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New economic geography meets Comecon

Regional wages and industry location in central Europe[1]

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Abstract

We analyse the internal spatial wage and employment structures of the Czech Republic, Hungary, Poland, Slovakia and Slovenia, using regional data for 1996–2000. A new economic geography model predicts wage gradients and specialization patterns that are smoothly related to the regions' relative market access. As an alternative, we formulate a 'Comecon hypothesis', according to which wages and sectoral location are not systematically related to market access except for discrete concentrations in capital regions. Estimations support both the NEG (new economic geography) prediction and the Comecon hypothesis. However, when we compare internal wage and employment gradients of the five new member states with those of Western European countries, we find that the former are marked by significantly stronger discrete concentrations of wages and service employment in their capital regions, confirming the ongoing relevance of the Comecon hypothesis.

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1. Introduction

After the overthrow of their socialist regimes in 1989–90, most Central and Eastern European countries (CEECs) have rapidly adopted market-based economic systems and redirected the focus of their political and economic relations towards the European Union. This process has culminated in the accession to the EU of eight CEECs in 2004. One of the main benefits of EU enlargement is the boost it is expected to provide for economic activity both in accession countries and in incumbent member states. Lower barriers to trade yield gains that are well understood by economists and estimated to be significant (see, for example, Baldwin *et al.*, 1997).

Although the potential for aggregate economic gains through closer economic integration in Europe is undisputed, economists also acknowledge that integration transforms the internal structures of national economies, which can have important distributional consequences. One dimension of integration-induced restructuring concerns geography. How does European integration impact on the spatial distribution of activities, prices and incomes across regions? This question has been the object of a thriving research area in recent years.

It is somewhat surprising, given the vibrancy of the research field and the importance of the issue, that relatively little analysis has been conducted on the transforming economic geographies of CEECs.[2] For the academic researcher, these countries present an interesting 'laboratory case', due to their legacy of centrally planned economic structures and rapid trade reorientation towards the EU. Is the old spatial organization of those economies unravelling and giving way to a different geographic distribution of activities, shaped by market forces? If so, what is the nature of these forces, and what new spatial equilibrium is likely to emerge?

We provide an analysis of the internal economic geographies of five CEECs, drawing on regional data for wages and sectoral employment in the Czech Republic, Hungary, Poland, Slovakia and Slovenia. Specifically, we estimate spatial wage and employment gradients inside those countries based on a multi-country new economic geography (NEG) model. In this model, the better a region's access to large markets (and pools of suppliers), the higher its wages and the greater its locational attractiveness for mobile trade-oriented sectors. Depending on the precise modelling assumptions, access to markets will yield either high factor prices, large production, or a mix of both. The wage and output effects of market access are a typical feature of the NEG that sets these models apart from most neoclassical location theory. It makes the NEG approach eminently suitable as a theoretical framework for the analysis of locational changes in integrating economies with similar endowments.

As an alternative to the market-driven spatial structure described by the model, we formulate a somewhat looser 'Comecon hypothesis', based on the idea that the

[2] Descriptions of regional location patterns in CEECs have been provided by Resmini (2003) and Traistaru *et al*. (2003).

artifice of central planning created economic geographies whose only regularity was a concentration of certain sectors and high wages in the capital region.

Our estimations based on data for the accession countries support both the NEG prediction and the 'Comecon hypothesis'. When we compare internal wage and employment gradients of accession countries with those of existing EU members, we find that accession countries are marked by significantly stronger concentrations of wages and of employment in market services in their capital regions. One might therefore conjecture that market forces will in time attenuate those countries' economic concentration in capital regions and favour a dispersion of activities and an increase of relative wages in provincial regions – particularly in those that are located close to the core EU markets.

The paper is organized as follows. In Section 2, we present the theoretical model that underpins our empirical approach and derive the estimable equations. Our estimations of wage and employment gradients in accession countries and in the full sample of 21 European countries are given in Section 3. Section 4 concludes.

2. Theory

The NEG provides a well-suited framework for a formal analysis of the internal geography of countries that open their markets towards the outside world. In this section, we sketch the salient features of a three-region NEG model and derive the fundamental equations that underlie our empirical analysis.

2.1 The model

NEG models rely on four essential ingredients to explain the spatial configuration of economic activity.[3] First, production is subject to increasing returns to scale at the firm level. Second, the goods produced by different firms are imperfect substitutes. Third, firms are symmetric and sufficiently numerous to accommodate monopolistically competitive equilibria. Fourth, trade costs inhibit exchange among locations and thereby give economic relevance to otherwise featureless geographic space.

An essential feature of these models is that market access acts as the principal determinant of the spatial structure of employment and factor prices. Market access is an increasing function of a location's own market size and of the size of other markets, and a decreasing function of the trade costs that separate the home location from all other locations. Changes in market access trigger locational forces,

[3] For a comprehensive statement of the underlying modelling structure, see Fujita *et al.* (1999). Recent studies of the intra-national spatial effects of trade liberalization in NEG settings include Krugman and Livas (1996), Monfort and Nicolini (2000), Paluzie (2001), Alonso-Villar (2001), Behrens (2003), Crozet and Koenig (2004), and Brülhart *et al.* (2004).

which, adopting Head and Mayer's (2004) terminology, we call the price version and the quantity version of the market-access effect.

The *price version* can be illustrated as follows. Suppose a typical NEG framework with multiple locations, a unique production factor in the differentiated sector, industrial labour, and zero mobility of firms and labour. Consumers' utility increases with the number of varieties. The amount of variety i consumed by a representative consumer in j is equal to:

$$x_{ij} = \frac{(p_i \tau_{ij})^{-\sigma}}{P_j^{1-\sigma}} \mu Y_j \tag{1}$$

where Y_j is the total income of region j, s stands for the elasticity of substitution among goods from the competing symmetric firms, and μ is the share of expenditure that consumers allocate to the differentiated sector. P_j is the price index of the differentiated sector in region j:

$$P_j \equiv \left[\sum_i n_i (p_i \tau_{ij})^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \tag{2}$$

where n_i is the number of firms in i, p_{ij} is the final price paid by consumers in j ($p_{ij} = p_i \tau_{ij}$), and τ is the ad-valorem 'iceberg' cost of shipping goods between regions. Following Baldwin *et al.* (2003), we express trade costs as $\tau_{ij}^{1-\sigma} \equiv \Phi_{ij}$, which is comprised between 0 and 1 and is a measure of the degree of *trade freeness* between pairs of regions. At $\Phi_{ij} = 0$, trade costs are prohibitive, and $\Phi_{ij} = 1$ means perfectly free trade. The profit function of a representative firm in a differentiated sector and located in region i is:

$$\Pi_i = p_i x_i - w_i (F + c x_i). \tag{3}$$

To produce x_i units of the differentiated good, which it sells at price p_i, the firm uses F units of labour as a fixed input, and c units as a variable input. Labour is paid a wage w_i. Each firm maximizes its profit by behaving as a monopolist for its own variety of the differentiated good. The first-order profit maximizing condition combined with the large-group assumption implied by monopolistic competition determines the price set by each firm, $p_i = w_i (c\sigma / \sigma - 1)$. When incorporated in the profit function, this yields:

$$\Pi_i = w_i \left(\frac{x_i c}{\sigma - 1} - F \right). \tag{4}$$

We assume free entry in the differentiated sector. Hence, profits are zero in equilibrium. This allows us to derive the equilibrium quantity produced by each firm: $x_i^* = F(\sigma - 1)/c$. In the price version of the model, where labour is interregionally

immobile, equilibrium in the market for industrial labour implies that the number of firms, n_i, is proportional to the number of industrial workers, $n_i = H_i/F$, in each region. Hence, adjustments to changes in market access can only occur through factor prices. This effect is visible in the expression for equilibrium in the market for a variety of the industrial good. It expresses equilibrium firm output in i, x_i^*, as the sum of demands coming from all regions j:

$$x_i^* = \sum_j p_i^{-\sigma} \Phi_{ij} P_j^{\sigma-1} \mu Y_j . \tag{5}$$

Incorporating the price set by each firm, the equilibrium output per firm, and a normalization on marginal costs such that $c = (\sigma - 1)/\sigma$ (and hence $p_i = w_i$ and $x_i^* = F\sigma$), Equation (5) becomes:

$$w_i = \left[\frac{\mu}{F\sigma} \sum_j \Phi_{ij} P_j^{\sigma-1} Y_j \right]^{1/\sigma} . \tag{6}$$

We can see that the wage in each region is a function of the size of the demand to which it has access, Y_j, the level of trade freeness Φ_{ij}, and the price index, which can be understood as an inverse measure of the intensity of competition. Hence, through Equation (6) it appears that central regions will pay higher wages, in order to compensate for the advantage in profitability. Central regions are large (have high Y_i), and/or they have good access (high Φs), to large partner regions (high Y_j, $j \neq i$).

The *quantity version* of the market-access effect can most easily be derived in a variant of this model that assumes a single factor of production shared by two sectors, one of which is perfectly competitive and freely traded. In this case, the perfectly competitive sector pins down wages, and the industrial wage cannot increase in order to adjust for an increase in profitability of one of the regions. Adjustment occurs through factor movements, either across sectors or across regions. Regions with better market access will host a (disproportionately) larger differentiated sector. When the ratio of a region's share of production in a sector and that region's share of demand (weighted by trade costs) is larger than one, one speaks of a 'home-market effect' (see Krugman, 1980).[4]

2.2 The estimable equations

Our approach is based on a reduced-form estimation of the market-access effect described by the wage equation (6). This equation states that, in equilibrium, the

[4] It is worth underlining that, in saying this, we extrapolate the results of a three/multi region model from a two region model. Recent work by Behrens *et al.* (2004) suggests that a fully rigorous extension to the *N*-region case would in addition require taking account of spatial asymmetries. Given the empirical complexity this would entail, we choose to abstract from the issue here, leaving an examination of its relevance to future work.

nominal wage of a region i depends on the size of demand in each accessible market, multiplied by the intensity of competition in each of these markets, and weighted by the accessibility of each market. In our estimations, we focus on τ_{ij} as the essential characteristic that distinguishes regions' market access. The ideal empirical counterpart of τ_{ij} would be, for each region of interest, a measure of the level of trade costs with all existing outside potential markets as well as internally. We simplify this task by choosing, as in Hanson (1996, 1997), the access of each considered region to its principal markets, approximated by geographic distance.

Which are these principal markets in the case of the Central European countries? Before the dismantling of the Soviet bloc, those countries' trade was mainly focused on intra-Comecon (Council for Mutual Economic Cooperation) relationships. However, market forces played a minor role in shaping wages and location patterns compared to the importance of central planning. The explanatory power of market-based economic models, such as those of the NEG, regarding those countries' internal economic geographies prior to their conversion to market systems in the 1990s is therefore likely to be limited. By their very nature, however, centrally planned economies tend to be strongly centred on the capital region. We therefore formulate a 'Comecon hypothesis' as the reference point for our analysis: under central planning, nominal wages as well as employment shares of sectors that are closely linked to the central authorities are significantly higher in the capital regions but otherwise unrelated to market access. In other words, our Comecon hypothesis implies a discrete jump in wages and employment shares between the capital region and the provinces, and no systematic pattern among the provinces.[5]

In contrast, according to the NEG prediction embodied in (6), wages should rise smoothly in market access. We model market access in terms of regions' distances (i) from their respective national capitals and (ii) from the EU, whose economic centre of gravity we take to be Brussels. Continuous gradients of wages and/or employment shares relative to regions' market access are a general prediction of NEG models that we take as the alternative to our 'Comecon hypothesis'. We thus specify the following reduced-form expression for region i's relative wage:

$$\frac{w_i}{\bar{w}} = f\,(\Phi_{i\text{capital}}, \Phi_{i\text{EU}}, \textit{capdum}, \text{other market access variables}), \qquad (7)$$

where w_i is the regional nominal wage; $\bar{w}$ is the mean wage of the relevant country; $\Phi_{i\text{capital}}$ and $\Phi_{i\text{EU}}$ denote trade freeness between i and, respectively, the national capital and the EU; and *capdum* is a dummy for the capital region. We use distance to

[5] The arbitrariness in locational decisions by socialist planners with respect to economic fundamentals is well known. Lechmanova (1998), for instance, has pointed out that 'one of the main characteristics of communist trade was that instead of comparative advantage, countries' specialization was determined by the Politburo.' As for the concentration of economic activity in capital regions of non-democratic countries, Ades and Glaeser (1995, p. 224) concluded that 'urban giants ultimately stem from the concentration of power in the hands of a small cadre of agents living in the capital. This power allows the leaders to extract wealth out of the hinterland and distribute it in the capital.'

represent trade freeness, and we specify a log-linear relation between the variables as our benchmark empirical model. Specifically, our first estimable equation is:

$$\ln\left(\frac{w_i}{\overline{w}}\right) = \alpha_0 + \alpha_1 \ln(d_{icapital}) + \alpha_2 \ln(d_{iEU}) + \alpha_3 (capdum) + \boldsymbol{\alpha} \boldsymbol{X}_i + \varepsilon_i \tag{8}$$

where $\boldsymbol{X}$ is a vector of other variables that determine market access, and ε_i is a potentially heteroscedastic error term. Based on the NEG model, we expect the estimated α_1 and α_2 to be negative, while α_3 is not significantly different from zero.[6] The Comecon hypothesis, in turn, implies a significantly positive α_3 and insignificant α_1 and α_2. Note again that both the Comecon hypothesis and the NEG imply higher wages in the capital regions; the difference is that wages of capital regions are *discretely* higher in the former, while they rise smoothly with proximity to the capital in the former.

Our second estimable equation focuses on the quantity version of the market-access effect, where, in the NEG model, the adjustment variable is the number of firms, which in turn maps into the number of workers. Hence, regions with relatively good access to the main markets will have a relative high share of employment in differentiated sectors. We write the following reduced-form expression, which holds for regional relative employment inside an accession country:

$$\frac{l_{si}}{l_i} = g_s \ (\Phi_{i\text{capital}}, \Phi_{i\text{EU}}, capdum, \text{other market access variables}). \tag{9}$$

l_{si} is employment in sector s and region i, and l_i is the region's total employment. The right-hand side variables have been defined in (7). As for Equation (8), we specify a log-linear relation between our variables and use distance to represent the trade costs. Our second estimable equation thus becomes

$$\ln\left(\frac{l_{si}}{l_i}\right) = \beta_{s_0} + \beta_{s_1} \ln(d_{icapital}) + \beta_{s_2} \ln(d_{iEU}) + \beta(s_3)(capdum) + \boldsymbol{\beta}_s \boldsymbol{X}_i + \varepsilon_{s_i} \tag{10}$$

where we make the same assumptions on the structure of ε_i.

The log-linear functional form chosen for our estimable Equations (8) and (10) facilitates the interpretation of estimated coefficients on continuous variables, but it is not the only one compatible with the theory. Hence, we estimate both equations in levels in order to ascertain the robustness of results found for the log-linear benchmark specifications.

While our estimations are designed to uncover spatial patterns that are of interest in terms of both theory and policy, we ought to point to two issues concerning the interpretation of our findings. First, we cannot interpret our analysis as a rigorous

[6] Note that in estimating a single equation for average wages across sectors – a choice necessitated by data constraints – we imply the assumption that labour is intersectorally mobile.

test of competing locational theories. Our Comecon hypothesis is a rather loosely formulated counterpart to the NEG prediction; so, while it would seem appropriate in our empirical context to frame the Comecon hypothesis in terms of political-economy forces in socialist regimes, discrete concentration in the capital regions might conceivably result also in non-socialist contexts such as market-oriented economies with legacies of highly centralized political institutions and/or exogenous endowments favouring the capital region.[7] Fingleton (2005), for example, pits a regression of regional wages on a theory-consistent measure of market access (the NEG model) against a regression of regional wages on regional employment density. He calls the second regression the 'urban economics' model, as it is inspired by a theory that accounts only for intra-regional proximity effects. In practice, Fingleton's (2005) urban economics specification is very close to our Comecon hypothesis, because the capital regions are the regions with the highest employment density in all but two of our sample countries. This shows that socialist planning is not the only possible base for spatial patterns that conform with our Comecon hypothesis. Second, where we do find discretely higher wages in capital regions, we remain agnostic as to whether this wage bonus is due to higher productivity from agglomeration and/or labour sorting effects or to simple rent extraction from provincial regions via urban bias in public policies (see, for example, Lipton, 1993).

3. Wage and employment gradients

The CEEC economies have become progressively more integrated with the EU during the 1990s, long before their official accession.[8] We now explore to what extent regional wages and employment patterns inside Central European countries already reflected the new geography of market access in the second half of that decade.

3.1 The geography of wages and employment in CEECs

3.1.1 Wages

In this section we study the impact of market access on regional wages in the Czech Republic, Hungary, Poland, Slovenia and Slovakia, using time-averaged data for 1996–2000 (see Appendix A for further details). We estimate Equation (8) as a reduced form of the NEG model.

The dependent variable, *RELWAGE*, is defined as $\frac{w_i}{sd(w_i)}$, where $sd(w_i)$ represents the intra-country standard deviation of nominal wages. This normalization is

[7] It is therefore not entirely surprising that our estimation results support the Comecon hypothesis also for Western European economies, although less forcefully than for the CEECs.

[8] Theory-consistent calculations of CEEC countries' increasing 'trade freeness' relative to the EU countries over the 1980–99 period are reported in an earlier version of this paper (Brülhart and Koenig, 2005).

required to minimize estimation biases arising from the different measurement scales implied by national currencies. We control for exogenous differences in mean country wages, as implied by the numerator $\bar{w}$ on the left-hand side of Equation (8), by including country fixed effects. Our market-access variables include two measures of proximity to the main EU markets (distance to Brussels, and a dummy for regions bordering pre-2004 EU member countries), a dummy for regions bordering other CEECs, and a dummy for regions with direct access to the sea.[9] Distances are measured using the great-circle method, taking the largest town in each region as the relevant centroid. Intra-regional distances for the capital regions are modelled as $d_i = \gamma\sqrt{(area_i/\pi)}$. The underlying assumption is that intra-regional economic geographies can be approximated by a disk where all firms are located at the centre and consumers are spread uniformly over the area. All estimated standard errors are based on White-corrected variance-covariance matrices allowing for country-level clustering.

The first three columns of Table 1 report our baseline log-linear specification for three different levels of γ: 0.5, 0.33 and 1. Our results turn out not to be sensitive to this parameter in the computation of intra-region distances of capital regions. For the remainder of our analysis, we therefore set γ equal to 0.5.

The R-squares suggest that our simple model explains more than three quarters of the within-country variance in *RELWAGE*. Looking at the estimated coefficients, we find that wage gradients are indeed highly discontinuous: being a capital region raises the log of *RELWAGE* by a factor ranging between 2.6 and 2.9. This result is statistically highly significant. The remaining coefficient estimates are compatible with the NEG prediction whereby market access raises nominal wages (wages fall in distance from national capitals and from Brussels, but they are higher in regions bordering other countries or the sea), but none of these estimates is statistically significant. If we take our imprecisely measured coefficients at face value, we find that, in provincial regions, relative wages fall by 2.4 percent for every 10 percent increase in distance from the capital.

Columns 4 to 6 of Table (1) report the same regressions but with all continuous variables measured in levels instead of logs. We find that this transformation makes no qualitative difference: discretely higher wages in capital regions remains the sole statistically significant result, and all other estimated coefficients retain their signs.

In Table 2, we show results of our benchmark model estimated separately for each of the five CEECs in our sample. The most striking result again is the consistent wage advantage of central regions. The estimated effect ranges from 21 percent (Slovenia) to 48 percent (Poland) and is statistically significant throughout.[10] In contrast,

[9] For the construction of the dummy variable representing CEEC border regions, we considered as relevant CEECs our five sample countries plus Romania and Lithuania.

[10] Since these regressions are for individual countries, we do not need to normalize regional wages by their country-level standard deviations on the left-hand side, and we can thus interpret the estimated coefficients directly in terms of relative nominal wages.

Table 1. Wage gradients in CEECs, panel

	Dependent variable: *RELWAGE*					
	(1)	(2)	(3)	(4)	(5)	(6)
	logs	logs	logs	levels	levels	levels
Capital	2.638[a]	2.732[a]	2.921[a]	3.184[a]	3.196 [a]	3.229[a]
	(0.493)	(0.480)	(0.424)	(0.291)	(0.293)	(0.299)
Dist to capital				–0.001	–0.001	–0.001
				(0.001)	(0.001)	(0.001)
ln dist to capital	–0.238	–0.239	–0.217			
	(0.143)	(0.163)	(0.186)			
Dist to Brussels				–0.001	–0.001	–0.001
				(0.001)	(0.001)	(0.001)
ln dist to Brussels	–0.550	–0.584	–0.663			
	(0.618)	(0.605)	(0.568)			
Land border with EU, N, CH	0.083	0.073	0.054	0.024	0.023	0.021
	(0.140)	(0.135)	(0.121)	(0.088)	(0.088)	(0.087)
Land border with CEEC	0.074	0.077	0.074	0.054	0.052	0.045
	(0.116)	(0.115)	(0.116)	(0.134)	(0.134)	(0.132)
Access to sea	0.527	0.528	0.521	0.508	0.505	0.493
	(0.432)	(0.436)	(0.442)	(0.420)	(0.422)	(0.427)
Country dummies	yes	yes	yes	yes	yes	yes
N	70	70	70	70	70	70
Within-R^2	0.7682	0.7661	0.7616	0.8050	0.8045	0.8031

Note: Standard errors in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels.

distance from the capital has a statistically significant effect only in Hungary, where it is negative, and in Poland, where it is positive.

What we retain from the analysis of regional wage gradients in accession countries is that the nominal wage bonus of capital regions is highly significant in both economic and statistical terms. This is consistent with our Comecon hypothesis. Conversely, the evidence for wage-boosting effects of provincial regions' proximity to the capital and to the EU is weak and partly inconsistent.

3.1.2 Sectoral employment

Using regional employment data for nine sectors covering the full spectrum of economic activities, we have estimated Equation (10). The estimation results are reported in Table 3.

Table 2. Wage gradients in CEECs, by country

	Dependent variable: ln(w_i)				
	Czech Rep.	**Hungary**	**Poland**	**Slovenia**	**Slovakia**
Capital	0.286[a]	0.240[a]	0.478[a]	0.205[a]	0.342[a]
	(0.083)	(0.064)	(0.041)	(0.032)	(0.044)
ln dist to capital	–0.046	0.069[a]	0.078[c]	0.006	–0.001
	(0.031)	(0.019)	(0.037)	(0.036)	(0.044)
ln dist to Brussels	0.169[c]	–0.271	–0.041	–0.870	0.101
	(0.090)	(0.158)	(0.085)	(0.671)	(0.676)
Land border with EU, N, CH	0.039	0.054	–0.060	–0.022	0.059
	(0.024)	(0.040)	(0.034)	(0.032)	(0.040)
Access to sea			0.005	0.104[b]	
			(0.020)	(0.038)	
N	14	20	16	12	8
R^2	0.9088	0.7898	0.9319	0.8282	0.8911

***Note*:** Standard errors in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels.

Because we are regressing sector shares in total regional employment, simple adding up constraints make it impossible for the coefficients on any of the dummy variables to have the same sign across all sectors. For example, it would be impossible to find all sectors as being relatively concentrated in the capital regions. This is of course exactly what we seek, as our aim here is to bring into focus differences across sectors.

Our market-access model of employment shares has greatest explanatory power in secondary and some tertiary sectors. Manufacturing, banking and insurance, and 'other market services' stand out with the largest R-squares, but they differ substantially in terms of estimated coefficients. Employment in all market-based service sectors is significantly and discretely concentrated in capital regions. This evidence is consistent with the Comecon hypothesis. Conversely, manufacturing is significantly less strongly represented in capital regions than elsewhere. Manufacturing conforms with the NEG predictions in so far as its locational gradient falls in distance from the national capital (controlling for the discrete effect of the capital region itself) and from Brussels. The opposite holds for market service sectors: they generally become more concentrated in regions further away from the national capital. Taken together, these results suggest two complementary non-monotonic locational gradients: discrete concentration of market services in capital regions, concentration of manufacturing near (but not in) capital regions, and concentration of market services again further away from capital regions.

Table 3. Regional employment gradients in CEECs, by sector

	Dependent variable: $\ln(l_{si}/l_i)$							
Model:	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**
Capital	–1.486	–0.837[a]	0.387[a]	0.580[b]	0.608[a]	1.460[a]	1.085[a]	0.109
	(0.974)	(0.089)	(0.131)	(0.242)	(0.181)	(0.307)	(0.084)	(0.158)
ln dist to capital	0.133	–0.077[a]	0.149[b]	0.118	0.061[a]	0.165	0.114[a]	0.010
	(0.338)	(0.028)	(0.061)	(0.144)	(0.022)	(0.105)	(0.035)	(0.037)
ln dist to Brussels	0.045	–0.334[a]	–0.979[b]	0.268	–0.484	–0.253	–0.030	0.730[a]
	(1.287)	(0.089)	(0.446)	(0.385)	(0.292)	(0.604)	(0.172)	(0.134)
Land border with	–0.218	–0.013	–0.091	0.074	–0.048	0.099	0.127[c]	0.034
EU, N, CH	(0.258)	(0.035)	(0.069)	(0.102)	(0.046)	(0.097)	(0.071)	(0.057)
Land border with	0.381	0.016	–0.036	–0.244	0.173[c]	–0.143[c]	–0.007	0.007
CEEC	(0.415)	(0.041)	(0.061)	(0.197)	(0.090)	(0.086)	(0.019)	(0.043)
Access to sea	–0.388	–0.311	0.119	0.324	0.436	0.387	0.296[c]	0.018
	(0.617)	(0.183)	(0.117)	(0.282)	(0.281)	(0.256)	(0.175)	(0.025)
Country dummy	yes	yes	yes	yes	yes	yes	yes	yes
N	70	70	70	70	70	70	70	70
Within-R^2	0.30	0.60	0.01	0.08	0.22	0.63	0.59	0.16

Note: Standard errors in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels.

Model F, agriculture; Model G, manufacturing; Model H, construction; Model L, distribution; Model J, transport and communication; Model K, banking and insurance; Model L, other market services; Model M, non-market services.

3.2 A comparison with pre-2004 EU members

Our wage and employment regressions for Central European accession countries are to a considerable extent consistent with a central-planning explanation, which implies a discrete advantage for the capital region, but less so with a market-based NEG model, which implies continuous wage and employment gradients on distance from economic centres. One may still ask whether the intra-country economic geographies inherited from the central-planning period resemble those that would have arisen in a market economy, or whether market forces can be expected to push towards a spatial reorganization of Central European economies.

There are two analytical approaches to this issue. One is to track the evolution of spatial patterns in Central European countries over time since their transition in the early 1990s, and to extrapolate. We prefer a second approach, which is both less dependent on assumptions about timing and unaffected by the fact that the time dimension of our data panel is relatively short (5 years). This second approach

consists in comparing wage and employment gradients of accession countries directly with those observed in existing EU member countries. Specifically, we re-estimate Equations (8) and (10) in a sample consisting of the five accession countries plus a comparison group of 16 EU and EFTA countries.[11] By interacting market access variables with a dummy variable that identifies the five accession countries, we can estimate to what extent the internal geographies of accession economies differ from those of established member countries. If we assume, quite plausibly, that the existing EU economies are closer to their long-run spatial equilibrium than the economies of accession countries, we can interpret any significant effects on the interaction variables as an (inverse) indicator of impending spatial changes in accession countries.

3.2.1 Wages

Our estimations reported in Table 4 replicate those of Table 1, this time drawing on the full sample of 21 countries and estimating coefficients for the accession countries *relative* to those of established member states via interaction variables. The first column reports estimates of the log-linear model, whereas the second column reports estimates of the model in levels.

For the EU reference sample, we find a statistically significant continuous wage gradient relative to the distance from the capital region in the log-linear specification, which is consistent with our NEG hypothesis.[12] However, this result is not statistically significant in the levels specification. In addition, we find that the incumbent EU countries also exhibit discretely higher nominal wages in capital regions – suggesting that the Comecon hypothesis is valid there too! A discrete central-region wage premium is therefore not uniquely attributable to formerly socialist economies, as we observe it in the mature market economies of Western Europe as well.

Before dismissing our Comecon hypothesis as a misnomer, we need to inspect our estimated coefficients on the interaction effects, which tell us to what extent CEECs are different from incumbent EU countries. We find that in both specifications of our model, the discrete central regions wage premium is even stronger in CEECs than in pre-2004 EU countries. This discrepancy is large (+126 and +73 percent in the log-linear and levels versions, respectively) and statistically significant. Figure 1 illustrates these results. In addition, there is some, albeit not statistically significant, evidence that fall-off of wages with distance from the central region is less pronounced in the CEECs than in incumbent EU countries. We therefore find confirming evidence for the ongoing relevance of the Comecon hypothesis in CEECs: the discrete wage premium in capital regions is even larger there than in the mature market economies of Western Europe. The implied conjecture is that market forces will

[11] Our reference group includes Norway and Switzerland, which, albeit not full members of the EU, are mature market economies that have enjoyed preferential access to EU markets for decades.

[12] Capital regions in the reference sample are defined as economic centres of gravity. These coincide with political capitals in all cases bar Germany (Köln-Bonn), Italy (Milan) and Switzerland (Zurich).

Table 4. Regional wage gradients, CEECs vs. EU

	Dependent variable: *RELWAGE*	
	(1) logs	**(2) levels**
Capital	1.2083[b] (0.4619)	1.8376[a] (0.4032)
Capital × CEEC	1.5346[b] (0.620)	1.3529[b] (0.4745)
Dist to cap		–0.0004 (0.0007)
Dist to cap × CEEC		–0.0005 (0.0012)
ln dist to cap	–0.2444[b] (0.0948)	
ln dist to cap × CEEC	0.0265 (0.1660)	
Dist to Brussels		–0.0008[c] (0.0004)
Dist to Brussels × CEEC		0.0001 (0.0007)
ln dist to Brussels	–0.2647 (0.3351)	
ln dist to Brussels × CEEC	–0.2451 (0.6246)	
Land border with EU, N, CH	0.1176 (0.1278)	0.0252 (0.1245)
Land border with EU, N, CH × CEEC	–0.0213 (0.1794)	0.0182 (0.1548)
Land border with CEEC	–0.0102 (0.1236)	–0.0369 (0.1141)
Access to sea	0.3366[b] (0.1184)	0.3411[b] (0.1320)
Country dummies	yes	yes
N	280	280
Within-R^2	0.3985	0.4229

***Note*:** Standard errors in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels.

leave nominal wages relatively high in CEECs' capital regions, but the difference particularly compared to proximate regions will tend to erode.

3.2.2 Sectoral employment

In Table 5, we show the results of our sectoral employment regressions for the full sample of 21 countries. Significant positive effects on the interaction term with the dummy for capital regions are found in the construction sector and in two market service sectors (banking and insurance, other market services). Figure 2 illustrates the configuration in the banking and insurance sector. This suggests that these sectors are significantly more strongly concentrated in the capital regions of CEECs, conforming with our Comecon hypothesis.

A different pattern holds for manufacturing employment. Manufacturing jobs are significantly less concentrated in capital regions of CEECs than of incumbent EU countries (see Figure 3 for an illustration). Hence, an 'inverse Comecon hypothesis' seems to apply to manufacturing, whereby manufacturing employment is excessively located in provincial regions.

Figure 1. Wage gradients, CEECs vs. EU

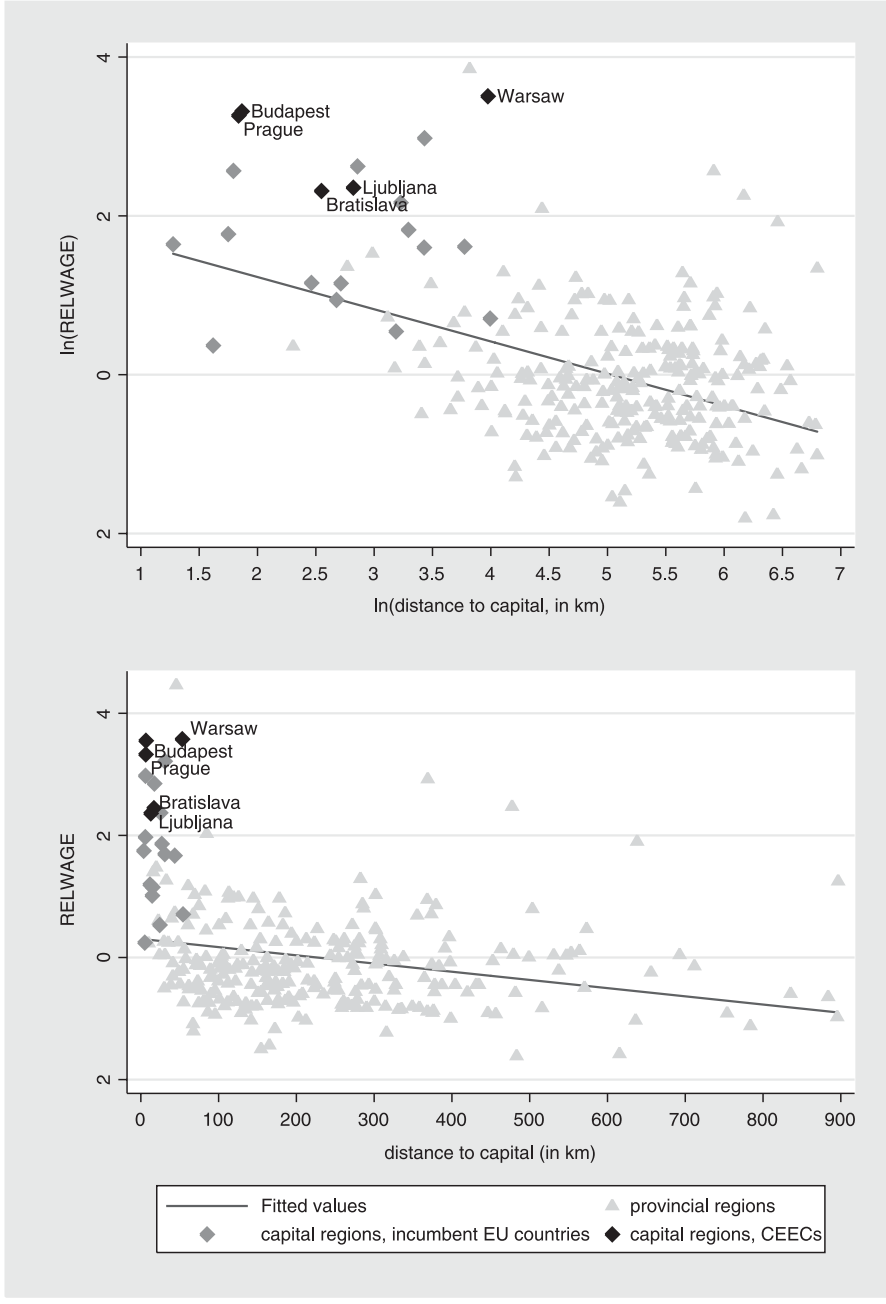


Table 5. Regional employment gradients by sector, CEECs vs. EU

	Dependent variable: $\ln(l_{si}/l_i)$							
Model:	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**
Capital	–1.060[a]	–0.172	–0.191[b]	0.178[b]	0.166[b]	0.10	0.162[b]	0.102
	(0.342)	(0.167)	(0.094)	(0.071)	(0.070)	(0.090)	(0.075)	(0.083)
Capital × CEEC	–0.094	–0.552[b]	0.319[b]	0.180	0.281	0.952[a]	0.830[a]	–0.001
	(0.797)	(0.208)	(0.120)	(0.140)	(0.187)	(0.208)	(0.118)	(0.174)
ln dist to capital	0.221[b]	0.062	0.006	–0.045[c]	–0.049[b]	–0.068[b]	–0.052[c]	0.006
	(0.10)	(0.068)	(0.031)	(0.023)	(0.023)	(0.033)	(0.025)	(0.022)
ln dist to capital × CEEC	0.118	–0.106	0.010	0.024	0.071	0.054	0.136[a]	0.008
	(0.204)	(0.075)	(0.036)	(0.044)	(0.049)	(0.047)	(0.034)	(0.043)
ln dist to Brussels	0.224[c]	–0.208[c]	0.123[b]	0.004	0.002	–0.014	–0.004	0.106[b]
	(0.112)	(0.129)	(0.059)	(0.031)	(0.030)	(0.043)	(0.034)	(0.046)
ln dist to Brussels × CEEC	–0.344	–0.395	–0.341	0.252	0.171[c]	0.476[a]	–0.057	0.459[c]
	(0.335)	(0.206)	(0.254)	(0.221)	(0.088)	(0.157)	(0.267)	(0.225)
Land border with EU, N, CH	–0.003	0.032	–0.049[b]	0.008	0.015	0.037	0.021	0.002
	(0.189)	(0.069)	(0.022)	(0.022)	(0.024)	(0.047)	(0.028)	(0.024)
Land border with EU, N, CH × CEEC	–0.013	–0.125	0.017	0.033	0.115[b]	0.099	0.129	0.045
	(0.257)	(0.078)	(0.049)	(0.062)	(0.053)	(0.060)	(0.094)	(0.045)
Land border with CEEC	–0.133	0.166[b]	0.034	–0.022	–0.080	–0.084c	–0.054	–0.047
	(0.147)	(0.061)	(0.074)	(0.052)	(0.052)	(0.043)	(0.056)	(0.044)
Access to sea	0.083	–0.168[a]	–0.027	0.068[b]	0.091[b]	0.058c	0.073[b]	0.034
	(0.206)	(0.037)	(0.040)	(0.031)	(0.041)	(0.032)	(0.033)	(0.022)
Country dummies	yes	yes	yes	yes	yes	yes	yes	yes
N	303	303	303	303	303	303	303	303
Within-R^2	0.34	0.17	0.12	0.30	0.26	0.45	0.45	0.11

***Note*:** Standard errors in parentheses with [a], [b] and [c] respectively denoting significance at the 1%, 5% and 10% levels.
Model F, Agriculture; Model G, Manufacturing; Model H, Construction; Model I, Distribution; Model J, Transport and Communication; Model K, Banking and Insurance; Model L, Other market services; Model M, Non-market services.

Figure 2. Employment gradients, CEECs vs. EU: Banking and insurance

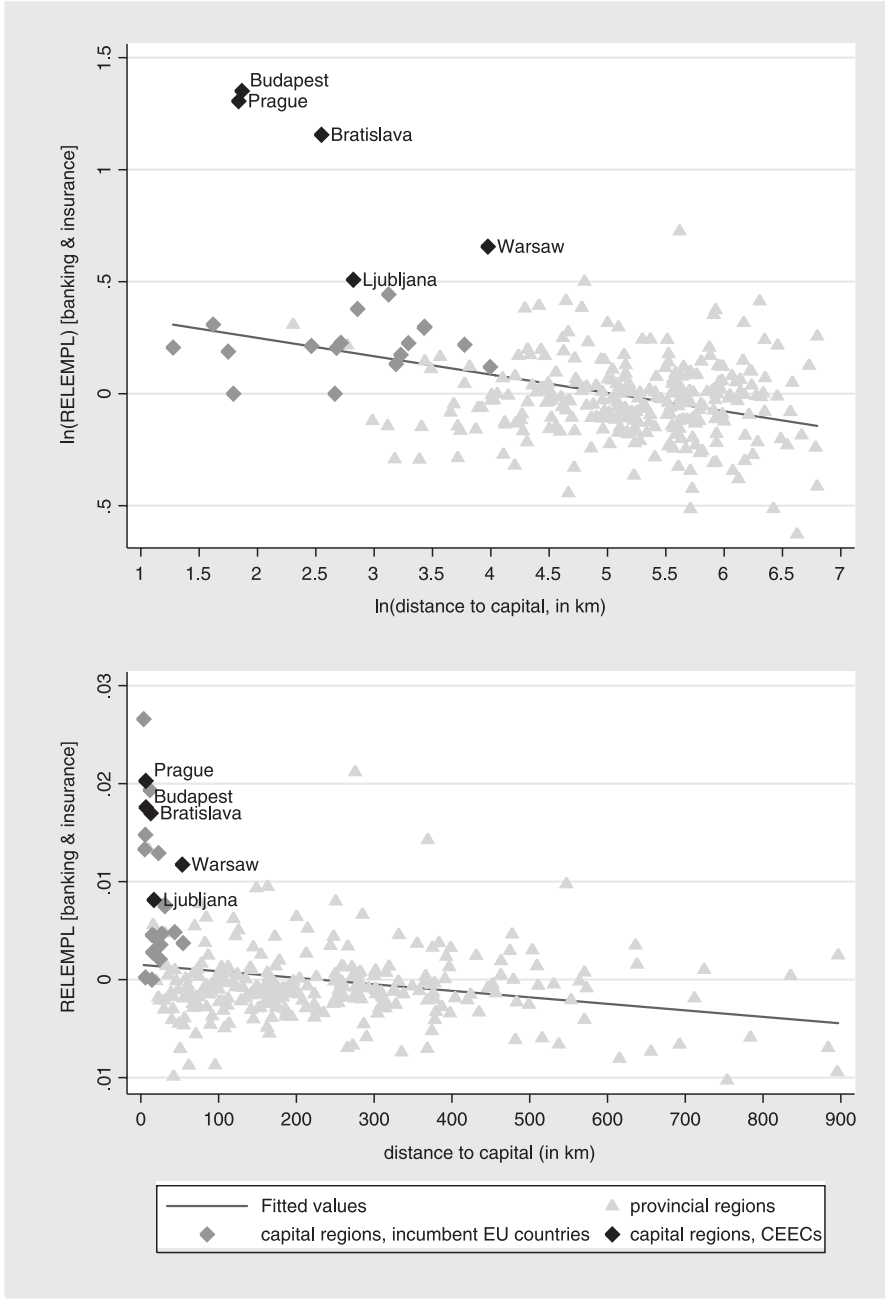
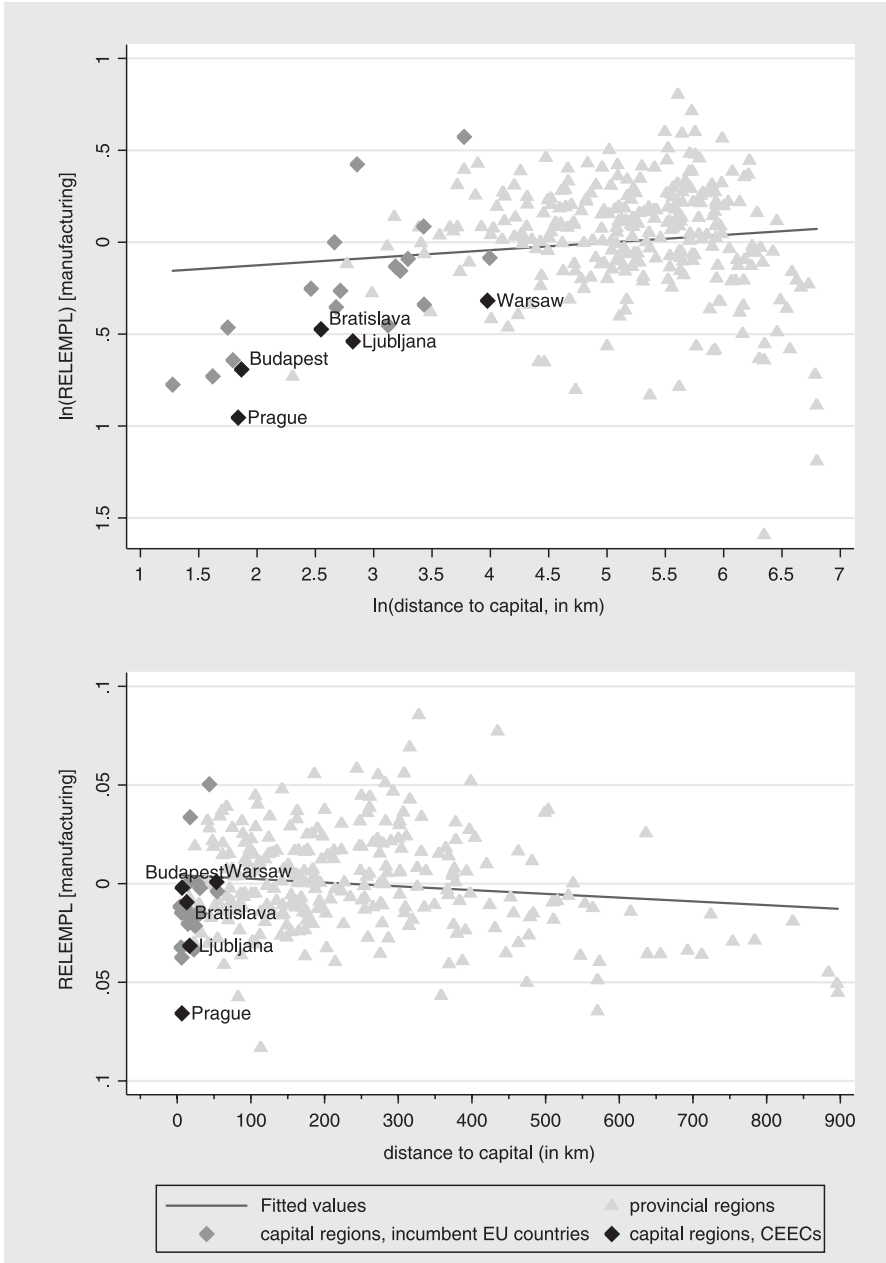


Figure 3. Employment gradients, CEECs vs. EU: Manufacturing



Finally, it might appear surprising that non-market service employment is not more concentrated in CEECs than in incumbent EU countries. This is of course not inconsistent with our Comecon hypothesis, as what is now classified as market services was formerly largely state-controlled. Conversely, activities that have remained in the public sector, such as basic health and education services, may be less susceptible to spatial concentration.

3.3 Is it really market access?

So far, we have implicitly assumed either that all regions are identical except for their differential market access or that other relevant regional features are uncorrelated with our market access variables. This assumption underlies practically all NEG models. Indeed, it is by formalizing spatial concentration forces in such a uniform world that these models become so valuable. Unfortunately, this assumption is empirically implausible, particularly when applied to the scale of half a continent. Regions differ in natural and man-made endowments and technologies, and these differences may well to some extent correlate with our market access variables. It is, however, beyond the scope of this study to collect a full set of endowment and technology controls for all the regions in our sample.

As an alternative to estimating a full model that includes region-specific features other than market access, we estimate the extent to which total regional differences in wages and sectoral employment shares can be explained by differences in those regions' market access. Specifically, we re-estimate our wage and employment equations, taking the underlying annual data and substituting all regressors by regional dummies. In a second step, we regress estimated coefficients for the regional dummies on our market access variables, including interactions. The R-square of this second equation is taken as a gauge of the power of market access in explaining regional differences in wages and sectoral employment shares.[13]

The results are reported in Table 6 for the wage equation and the eight employment equations, estimated year-by-year. The R-squares range from 0.18 to 0.43. Market access variables therefore explain up to 43 percent of the variance in regional fixed effects, which suggests that they are a significant explanatory factor in the spatial patterns of wages and sectoral employment.

As an aside, we note that the highest R-squares are found in employment regressions for tertiary sectors (banking and insurance, and distribution), which again confirms the significance of geographic market access for market services.

[13] Perfect multicollinearity of course makes it impossible to include regional fixed effects in the wage and employment regressions together with our region specific and time invariant market access variables. See also Hanson (1997).

Table 6. Regressing region dummies on market access variables

	Dependent variable: Regdummy								
Model:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
ln dist. to cap.	–0.117	–0.108	0.192	0.078	0.000	–0.004	0.004	0.002	0.079
	(–14.13)	(–2.36)	(10.30)	(3.82)	(–0.02)	(–0.21)	(0.17)	(0.12)	(7.98)
ln dist. to cap & CEEC	0.071	0.053	0.044	0.034	0.217	0.242	0.329	0.376	0.088
	(4.23)	(0.58)	(1.18)	(0.83)	(7.90)	(6.63)	(7.28)	(10.60)	(4.40)
Capital	–0.030	–1.084	0.223	–0.069	0.357	0.376	0.361	0.380	0.361
	(–1.06)	(–7.04)	(3.52)	(–1.01)	(7.74)	(6.12)	(4.76)	(6.37)	(10.79)
Capital & CEEC	0.213	–0.699	0.060	0.802	0.827	1.023	1.885	1.398	0.514
	(4.56)	(–2.72)	(0.57)	(7.01)	(10.78)	(10.00)	(14.92)	(14.08)	(9.23)
ln dist. to Brussels	0.084	0.548	–0.180	–0.158	–0.163	–0.170	–0.188	–0.167	–0.048
	(10.93)	(13.04)	(–10.45)	(–8.41)	(–12.94)	(–10.12)	(–9.06)	(–10.28)	(–5.27)
ln dist. to Bru. & CEEC	0.239	1.545	–0.153	–0.589	–1.870	–1.719	–3.239	–1.926	–1.160
	(3.80)	(4.46)	(–1.07)	(–3.81)	(–18.07)	(–12.47)	(–1.00)	(–14.39)	(–15.45)
Land border with EU, N, CH	0.067	0.331	0.058	–0.109	–0.072	–0.052	–0.034	–0.055	0.056
	(5.58)	(4.99)	(2.13)	(–3.66)	(–3.65)	(–1.97)	(–1.05)	(–2.16)	(3.87)
Land border with EU, N, CH & CEEC	0.027	–0.343	–0.127	0.322	0.065	0.334	0.112	0.255	–0.009
	(0.97)	(–2.24)	(–2.01)	(4.71)	(1.43)	(5.46)	(1.49)	(4.30)	(–0.28)
Land border with CEEC	0.009	–0.023	0.093	–0.122	–0.004	–0.073	–0.009	–0.081	–0.008
	(0.52)	(–0.25)	(2.49)	(–2.99)	(–0.16)	(–2.00)	(–0.19)	(–2.28)	(–0.40)
Access to sea	0.042	0.289	–0.383	–0.207	–0.007	0.030	–0.006	–0.011	–0.066
	(3.53)	(4.39)	(–14.16)	(–7.02)	(–0.34)	(1.14)	(–0.18)	(–0.44)	(–4.65)
CEEC	–2.186	–10.024	0.568	3.538	11.714	10.253	20.178	11.231	7.433
	(–5.14)	(–4.29)	(0.59)	(3.39)	(16.76)	(11.00)	(17.52)	(12.41)	(14.65)
N	1921	1921	1921	1921	1921	1921	1921	1921	1921
R^2	0.216	0.266	0.264	0.175	0.386	0.372	0.425	0.364	0.333

***Note*:** t-statistics in parentheses.

Model 1, wage equation; Model 2, employment (Agriculture); Model 3, employment (Manufacturing and energy); Model 4, employment (Construction); Model 5, employment (Distribution); Model 6, employment (Transport and communication); Model 7, employment (Banking and Insurance); Model 8, employment (Other market services); Model 9: employment (Non-market services).

4. Conclusion

We have studied the internal economic geographies of five Central European countries (Czech Republic, Hungary, Poland, Slovenia and Slovakia), using data for pre-2004 EU member countries as a point of comparison. According to a new economic geography model, the external trade liberalization represented by progressing integration into the EU market will have significant location effects in those countries, by strengthening the locational pull of regions with good market access. Depending on the mobility of labour and firms across regions and sectors, this will translate into regional relocations of sectors and/or into changes in the spatial structure of average wages.

As an alternative to this market-based scenario, we have formulated a Comecon hypothesis, according to which the spatial structure of economic activity is not systematically related to regions' market access, except for a strong concentration of activity and high wages in the capital region.

Our estimations confirm the ongoing relevance of the Comecon hypothesis in Central European countries into the late 1990s. Wages are discretely higher in capital regions, and service employment is strongly concentrated in those regions. The comparison with pre-2004 EU member countries shows that these concentrations are significantly stronger in the accession countries than in the incumbent member states.[14] We therefore conjecture that the extreme centralization of wages and service sectors in Central European capital cities is likely to erode and give way to smoother gradients driven by market access, as predicted by the theory and confirmed in the regressions for existing EU members.

Going beyond this study, it could be interesting to examine the locational stability of specific industrial clusters inherited from the era of central planning. This would require detailed knowledge of the spatial allocation of production under socialism, as well as access to more finely disaggregated data. If such information can be obtained, this will be a promising direction for future research.

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[14] Hence, evidence consistent with the Comecon hypothesis is also found for the Western European economies. Such 'excess centralization' beyond the smooth gradients predicted by the NEG therefore does not seem exclusive to formerly state-controlled economies, although the effects in mature market economies are less pronounced.

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Appendix

Data

Our wage and employment data for the five CEECs, 1996–2000, were made available by the Vienna Institute for International Economic Studies (WIIW). The original database contains information on population, employment, and wage (among others) at the NUTS-3 level (acronym for Eurostat's 'Nomenclature of Territorial Units for Statistics') for the Czech Republic, Hungary, Slovakia, Slovenia; and at the NUTS-2 level for Poland. The sectoral classification used corresponds to the Statistical Classification of Economic Activities in the European Community, rev. 1, at the lowest level of disaggregation. Nominal wages are stated in national currencies. The corresponding data for Western European countries are taken from the Cambridge Econometrics regional database.