	2000
$\alpha_0$	6.54** (18.55)	6.57** (19.06)
$\alpha_1$	0.17** (10.28)	0.19** (11.05)
$\alpha_2$	0.0039** (4.61)	0.0040** (5.02)
$\sigma$	5.81	5.40
$\tau$	0.00082	0.00090
Moran's I (z-value)	0.24** (4.11)	0.28** (4.62)
Adj. $R^2$	0.86	0.87

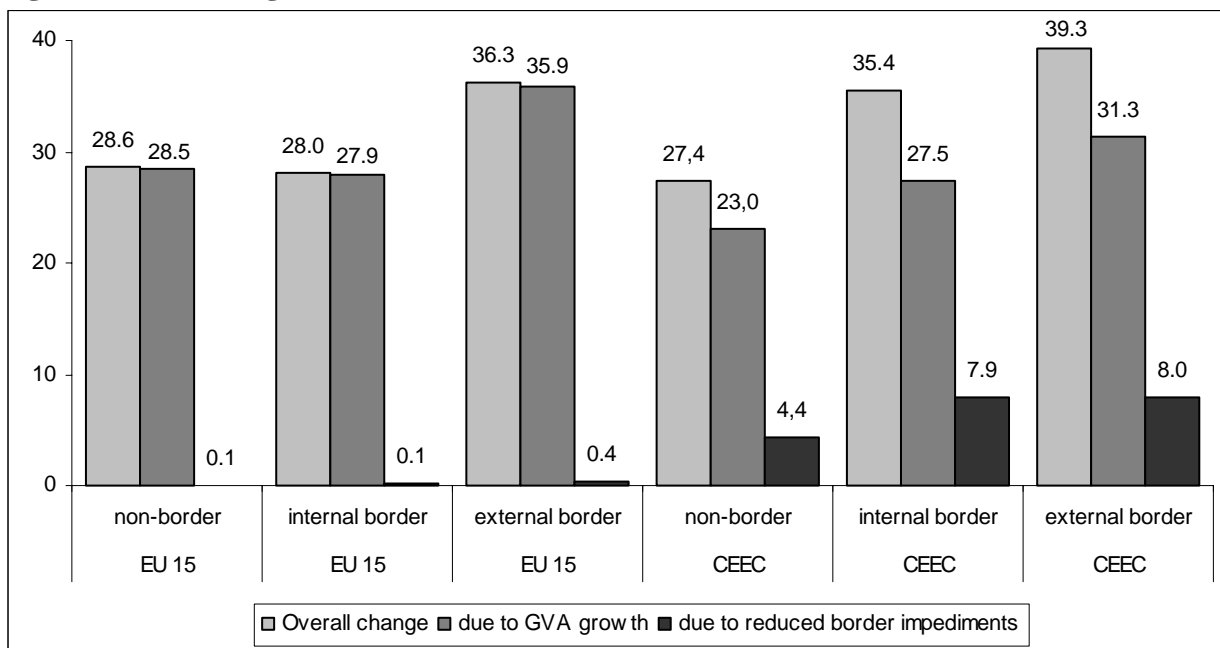
*Notes:*  $t$ -statistics are based upon White's heteroscedasticity-adjusted standard errors.  
The regression models include control variables, dummies for outlying regions, and some country-dummies.  
\*\* significant at the 0.01 level, \* significant at the 0.05 level.

**Table 2: Estimated Integration Effects on Per Capita Income, 1995-2000 – Average percentage changes**

	Scenario				
	1	2a	2b	3a	3b
<b>Bulgaria</b>	<b>0.58</b>	<b>0.21</b>	<b>0.63</b>	<b>0.67</b>	<b>0.94</b>
Non-border	0.61	0.19	0.56	0.69	1.02
Internal border	0.58	0.20	0.59	0.66	0.95
External border	0.50	0.28	0.85	0.62	0.77
<b>Czech Republic</b>	<b>1.72</b>	<b>2.48</b>	<b>6.86</b>	<b>2.78</b>	<b>1.97</b>
Non-border	1.65	2.48	6.86	2.72	1.85
Internal border	1.74	2.48	6.86	2.80	2.00
<b>Estonia</b>	<b>1.48</b>	<b>1.91</b>	<b>5.38</b>	<b>2.30</b>	<b>1.81</b>
Non-border	1.46	2.09	5.85	2.63	1.69
Internal border	1.45	1.87	5.29	2.26	1.78
External border	1.53	1.73	4.91	2.27	1.97
<b>Hungary</b>	<b>1.33</b>	<b>1.57</b>	<b>4.48</b>	<b>2.00</b>	<b>1.68</b>
Non-border	1.12	1.25	3.62	1.66	1.45
Internal border	1.46	1.75	4.98	2.22	1.84
External border	1.36	1.63	4.65	2.06	1.71
<b>Lithuania</b>	<b>0.83</b>	<b>0.22</b>	<b>0.66</b>	<b>0.92</b>	<b>1.38</b>
Non-border	0.85	0.20	0.62	0.93	1.42
Internal border	0.83	0.23	0.70	0.93	1.38
External border	0.81	0.21	0.63	0.91	1.36
<b>Latvia</b>	<b>1.34</b>	<b>0.54</b>	<b>1.60</b>	<b>1.57</b>	<b>2.16</b>
Internal border	1.22	0.47	1.40	1.42	1.96
External border	1.59	0.67	1.98	1.87	2.52
<b>Poland</b>	<b>0.35</b>	<b>0.43</b>	<b>1.29</b>	<b>0.54</b>	<b>0.45</b>
Non-border	0.28	0.34	1.01	0.43	0.35
Internal border	0.48	0.62	1.84	0.75	0.59
External border	0.26	0.26	0.79	0.38	0.35
<b>Romania</b>	<b>0.32</b>	<b>0.14</b>	<b>0.42</b>	<b>0.38</b>	<b>0.52</b>
Non-border	0.26	0.10	0.32	0.30	0.42
Internal border	0.46	0.20	0.61	0.54	0.73
External border	0.36	0.16	0.49	0.44	0.58
<b>Slovenia</b>	<b>3.32</b>	<b>5.17</b>	<b>13.16</b>	<b>5.47</b>	<b>3.58</b>
Non-border	3.37	5.39	13.64	5.60	3.56
Internal border	3.29	5.13	13.06	5.41	3.54
External border	3.33	5.13	13.06	5.45	3.61
<b>Slovakia</b>	<b>2.35</b>	<b>2.44</b>	<b>6.74</b>	<b>3.37</b>	<b>3.11</b>
Internal border	2.41	2.64	7.25	3.51	3.13
External border	2.04	1.42	4.07	2.63	3.00
<b>EU 15</b>	<b>0.01</b>	<b>0.07</b>	<b>0.02</b>	<b>0.02</b>	<b>0.01</b>
<b>CEECs</b>	<b>1.18</b>	<b>1.48</b>	<b>4.25</b>	<b>1.83</b>	<b>1.47</b>

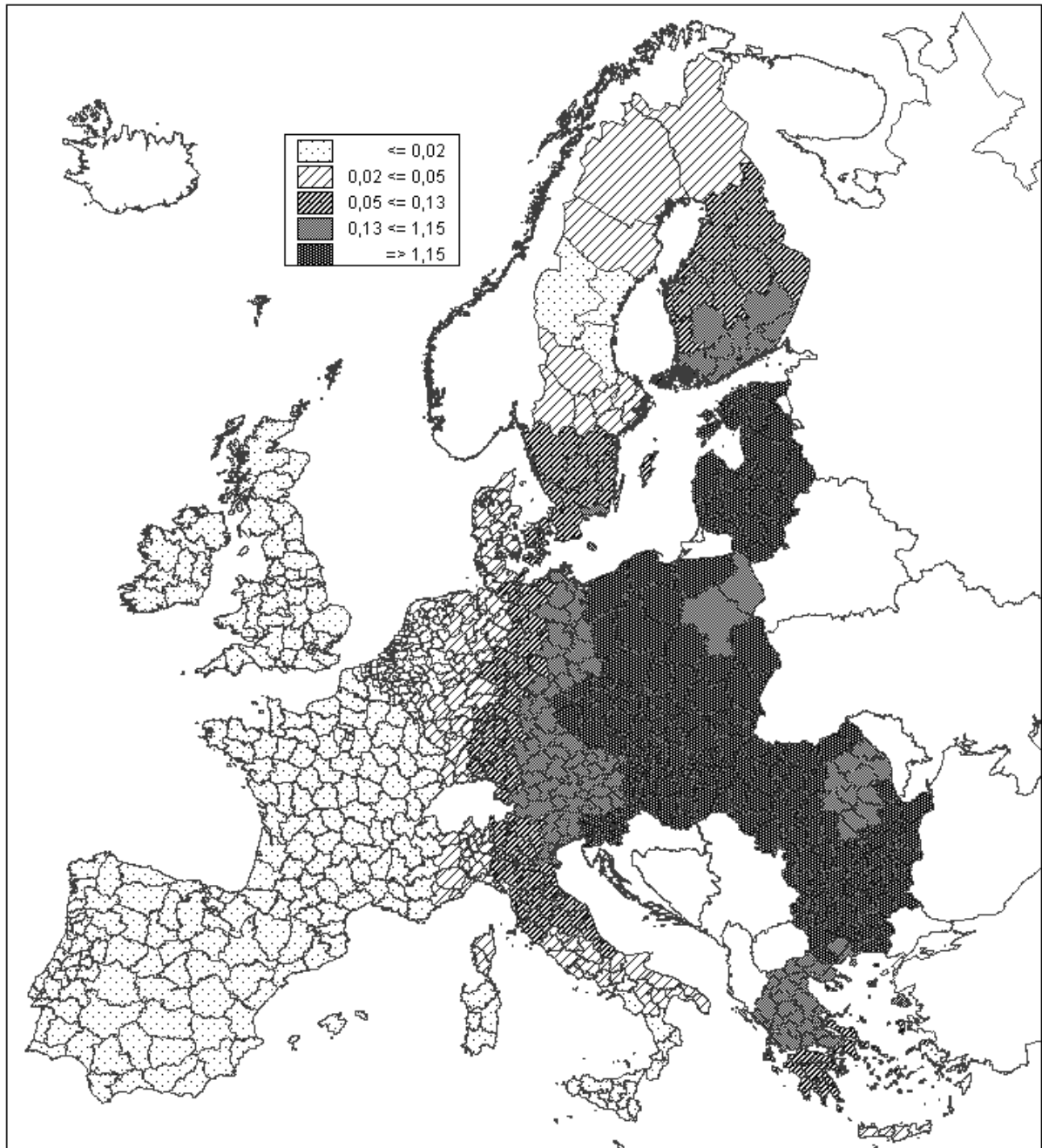
Source: Own calculations based on data from Eurostat Regio data bank.

**Figure 1: Changes in Market Potential 1995-2000 (in %), Scenario 1**



Source: Own Estimates based on Eurostat data.

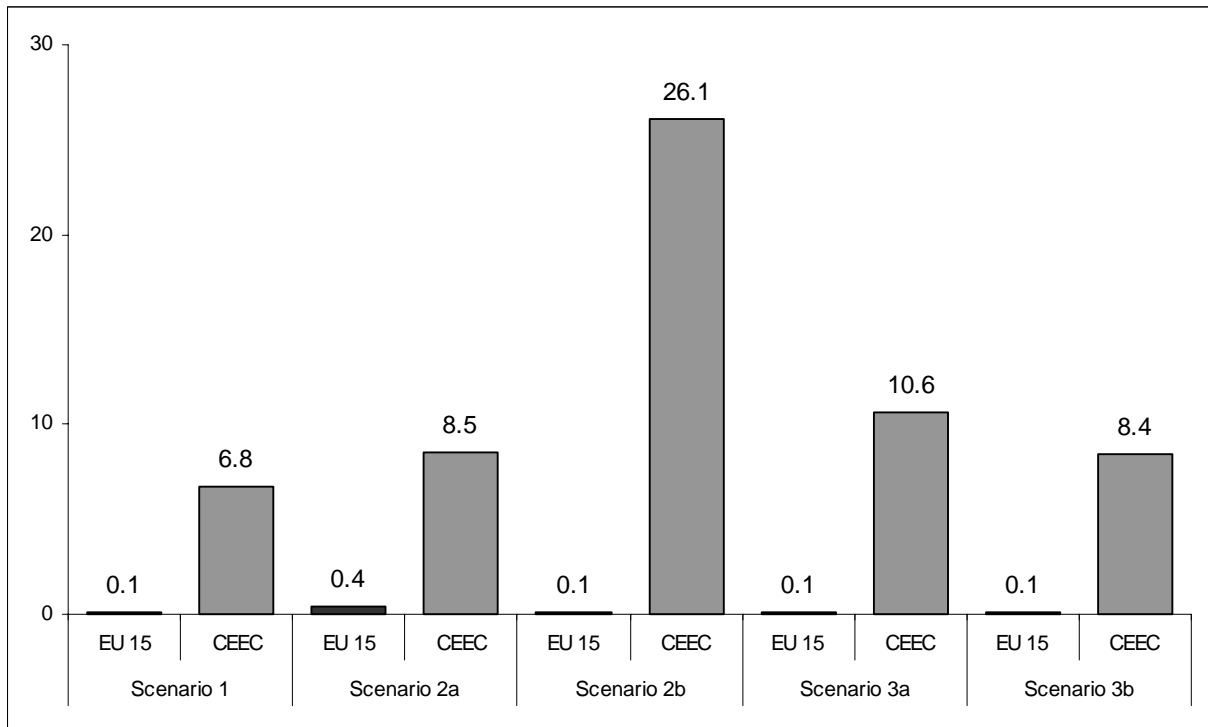
**Figure 2: Changes in Market Potential due to Reduced Border Impediments, 1995-2000, Scenario 1**



Source: Own Estimates based on Eurostat data.



**Figure 3: Changes in Market Potential EU15 and CEECs 1995-2000 for all Scenarios (in %)**



Source: Own Estimates based on Eurostat data.