Enlargement and the EU Periphery: The Impact of Changing Market Potential

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1. INTRODUCTION

EUROPE'S economic centre of gravity is shifting east. No event marks this tendency more visibly than the 2004 EU enlargement, which integrates ten Central and Eastern European countries (CEECs) fully into the EU's internal market. Improved access to and from the CEEC economies is likely to affect production structures not just in the new member states but also in incumbent EU countries.

One can think of a myriad of economic mechanisms through which EU enlargement may impact on the economies of Western Europe: increased specialisation according to comparative advantage (which includes the vertical fragmentation of production processes), enhanced scope for scale economies in a larger European market, changing factor supplies through movements of workers and capital, stiffer competition from CEEC competitor firms, to name but the most obvious.[1] We focus on a particular aspect of this complex set of economic effects, the locational implications of a changing spatial configuration of market access at the level of sub-national EU regions. We abstract from endowment differences and market structure and ask how the changes in relative market access are likely to affect peripheral regions of pre-enlargement member states, all else equal.

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[1] For simulations of the economic effects of eastward EU enlargement based on computable general equilibrium models, see Baldwin, Francois and Portes (1997); Bröcker (1998); Forslid, Haaland, Midelfart-Knarvik and Maestad (2002); and Kohler (2004). These studies report results at the level of countries or groups of countries.

We first explore this issue in a *three-region new economic geography model*. Except for differences in trade costs, space is assumed to be homogenous, and sectoral location is determined endogenously through the interplay of agglomeration and dispersion forces. Two of the three regions are relatively integrated (the 'EU'), and we track how the economies of these regions are affected by an opening towards the third region (the 'CEECs'). External market opening has a bearing on several spatial forces. Forces related to better access to foreign export markets and cheaper imports enhance the locational attraction of the border region. Conversely, forces related to import competition from foreign firms enhance the locational attraction of the interior region.

The interplay of these forces in the non-linear setup of the model can lead to a variety of equilibria. We find that, for most parameter configurations, external liberalisation favours the concentration of the mobile sector in the region that is closer to the outside country (the 'border region'). However, this mechanism is not deterministic. For example, a sufficiently strong pre-liberalisation concentration of economic activity in the region that is relatively remote from the outside country (the interior region) can make this concentration globally stable, i.e. the locational forces triggered by the external opening are insufficient to offset the locational hysteresis of an established agglomeration. For some parameter values the model can even predict a locational pull towards the interior region (e.g. when the relative size of the mobile sector is small).

In our *empirical analysis* we seek to capture the essential features of the theoretical framework without attempting full structural estimation of the model. Our main explanatory variable is the market potential of each region, measured by the economic mass of all European regions, each weighted by the inverse of its bilateral distance from the region whose market potential we are measuring. We apply an economically relevant measure of interregional distance by drawing on a set of bilateral estimates of average road freight travel time. For the economic mass variable we use alternatively regional purchasing-power parity GDPs, and regional employment in particular sectors (which yields 'sectoral market potentials').

The market potential measures are the main ingredients in the two stages of our empirical exercise. First, we estimate the relation between, on the one hand, regional per capita GDP (regional manufacturing employment), and, on the other hand, computed regional market potentials for the full sample of up to 202 European regions.[2] In the second stage, we take the estimated first-stage coefficients to simulate the effect of changes in regional market potentials. The scenario we simulate is stark. We compare a situation where the EU ends at its pre-2004 eastern border (i.e. where market potentials take account only of regions in

[2] Niebuhr (2003) has estimated a similar model for EU + EFTA regions, using average wages as the dependent variable.

incumbent member countries) with a situation where the EU has grown to encompass 25 and then 33 countries (i.e. where market potentials incorporate also the ten 2004 accession countries, and eight potential future members in South-Eastern Europe). These simulations thus provide upper-bound estimates of the pure market-potential effects of EU enlargement on incumbent regions.

Our estimates suggest that the effects on per capita incomes of Objective 1 regions are small, with an estimated average gain from the 2004 enlargement of 0.93 per cent, compared to 0.65 per cent for the non-Objective 1 regions. Large magnitudes, however, are found for effects on manufacturing, the most footloose of broad sectors. Manufacturing employment as a share of population is predicted by our estimates to expand by 33 per cent in Objective 1 regions on average. This number is surely too high to be plausible, and thus highlights the limits of our methodology, but it is interesting that we find no region for which our estimates suggest a negative impact of enlargement on manufacturing employment. We also detect significant variance across Objective 1 regions: the enlargement-induced boost to manufacturing of the most affected region (Burgenland, Austria) is seven times larger than that of the least affected region (South Yorkshire, UK).

The paper is structured as follows. Section 2 describes the theoretical model (with the main algebraic elements given in Appendix A), and Section 3 presents our empirical results. Section 4 concludes.

2. EXTERNAL MARKET ACCESS AND INTERNAL GEOGRAPHY: A THREE-REGION MODEL

We develop a three-region model derived from Pflüger (2004), which in turn represents an analytically solvable version of Krugman's (1991) core-periphery model. In that model, we can study the impact of improved external market access on the internal geography of a trading bloc. By adopting this framework, we consciously abstract from locational features other than the spatial backward and forward linkages typical in the new economic geography: since regions are assumed to be identical in terms of technologies, endowments and tastes, we ignore a large and important literature on integration effects other than the market-size linkages that we study here. Furthermore, we abstract from the effects of cross-border factor flows.[3] We do not claim, therefore, to provide a comprehensive account of locational changes that might be triggered by EU enlargement. Rather, we want to focus on the main forces identified by the modern economic

[3] This is of course a significant omission, since one of the main areas of uncertainty surrounding enlargement concerns the size and composition of labour movements. However, cross-border labour flows in Europe have historically been small (Decressin and Fatás, 1995), and available projections predict relatively modest worker movements subsequent to the 2004 enlargement (OECD, 2001).

geography literature and to explore them in terms of their implications for the EU periphery as the EU is being enlarged eastwards.

We confine the exposition of the model in this section to a rough sketch of the main features and some salient simulations. A more detailed exposition of the analytical framework is given in Appendix A.

a. Symmetric Regions: Endogenous Agglomeration

(i) The basic model

Consider two countries: a domestic country, which in turn contains two regions, labelled 1 and 2; and a foreign country, labelled 0. We think of the domestic country as the EU, and of the foreign country as the accession countries. The two regions of the domestic country will stand for the EU's border and interior regions, relative to the eastern accession countries.

There are two sectors: monopolistically competitive 'manufacturing', which produces a differentiated good and stands for all increasing-returns and mobile production activities in the economy; and 'agriculture', the perfectly competitive immobile sector that will serve as numéraire. Two production factors are used in this economy: agriculture uses only labour (L), while manufacturing uses human capital (K) as a fixed cost and labour for the variable cost. All goods are traded among all regions.

The size and composition of the foreign economy is assumed to be fully exogenous. It contains L_0 units of labour and K_0 units of human capital, which are both immobile. In the domestic country, regional supplies of labour are fixed: the two domestic regions contain L_1 and L_2 units of labour respectively. Domestic human capital, however, is interregionally mobile. The domestic economy hosts K units of human capital, distributed endogenously among regions: $K = K_1 + K_2$. Human capital migrates between regions 1 and 2 according to the indirect utility differential. We express the regional shares of human capital as $K_1/K = \lambda$ and $K_2/K = 1 - \lambda$.

Product markets of the three regions are separated by trade costs. Manufacturing varieties produced in a region r are sold by firms at mill price, and the entire transaction cost is borne by consumers. This is because trade costs are of the 'iceberg' type: when one unit is shipped, priced p, only $1/T$ actually arrives at its destination. Therefore, in order for one unit to arrive, T units have to be shipped, increasing the price of the unit received to pT . Cross-border exchange of manufactured goods is subject to such trade costs, which differ across regions. T_{12} is the internal trade cost, which applies to interregional domestic trade (with $T_{12} = T_{21}$). T_{01} and T_{02} are the trade costs that arise in each domestic region's trade with the outside economy. To begin with, we assume T_{01} and T_{02} to be equal, and the two domestic regions therefore to be perfectly symmetric. This assumption will later be relaxed.

(ii) External trade liberalisation and internal geography

What happens to the domestic distribution of manufacturing activity as external trade barriers are lowered? A decrease in the external trade cost triggers two forces. On the one hand, cheaper access to the external market lowers the incentive for domestic firms to locate near domestic consumers, which now represent a smaller share of domestic firms' sales. Thus, the domestic demand-related agglomeration force is weakened by the increased importance of foreign demand.[4] For similar reasons, the domestic cost-related agglomeration force is weakened by the increased importance of foreign supply: foreign firms now represent a more important share of supply to domestic consumers.[5]

On the other hand, trade liberalisation also affects the intensity of competition in the domestic country. Increased competition from foreign firms reduces the relative importance for domestic firms of locating away from domestic competitors, and thus attenuates dispersion forces.[6]

It can be shown that, while external liberalisation decreases both internal agglomeration and dispersion forces, the effect on the dispersion force generally dominates.[7] As a result, the range of parameter values for which domestic manufacturing agglomerates in only one region increases as external trade costs fall. Given the perfect symmetry of domestic regions assumed up to now, the location of such agglomerations is indeterminate. The same result obtains if we hold external trade costs constant but let the foreign country get bigger: the larger the outside economy, *ceteris paribus*, the greater the probability that domestic manufacturing agglomerates in one region. The prediction from the model with symmetric domestic regions is clear-cut: closer economic integration with the external country favours the concentration of domestic manufacturing activity.[8]

[4] In Appendix equations (15) and (16), income from the foreign country becomes a more important part of total demand.

[5] To put the cost-related effect more precisely, we observe that, as external trade costs fall, each domestic region's price index depends relatively less on the domestic distribution of manufacturing and relatively more on proximity to foreign manufacturing, which in turn lessens the incentive for human capital (i.e. firms) to locate in the domestic region that hosts the larger manufacturing share. In Appendix equations (12) and (13), an increased weight of foreign firms now constitutes the main element that drives down price indices.

[6] As stated before, an increased weight of foreign firms lowers both price indices in Appendix equations (12) and (13).

[7] Analytical and simulation results can be provided on request.

[8] The same qualitative result has been found in related models by Monfort and Nicolini (2000), Paluzie (2001) and Crozet and Koenig (2004). Krugman and Livas Elizondo (1996) show that this result is reversed if the domestic dispersion force is assumed to be exogenous and independent of trade costs: in that case external liberalisation favours internal dispersion. Behrens, Gaigné, Ottaviano and Thisse (2003) confirm Krugman and Livas's results, by incorporating intensified endogenous internal competition effects.

b. Asymmetric Regions: Changing Relative Attractiveness of Border and Interior Regions

Perfect symmetry of domestic regions is of course a highly unrealistic assumption, and one that fits badly with our aim to shed light on differential impacts of enlargement across EU regions. We therefore now allow the two external trade costs to differ. Specifically, we suppose that domestic region 2 has better access to the foreign market, such that $T_{02} < T_{01}$. Hence, we call region 2 the border region, while we refer to region 1 as the interior region.

(i) Trade liberalisation

Although the model can be solved analytically, the equilibrium expressions for our three-region setup are quite involved. For expositional clarity, we therefore report representative simulations instead of the structural equations.[9] We find two particular features of the asymmetric model. First, as foreign demand weakens the domestic agglomeration force, an additional effect appears, because domestic firms now have an incentive to locate in the region closest to the foreign market. One of the potential effects of trade liberalisation is thus to attract domestic firms towards the border, where they can reap the full benefit of improved access to foreign demand. Second, as foreign supply weakens the domestic dispersion force, the interior region allows firms to locate away from the foreign competitors. Hence, trade liberalisation may attract domestic firms towards the interior region, where they are relatively sheltered from foreign competition.

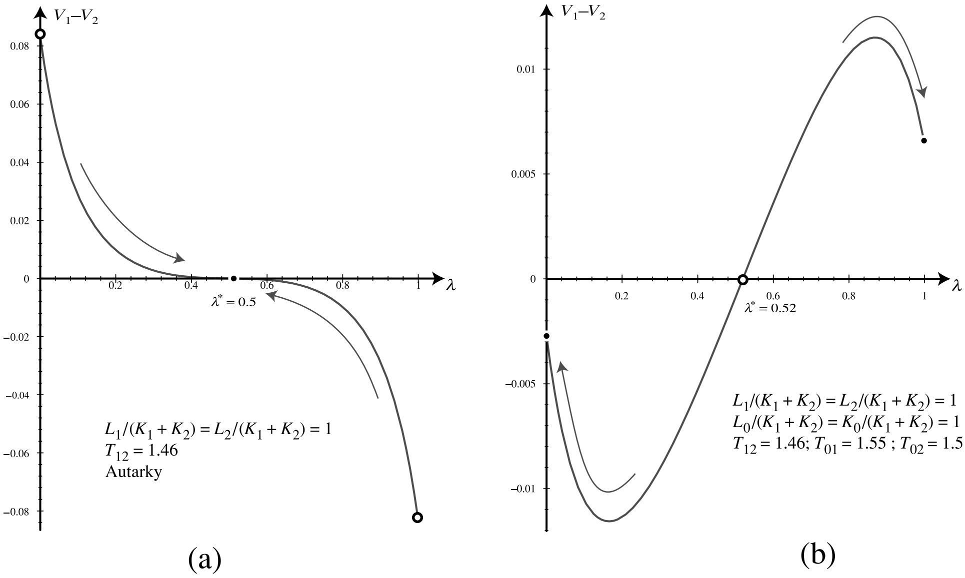
Figure 1 illustrates the impact of these forces according to the degree of trade liberalisation. It plots the indirect utility differential between the two domestic regions ($V_1 - V_2$, Appendix equation (19)) against the share of manufacturing that locates in the interior region (λ).[10] An allocation of manufacturing is an equilibrium either when the indirect utilities are equalised, or when manufacturing is totally agglomerated in one region and the (potential) indirect utility in the other region is lower. In Figure 1(a), the domestic country is in autarky, and the dispersed configuration is the only stable equilibrium.[11] In Figure 1(b), the domestic country trades with a large foreign country. The curve tracing the indirect utility differential has shifted to the right and pivoted anti-clockwise: in Figure 1(b), the curve now comes to cross the x-axis with a positive slope, meaning that only the two completely agglomerated configurations are stable equilibria. For this

[9] Detailed results are available on request from the authors.

[10] In Pflüger's (2004) version of the core-periphery model, as in Forslid and Ottaviano (2002), the values of the human capital remuneration in both regions that represent solutions of the indirect utility differential can be analytically derived. The simulations illustrated in this paper are based on the following parameter values: $\sigma = 6$, $\alpha = 0.3$ (see Appendix A.1).

[11] Figure 1 is drawn for a value of T_{12} for which industry is dispersed in autarky ($T_{12} = 1.5$, $T_{01} = T_{02} = \infty$).

FIGURE 1
Internal Geography and External Openness

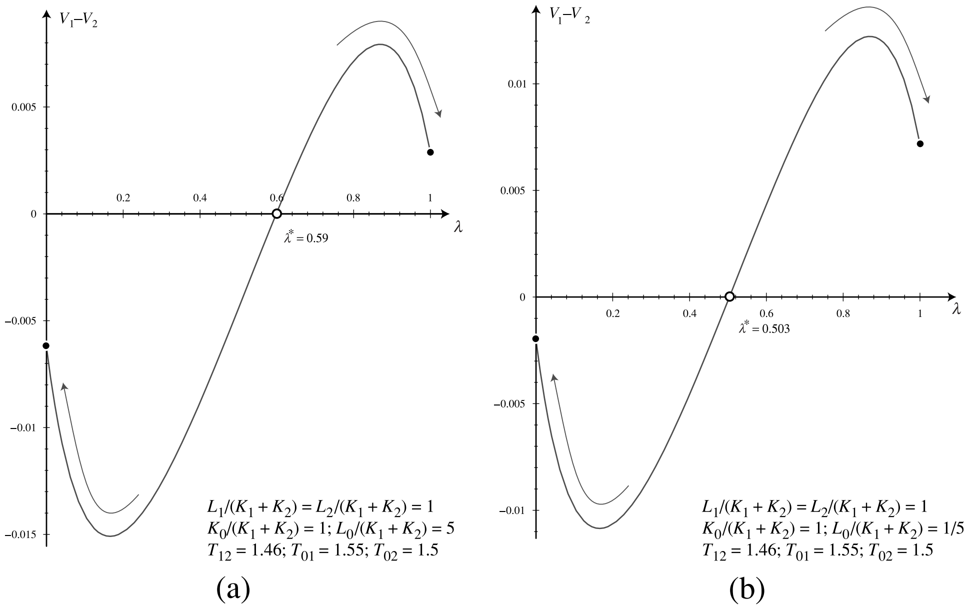


configuration, we thus find that liberalising trade with the outside world enhances the relative locational attraction of the border region. The increase of demand emanating from the foreign country dominates the competition effect of proximity to foreign firms, and domestic manufacturing is attracted to the border region. Agglomeration of industry in the interior region remains possible, however, but only if, before liberalisation, that region has hosted a relatively large share of domestic manufacturing (if λ lies between the intersection of the curve with the x-axis and $\lambda = 1$, i.e. if λ exceeds 52 per cent in the case of Figure 1(b)). Additional simulations that we do not illustrate here also show that, other things equal, the larger the outside country, the stronger is the locational attraction of the border region.

(ii) Sectoral composition of the foreign economy

We now consider the implications of varying the sectoral composition of the outside economy. In Figure 2(a), the size of the foreign country's agricultural sector has increased, while the composition of the domestic country has not changed compared to the autarky scenario of Figure 1. Farmers represent an immobile workforce and thus a large additional demand without additional competition. In Figure 2(a), we therefore observe a (slight) increase in the locational attractiveness of the border region subsequent to trade liberalisation. When foreign markets represent larger demand rather than fiercer competition, integration will favour manufacturing relocation towards the border region.

FIGURE 2
Internal Geography and Sectoral Specialisation of the Foreign Economy



Conversely, Figure 2(b) depicts the case where the foreign country's labour endowment is comparatively small. The competition effect of lower trade costs with the foreign country now becomes relatively more important, and the forces for agglomeration in the border region are attenuated. Specifically, the basin of attraction of border-region agglomeration is considerably smaller in Figure 2(b) than in Figure 2(a).

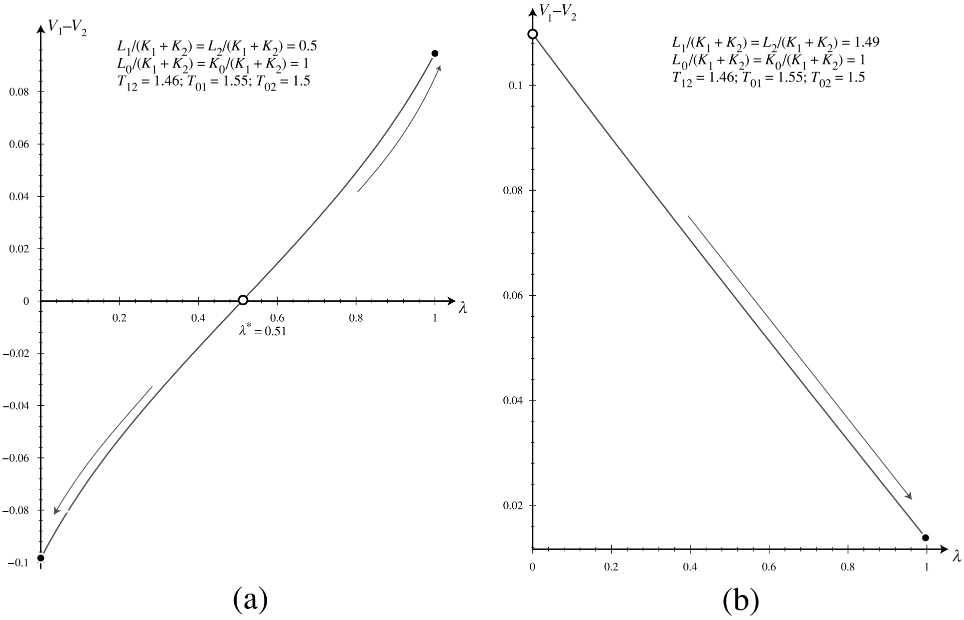
(iii) Sectoral composition of the domestic economy

Finally, we investigate the importance of the home country's sectoral composition for the forces that shape the spatial distribution of economic activity. Figure 3 features (a) a home country that hosts more industry than agriculture and (b) a home country that hosts more agriculture than industry.

We observe the following patterns: for a large range of parameter values, when the home country hosts a relatively large manufacturing sector, agglomeration forces towards the border will be stronger. On the other hand, when the home country has a relatively small manufacturing sector, the competition effect dominates, and manufacturing is more likely to concentrate in the interior region.

In sum, our model suggests that the larger the domestic manufacturing share and the smaller the foreign one, the stronger will be the tendency for domestic manufacturing to relocate towards the border region. Taken at face value, this

FIGURE 3
Internal Geography and Sectoral Specialisation of the Domestic Economy



result could be interpreted to imply that EU enlargement will favour the location of industry in regions proximate to the new accession countries, particularly in those sectors where direct import competition from accession countries is unlikely to be strong.

3. EMPIRICS

a. Market Potential and Regional Activity in the EU: Benchmark Regressions

Our theoretical model shows that external market access can act as a force that shapes the internal spatial allocation of economic activity even if there are no differences in endowments. The relatively simple model of economic geography that we work with yields a rich set of predictions, featuring multiple equilibria, path dependency, and differential effects of market access dependent on sector composition and region sizes. In our empirical investigation, we abstract from most of the theoretical complexity and focus on the principal prediction of the model, that a change in external market access will change the internal distribution of activity. The question we ask is: given the estimated equilibrium relationship between market access and the location of activity, how is the change in market access implied by EU enlargement likely to alter the internal geography of the pre-enlargement EU?

We define market access using Harris's (1954) market potential function

$$M_{i,J} = \sum_{j} Y_i/d_{ij}, \quad j \in J, \tag{1}$$

where i and j denote regions, Y stands for economic mass, d represents bilateral distance, and J denotes the relevant set of trading regions. A region's economic mass is defined alternatively using GDP or sectoral employment. Drawing on the dataset of Schürmann and Talaat (2000), interregional distances are represented by estimated road-freight travel times between regional capitals. These estimates take account of road quality, border delays and legal constraints that affect the speed of road transport (see Appendix B for details on the data used).

The central element of our empirical exercise is to compute estimated market potentials $\hat{M}_i$ with different assumptions on what constitutes the relevant set of trading regions J. Since we are interested in the effects of EU enlargement on regional economies of incumbent member states, we compute $\hat{M}_i$ for regions in the EU-15 assuming three different scenarios. In the first scenario, J is defined as including only the EU-15 plus EFTA. This implies that, so far as economic location is concerned, European regions' market access is defined solely with respect to established Western European markets. Hence, geographical proximity to regions east of the pre-2004 eastern EU border is assumed to be economically irrelevant. In the second scenario, J is defined as also including the regions of the ten 2004 accession countries. We call this the EU-25 scenario. Estimated market potentials in the EU-25 scenario imply that proximity to regions outside of the post-2004 EU + EFTA borders is economically irrelevant. Finally, in what we call the EU-33 scenario, J in addition includes the possible future accession countries Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Macedonia, Romania, Serbia-Montenegro and Turkey.

Regional activity can be defined in various ways. We retain two activity measures, GDP per capita, and manufacturing employment (assuming that manufacturing is the most mobile sector).

The baseline regression model for GDP per capita is as follows:

$$(\mathrm{GDP/POP})_i = \beta_0 + \beta_1 \hat{M}_{i,J} + \beta_2 \mathrm{Obj1Dum}_i + \vec{\gamma}\vec{X} + \varepsilon_i, \quad \text{with} \quad J = \mathrm{EU15} + \mathrm{EFTA} - i, \tag{2}$$

where $\hat{M}_{i,J}$ is the estimated market potential of region i considering only EU15 + EFTA partner regions, $\mathrm{Obj1Dum}_i$ is a dummy variable for regions belonging to the EU's 'Objective 1' category of economically lagging regions, and $\vec{X}$ is a set of country fixed effects. In order to avoid simultaneity problems, we have purged $\hat{M}_{i,J}$ of the region's own GDP.

TABLE 1
Market Potential Regressions

	Dependent Var.: GDP Per Capita	*Manufacturing Employment/Population*	
Regressors:	*(1)*	*(2)*	*(3)*
GDP Market Potential	0.145*	0.721*	−1.468
	(0.068)	(0.181)	(0.841)
Manufacturing Market Potential			2.676*
			(0.816)
Distribution Market Potential			0.714
			(0.745)
Financial Services Market Potential			−1.104
			(0.693)
Objective 1 Region Dummy	−0.353*	−0.285*	−0.302*
	(0.032)	(0.085)	(0.085)
Country Fixed Effects	Yes	Yes	Yes
Observations	202	192	192
Total R-square	0.61	0.47	0.52
Within R-square	0.42	0.25	0.31
F-statistic on fixed effects	3.32*	6.49*	4.25*
RESET test, p-value	0.75	0.02	0.14

Notes:
See text for variable definitions; all non-binary variables in logs; heteroscedasticity-consistent standard errors in parentheses; * denotes statistical significance at the five per cent level.

Column 1 of Table 1 reports our estimation results for this specification. We find that the model fits the data well: 42 per cent of within-country variation in per capita GDP is explained by our market potential measure, and the RESET test suggests no misspecification. The point estimate on $\hat{M}_{i,J}$ is statistically significant and implies that a 10 per cent increase in a region's market potential will increase its per capita GDP by 1.5 per cent.

We then estimated the same model, but replacing the dependent variable by the share of a region's population that is employed in the manufacturing sector (ManEmp/Pop$_i$). The results are reported in column 2 of Table 1. We find that GDP-based market potential is considerably less successful in predicting employment shares than it was in predicting per capita GDP: the explanatory power in terms of R-square has fallen significantly, and, more importantly, the RESET test indicates misspecification. This is in fact not surprising. Our model suggests that sectoral location may be affected unequally by proximity to different sectors, depending on whether regions' sector mixes are such that agglomeration forces dominate or that dispersion forces dominate. Therefore, we have augmented the manufacturing baseline specification to include three additional market potential variables: (i) manufacturing market potential, for which we define Y_i in (1) as manufacturing employment; (ii) distribution market potential, for which we define Y_i in (1) as employment in distribution services; and (iii) financial services market potential, for which we define Y_i in (1) as employment in financial services.[12]

Column 3 of Table 1 reports the results of the extended model for manufacturing. This model explains 31 per cent of within-country variation in manufacturing employment shares, and the RESET test no longer suggests misspecification. The estimated coefficients are interesting: the effect of manufacturing market potential is strongly and significantly positive. This suggests that positive agglomeration forces dominate the competition effect. We also find a positive relationship between manufacturing employment and distribution market potential, although this effect is not statistically significant. Although they are not statistically significant either, the negative coefficients on GDP market potential and financial services market potential are suggestive of a pattern that sees manufacturing activities locating away from the main (urban) economic centres.[13] The most striking aspect of our regression results for this model, however, is the size of the point estimates. The data suggest that the elasticities of manufacturing employment shares are larger than one (in absolute value) with respect to three of the four market potential measures in the model. We find, for example, that a 10 per cent increase in manufacturing market potential (own-region effects not included) will raise a region's manufacturing employment share by roughly 27 per cent. This finding is consistent with the 'home-market effect' that characterises modern trade and geography models, according to which differences in market access translate into larger than proportional differences is sectoral production shares.

b. EU Enlargement and Objective 1 Regions: Simulations

(i) Regional per capita GDP

Our simulation strategy is straightforward. We take the coefficients estimated for the benchmark regressions (models 1 and 3 of Table 1), recalculate the market potential variable $\hat{M}_i$ by including the ten 2004 accession countries, and predict per capita GDPs and manufacturing employment shares in incumbent EU regions on this basis (the EU-25 scenario). These predicted values are then compared to fitted values from the benchmark regressions. Note that by imposing parameters estimated in the pre-enlargement EU sample on the post-enlargement sample, we imply that trade costs other than freight time will be equal in both

[12] To avoid simultaneity, we dropped own-region employment in the computation of manufacturing market potential. Own-region employment was, however, considered in the construction of distribution and financial services market potential measures. The number of observations in the employment regressions is smaller than in the GDP regressions, because we lack the relevant data for the regions of former East Germany.

[13] This is consistent with the finding of Brülhart and Traeger (2003) that, since the 1970s, the share of EU manufacturing jobs in peripheral regions has been increasing.

samples. The predicted changes should thus be seen as long-run upper-bound estimates.

The results for regional per capita GDP are reported in Table 2. Given the focus of this study, we report individual results for peripheral regions only, where peripherality is understood to mean Objective 1 status in the EU's regional policy. The second-last column of Table 2 lists percentage differences in predicted per capita GDPs. Given the simple linear functional form we have imposed, the changes are necessarily positive. On average, our simulations suggest that Objective 1 regions' incomes rise by 0.93 per cent while those of non-Objective 1 regions rise by 0.65 per cent (last two rows of Table 2). Although these magnitudes may appear small, they are likely overestimates, since our simulation scenario implies a regime switch from infinite trade costs at the EU border to trade costs that are as low as those that applied to intra-EU trade in the late 1990s. We therefore deem the relative information implied in our simulations more informative than absolute magnitudes. Among Objective 1 regions, we indeed observe considerable variance in the magnitude of estimated effects. Our projected income changes range from 0.37 per cent (South Yorkshire) to 2.12 per cent (Burgenland). The maximum effect is thus almost six times larger than the minimum. Our adopted linear specification implies that the effect of enlargement is stronger the closer a region is to the accession countries (in terms of road freight travel time), and the less close it is to alternative large centres of economic activity.[14] It is the latter factor that is key to our findings that the effect for Austria's Burgenland region is more than twice that for most East German regions, and that the effect for the West of Ireland is considerably larger than that for all English and Welsh regions.

In a second simulation, we recomputed market potentials to include eight additional countries that are potential candidates for a next EU enlargement (the EU-33 scenario). Simulated income changes relative to the EU-only benchmark are reported in the right-most column of Table 2. With these simulations, we find that the income effects range from 0.48 per cent (South Yorkshire) to 2.77 per cent (East Macedonia and Thrace). Given that all of the additional countries considered in this simulation are located in the Balkans, it is of course not surprising to find that the strongest effects of such a future enlargement would be felt by Greek regions. Indeed, according to our simulations, a future Balkans enlargement would add an additional 0.83 per cent to the per capita GDP of the average Greek region, while it would boost the regional income of the average UK Objective 1 region by a mere 0.14 per cent.

From a regional policy perspective, it might be of interest how the simulated regional income effects correlate with pre-enlargement relative incomes of

[14] We experimented with non-linear specifications of our benchmark regressions but did not find them to add any explanatory power.

TABLE 2
Regional GDPs

Country	*Region*	*NUTS*[1]	*GDP Market Potential*[2]	*GDP Per Capita*[3]	*Percentage* Δ*GDP, EU-25*[4]	*Percentage* Δ*GDP, EU-33*[4]
Austria	Burgenland	AT11	7,468	13.98	2.116	2.525
Germany	Brandenburg	DE4	9,093	14.20	1.049	1.254
	Mecklenburg-Western Pomerania	DE8	8,259	12.94	0.968	1.175
	Chemnitz	DED1	9,996	11.91	1.022	1.230
	Dresden	DED2	9,126	13.93	1.187	1.408
	Leipzig	DED3	10,192	14.92	0.967	1.164
	Dessau	DEE1	10,106	11.92	0.911	1.101
	Halle	DEE2	10,658	13.84	0.884	1.073
	Magdeburg	DEE3	10,193	12.15	0.839	1.021
	Thuringia	DEG	10,885	12.81	0.839	1.028
Finland	Eastern Finland	FI13	2,941	14.54	1.255	1.597
	Northern Finland	FI15	2,645	16.64	1.231	1.579
Greece	East Macedonia and Thrace	GR11	2,737	11.54	1.396	2.773
	Central Macedonia	GR12	3,180	12.67	1.389	2.568
	West Macedonia	GR13	2,993	11.66	1.324	2.372
	Thessalia	GR14	3,134	11.85	1.254	2.255
	Epirus	GR21	2,876	8.22	1.247	2.157
	Ionian Islands	GR22	2,690	11.59	1.199	1.994
	Western Greece	GR23	3,225	10.88	1.056	1.785
	Continental Greece	GR24	3,266	12.39	1.126	1.976
	Peloponnese	GR25	3,223	11.04	1.049	1.786
	Attica	GR3	5,017	14.53	1.179	2.034
	North Aegean	GR41	2,180	9.81	1.225	1.999
	South Aegean	GR42	2,221	14.16	1.196	1.915
	Crete	GR43	2,324	13.67	1.211	1.933
Ireland	Border, Midlands, West	IE01	4,819	14.44	0.641	0.853

Italy	Campania	IT8	7,260	12.61	0.852	1.148
	Apulia	IT91	6,154	13.65	0.908	1.236
	Basilicata	IT92	5,805	13.33	0.836	1.133
	Calabria	IT93	4,826	11.38	0.919	1.257
	Sicily	ITA	4,360	12.61	1.005	1.375
	Sardinia	ITB	4,512	13.93	0.881	1.189
Portugal	North	PT11	5,247	12.45	0.633	0.853
	Centre	PT12	5,048	12.20	0.603	0.813
	Alentejo	PT14	4,485	12.43	0.609	0.826
	Algarve	PT15	4,141	14.33	0.652	0.886
Spain	Galicia	ES11	5,006	12.31	0.637	0.858
	Asturias	ES12	5,643	14.63	0.601	0.807
	Castile Leon	ES41	6,092	14.82	0.562	0.754
	Castile La Mancha	ES42	5,852	12.90	0.557	0.752
	Extremadura	ES43	5,111	10.55	0.584	0.790
	Valencia	ES52	6,396	14.67	0.628	0.845
	Andalusia	ES61	4,938	11.25	0.668	0.905
	Murcia	ES62	5,607	13.12	0.613	0.827
Sweden	Central Norrland	SE07	3,442	19.53	1.071	1.359
	Upper Norrland	SE08	2,921	19.00	1.128	1.439
UK	Merseyside	UKD5	12,212	14.50	0.388	0.510
	South Yorkshire	UKE3	12,399	14.61	0.366	0.480
	Cornwall	UKK3	7,350	14.45	0.530	0.698
	West Wales	UKL1	9,201	14.33	0.461	0.605
Average of Objective 1 regions (50 regions)			*5,789*	*13.24*	*0.929*	*1.338*
Average of non-Objective 1 regions (152 regions)			*11,253*	*20.38*	*0.653*	*0.831*

Notes:
[1] Eurostat's region codes (Nomenclature of Territorial Units for Statistics).
[2] Including regions' own GDP, considering only EU + EFTA (see text for full definition).
[3] 1998 purchasing-power parity data.
[4] Projected percentage changes in per capita GDPs with EU-25 and EU-33 enlargement scenarios.

Objective 1 regions. The simple correlation coefficient between 1998 real purchasing-power parity per capita GDP and our simulated EU-25 effect (i.e. between the second and third data columns in Table 2) is −0.07, which is statistically insignificant. The same correlation but with the EU-33 simulated effects is −0.24, which is statistically significant at the 10 per cent level. Note finally that the average GDP effect in the EU-33 scenario is 60 per cent larger for Objective 1 regions than for non-Objective 1 regions (final two rows of Table 2). Our simulations therefore suggest that the market-access effects of the 2004 enlargement will neither exacerbate nor reduce income inequalities among Objective 1 regions, but that a future Balkans enlargement could reduce these inequalities, mainly by boosting income in Greece.

(ii) Regional manufacturing employment

In a second set of simulations we take the coefficients from our benchmark regressions on manufacturing employment (Table 1, model 3), and apply them to EU-25 market potentials, so as to obtain predicted post-enlargement employment shares.[15] The results are shown in Table 3.

As expected, given the large coefficients obtained in the benchmark regression, the magnitudes of the simulated effects are substantial. We predict increases in the share of regional populations employed in manufacturing that range from 12.4 per cent (South Yorkshire) to 86.9 per cent (Burgenland). Here too, we of course have to interpret absolute magnitudes with caution. Nonetheless, it should be noted that the fact that all estimated effects are positive is not a necessary result of our specification here, since negative changes would in principle be possible. The market-access effect of EU enlargement on manufacturing employment in Objective 1 regions thus appears to be unambiguously positive.

The relative pattern of manufacturing effects resembles that found for regional incomes quite closely: regions that are proximate to the accession countries and relatively far from economic centres of the pre-enlargement EU benefit relatively more. Variations in the geographical distribution of manufacturing and service sectors across the regions of accession countries do not appear to be large enough to affect relative effects on incumbent EU regions significantly.

Finally, we again find that the market access effects of enlargement on average benefit Objective 1 regions more than non-Objective 1 regions. The simulated increase in manufacturing employment is 32.7 per cent for the average Objective 1 region and 23.4 per cent for the average non-Objective 1 region (last two rows of Table 3).

[15] Due to lack of sectoral data for non-EU-25 countries, we cannot carry out EU-33 simulations on employment shares.

TABLE 3
Regional Manufacturing Employment

Country	*Region*	*Manufacturing Employment/Population*	*Percentage Δman.empl., EU-25*[1]
Austria	Burgenland	5.07	86.9
Germany	Brandenburg	n.a.	41.5
	Mecklenburg-Western Pomerania	n.a.	37.7
	Chemnitz	n.a.	38.1
	Dresden	n.a.	46.5
	Leipzig	n.a.	37.7
	Dessau	n.a.	35.9
	Halle	n.a.	33.8
	Magdeburg	n.a.	31.5
	Thuringia	n.a.	29.7
Finland	Eastern Finland	6.44	40.5
	Northern Finland	7.87	40.7
Greece	East Macedonia and Thrace	5.70	48.3
	Central Macedonia	7.50	48.2
	West Macedonia	8.26	44.8
	Thessalia	5.12	41.4
	Epirus	3.77	42.7
	Ionian Islands	2.48	41.5
	Western Greece	2.72	35.3
	Continental Greece	5.73	36.0
	Peloponnese	3.28	33.9
	Attica	8.23	40.9
	North Aegean	3.81	42.6
	South Aegean	4.08	41.2
	Crete	3.03	40.8
Ireland	Border, Midlands, West	9.38	23.1
Italy	Campania	3.19	30.9
	Apulia	3.84	32.8
	Basilicata	4.10	31.1
	Calabria	1.74	33.3
	Sicily	2.35	35.1
	Sardinia	3.43	31.2
Portugal	North	12.86	21.7
	Centre	8.01	19.2
	Alentejo	3.29	20.2
	Algarve	2.60	21.8
Spain	Galicia	6.54	20.1
	Asturias	6.94	19.5
	Castile Leon	6.63	18.1
	Castile La Mancha	7.58	18.3
	Extremadura	2.69	19.2
	Valencia	10.40	20.7
	Andalusia	3.87	21.9
	Murcia	6.97	19.5

TABLE 3 *Continued*

Country	*Region*	*Manufacturing Employment/Population*	*Percentage Δman.empl., EU-25*[1]
Sweden	Central Norrland	8.47	38.3
	Upper Norrland	8.22	38.4
UK	Merseyside	4.93	13.1
	South Yorkshire	7.73	12.4
	Cornwall	5.35	19.2
	West Wales	5.13	16.5
Average of Objective 1 regions (50 regions)		*5.59*	*32.7*
Average of non-Objective 1 regions (152 regions)		*8.76*	*23.4*

Note:
[1] Projected percentage changes in (manufacturing employment/population) with EU-25 enlargement scenario.

4. CONCLUSIONS

We have explored the implications of changing market access in an enlarged EU, focusing on peripheral regions of incumbent member states. A three-region version of Krugman's (1991) core-periphery model predicts that, for most parameter configurations, external liberalisation favours the concentration of the mobile sector in the domestic region that is close to the outside country (the 'border region'). Our empirical simulations suggest that the economic impacts of enlargement are indeed likely to be significantly different depending on regions' geographic location relative to the new member states. We find that the effect on regional per capita income is six times larger in the most affected Objective 1 region (Burgenland, Austria) than in the least affected one (South Yorkshire, UK). In terms of manufacturing employment, this difference rises to a factor seven. We also find that the distribution of market-access related gains from the 2004 enlargement will not reduce inequality among current Objective 1 regions; but that a possible future Balkans enlargement would have such an effect, mainly by improving market access conditions for Greece.

APPENDIX A

A Three-region Core-Periphery Model

This appendix spells out our three-region version of Pflüger's (2004) geography model. The world consists of $R = 3$ regions (denoted 0 for the foreign country, and 1 and 2 for the domestic regions), endowed with two factors, immobile labour (L) and mobile human capital (K). There are two sectors: manufacturing (X), and agriculture (A). The agricultural good is homogenous and produced under perfect competition. It is assumed to be traded at zero cost, both inter-regionally and internationally. Therefore, its price equalises everywhere: $p_{A1} = p_{A2} = p_{A0}$. We choose units such that $p_A = w_A$ in each region. Finally, we use the agricultural good as a numéraire, therefore $w_A = 1$ in each region.

A.1 Consumers and Price Indices

All consumers share the same quasi-linear utility function:

$$U = \alpha \ln C_X + C_A \quad \text{with} \quad \alpha > 0. \tag{3}$$

C_X is a composite index of the consumption of the manufactured good, C_A denotes consumption of the agricultural good. The composite index C_X is defined by the following CES function:

$$C_X = \left[\sum_{i=1}^{n} x_i^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \tag{4}$$

where x_i represents consumption of a variety i of the manufactured good, n is the number of available varieties in the economy, and σ is the elasticity of substitution between two varieties ($\sigma > 1$). Given income Y, each consumer maximises utility subject to the budget constraint $Y = C_A p_A + \sum_{i=1}^{n} x_i p_i$. Using (3) and (4), we can derive the following demand function, representing demand emanating from consumers of region s, addressed to a producer i located in region r:

$$x_{i,rs} = p_{i,rs}^{-\sigma} \frac{\alpha}{\sum_i p_{i,rs}^{1-\sigma}}; \quad r, s = 0, 1, 2. \tag{5}$$

Equation (5) contains the spatial framework. Each of the three regions, $r = 0$, 1, 2, produces n_r varieties of the manufacturing good. Iceberg trade costs imply that the price of each variety i produced in r and sold in s contains the mill price and the trade cost: $p_{irs} = p_r T_{rs}$ (because of the symmetry of all varieties produced in the same region, we henceforth omit the variety subscript i). We use T_{rs} as a general expression which represents either T_{12}, T_{01} or T_{02}, assuming that the trade cost between two regions is identical for both directions of trade flows, and that $T_{rr} = 1$. Using (4) and (5), we are thus able to derive the following industrial price index for each region s:

$$P_s = \left[\sum_{r=0}^{R} n_r (p_r T_{rs})^{1-\sigma} \right]^{\frac{1}{1-\sigma}}. \tag{6}$$

Individual demand (5) can now be written as:

$$x_{rs} = \frac{\alpha(p_r T_{rs})^{-\sigma}}{P_s^{1-\sigma}} \quad r,\, s = 0,\ 1,\ 2. \tag{7}$$

A.2 Producers

Manufactured goods are produced in a monopolistically competitive industry that employs both labour and human capital. Each producer has the same production function. Recalling that labour is hired at a wage that is set equal to one, total cost of producing x_i units of variety i in region r is $\mathrm{TC}_r(x_i) = R_r K_i + L_i x_i$, where R_r represents the compensation of human capital in region r. Hence, $\mathrm{TC}_r(x_i)$ contains a fixed cost that corresponds to one unit of human capital, i.e., $K_i = 1$, and a marginal cost in terms of labour. The fixed cost gives rise to increasing returns to scale.

As usual in a monopolistic competition framework, we suppose that there are a large number of manufactured firms, each producing a single product. Hence, we obtain the constant mark-up equation for profit-maximising firms:

$$p_r = \left(\frac{\sigma}{\sigma - 1}\right), \tag{8}$$

where p_r is the price of a variety produced in r.

The equilibrium output of a firm producing in region r is given by market clearing for each variety. Using (7), output is:

$$X_r = \sum_{s=0,1,2} (K_s + L_s) T_{rs} x_{rs}, \tag{9}$$

and the profit function of a representative firm located in r is:

$$\Pi_r = p_r X_r - X_r - R_r. \tag{10}$$

A.3 Short-run Equilibrium

The number of varieties produced equals the number of firms located in that region, which is linked one to one to the number of human capital owners. Thus $K_r = N_r$. In the short run, human capital is immobile between regions. The zero-profit condition in equilibrium implies R_r adjustment. Using (8) and (10), we obtain:

$$X_r = R(\sigma - 1). \tag{11}$$

From (6), price indices in each region are:

$$P_1 = \left(\frac{\sigma}{\sigma - 1}\right)[K_0 T_{01}^{1-\sigma} + K_1 + K_2 T_{12}^{1-\sigma}]^{\frac{1}{1-\sigma}}, \tag{12}$$

$$P_2 = \left(\frac{\sigma}{\sigma - 1}\right)[K_0 T_{02}^{1-\sigma} + K_1 T_{12}^{1-\sigma} + K_2]^{\frac{1}{1-\sigma}}, \tag{13}$$

$$P_0 = \left(\frac{\sigma}{\sigma - 1}\right)[K_0 + K_1 T_{01}^{1-\sigma} + K_2 T_{02}^{1-\sigma}]^{\frac{1}{1-\sigma}}. \tag{14}$$

For a given distribution of human capital across regions, we can derive from (6), (7), (8) and (11) the equilibrium value for R_r. In our three-region setting, expressions for nominal wage are:

$$R_1 = \frac{\alpha}{\sigma}\left[\frac{(L_0 + K_0)T_{01}^{1-\sigma}}{K_0 + K_1 T_{01}^{1-\sigma} + K_2 T_{02}^{1-\sigma}} + \frac{(L_1 + K_1)}{K_0 T_{01}^{1-\sigma} + K_1 + K_2 T_{12}^{1-\sigma}} + \frac{(L_2 + K_2)T_{12}^{1-\sigma}}{K_0 T_{02}^{1-\sigma} + K_1 T_{12}^{1-\sigma} + K_2}\right], \tag{15}$$

$$R_2 = \frac{\alpha}{\sigma}\left[\frac{(L_0 + K_0)T_{02}^{1-\sigma}}{K_0 + K_1 T_{01}^{1-\sigma} + K_2 T_{02}^{1-\sigma}} + \frac{(L_1 + K_1)T_{12}^{1-\sigma}}{K_0 T_{01}^{1-\sigma} + K_1 + K_2 T_{12}^{1-\sigma}} + \frac{(L_2 + K_2)}{K_0 T_{02}^{1-\sigma} + K_1 T_{12}^{1-\sigma} + K_2}\right], \tag{16}$$

$$R_0 = \frac{\alpha}{\sigma}\left[\frac{(L_0 + K_0)}{K_0 + K_1 T_{01}^{1-\sigma} + K_2 T_{01}^{1-\sigma}} + \frac{(L_1 + K_1)T_{01}^{1-\sigma}}{K_0 T_{01}^{1-\sigma} + K_1 + K_2 T_{12}^{1-\sigma}} + \frac{(L_2 + K_2)T_{02}^{1-\sigma}}{K_0 T_{02}^{1-\sigma} + K_1 T_{12}^{1-\sigma} + K_2}\right]. \tag{17}$$

A.4 Long-run Equilibrium

In the long run, human capital owners are mobile between domestic regions. They migrate towards the regions with the highest indirect utility. From (3), utility maximisation yields the following indirect utility function:

$$V_r = -\alpha \ln(P_r) + Y + [\alpha(\ln \alpha - 1)]. \tag{18}$$

Hence, one can derive the utility differential:

$$V_1 - V_2 = \alpha \ln(P_2/P_1) + (R_1 - R_2). \tag{19}$$

Using equations (12)–(17), it is straightforward that $(V_1 - V_2)$ only depends on the share of human capital in region 1, i.e., $\lambda = K_1/(K_1 + K_2)$ and the parameters of the model. The assumed law of motion is:

$$\frac{d\lambda}{dt} = \begin{cases} (V_1 - V_2) & \text{if } 0 < \lambda < 1 \\ \min\{0, (V_1 - V_2)\} & \text{if } \lambda = 1 \\ \max\{0, (V_1 - V_2)\} & \text{if } \lambda = 0 \end{cases}. \tag{20}$$

We examine the implications of this law of motion graphically by plotting (19) for different parameter values (see Figures 1, 2, 3).

APPENDIX B

Data

B.1 Interregional Road Freight Travel Times

Our estimated interregional effective distances are based on the Schürmann-Talaat (2000) dataset for NUTS 2 regions. Effective (i.e. economically relevant) distances are represented by road freight travel times in hours, which are in turn obtained by multiplying geographic road distances with estimated average travel speeds in km/h. Estimated travel speeds are a function of road categories, border delays, ferry port delays, statutory speed limits and statutory rest periods for drivers. Where transport by ferry represents the only or quickest route, this is retained in the data. For details, see Schürmann and Talaat (2000).

The Schürmann-Talaat estimates for intra-regional travel times are based on the assumption that average intra-regional trip length is 10 km everywhere. Taking account of unequal region sizes, we assume instead that intra-regional distances can be approximated as a proportion of the radius of a circle whose area represents that of the region (see Head and Mayer, 2002, for a discussion of this and alternative intra-region distance estimations). Where our market potential variables included own-region components, we set that proportion to 1/3 and assume average intra-regional travel speeds to be 30 km/h, so that $\hat{d}_{ii} = 2 * 0.33 * \sqrt{\frac{\text{area}_i}{\pi}}$.

Estimated intra-region travel times for the EU and CEEC regions range from 5 minutes (Brussels) to 2 hours 26 minutes (Övre Norrland, Sweden), and estimated inter-region travel times range from 34 minutes (Brussels – Brabant) to 113 hours (South Aegean, Greece – Northern Norway).

B.2 Regional GDP and Employment

For GDPs of NUTS 2 regions, we use Eurostat's data for 1998, based on purchasing-power parity exchange rates. For the EU, EFTA and CEEC regions (2004 accession countries), these GDPs range from EUR 0.6 bn (Åland, Finland) to EUR 335 bn (Ile de France). The market potential indices for the EU-33 sample furthermore incorporate country-level GDPs for Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Macedonia, Romania, Turkey and Serbia-Montenegro.

Sectoral employment data for 1998, covering manufacturing, distribution services and financial services in NUTS 2 regions of EU-15 countries plus Norway and Switzerland, are taken from the regional database compiled by Cambridge Econometrics. Corresponding data have been obtained from the Vienna Institute for International Economic Studies (WIIW) and from the Austrian Institute of Economic Research (WIFO) for five CEECs (Czech Republic, Hungary, Poland, Slovenia and Slovakia). Hence, our 'EU-25' scenario of Table 3 does not incorporate data for Cyprus, Estonia, Latvia, Lithuania and Malta.

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