Czech and Slovak internal migration in the framework of gravity model with spatial effects

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Introduction

„Migration is an important means through which people can improve their economic well-being and quality of life. In general, net population movement tends to be oriented towards prosperous areas which offer higher real income prospects.

The redistribution of population across cities and regions invokes a wide range of short-run and long-run supply effects and demand effects of which the joint impact is ultimately an empirical matter“
(Ozgen, Nijkamp, Poot 2010)

Introduction

Two kinds of questions can be asked considering the relationship between the pattern of internal migration networking regional economies with uneven levels of performance.

(1) Does migration between different regions change their economic performance pattern?

(2) Do uneven regional economies shape migration pattern redistributing population between them?

Method

Elhorst (2010) provides a systematical overview of different modelling strategies

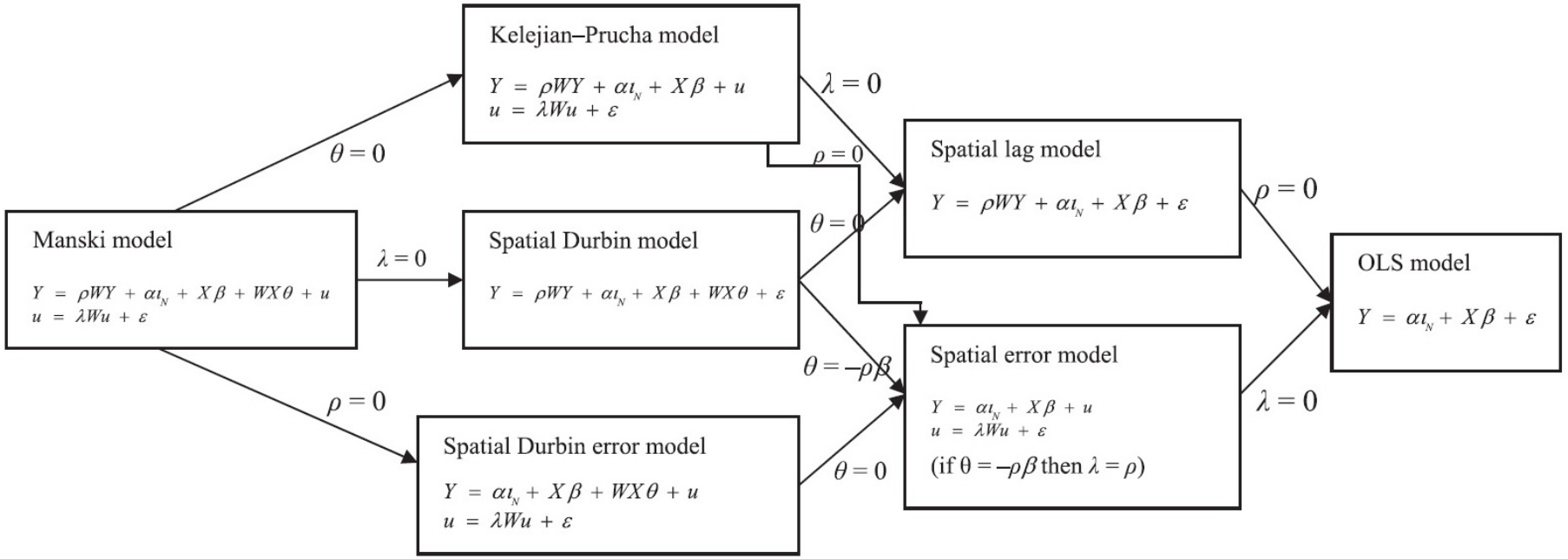
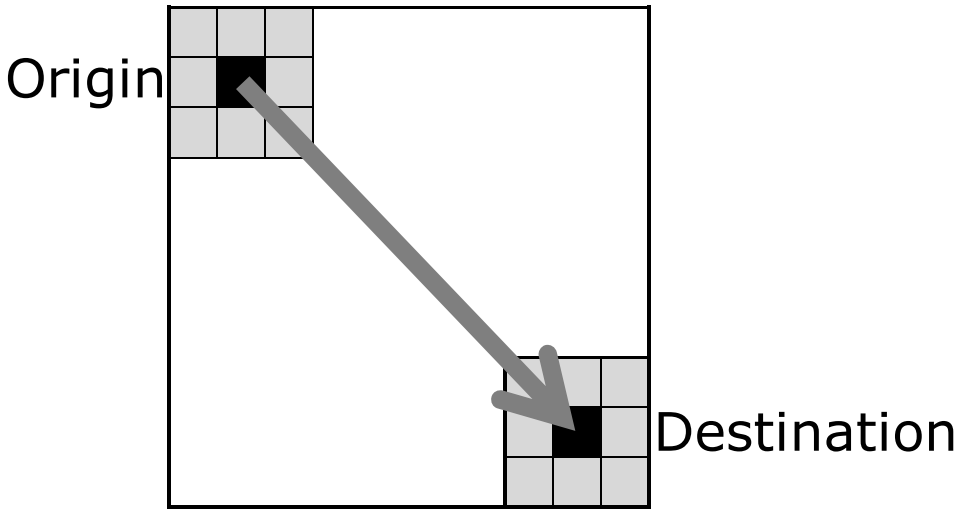


Figure 1. The relationships between different spatial dependence models for cross-section data.

Method

„In contrast to typical spatial econometric models where the sample involves *n* regions, with each region being an observation, these models involve $n^2=N$ OD pairs with each OD pair being an observation“ (LeSage, Pace 2008).



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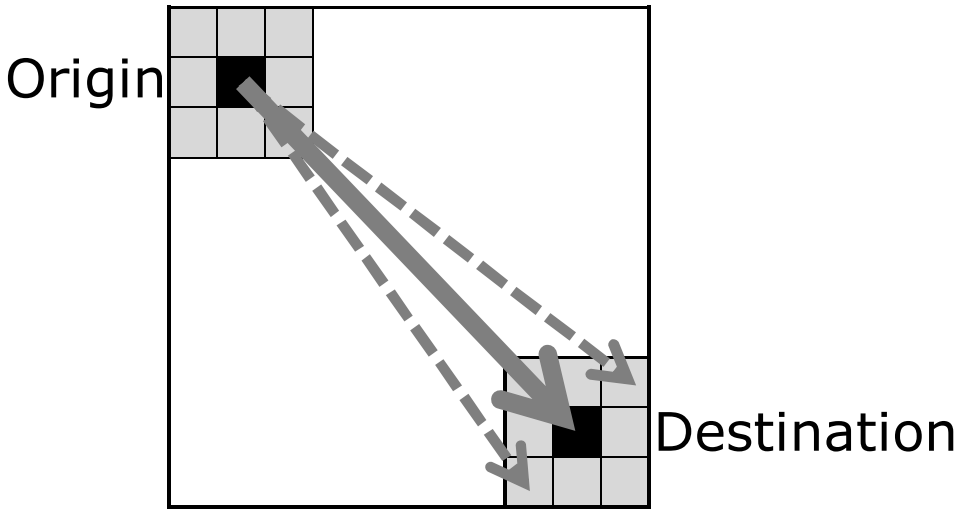

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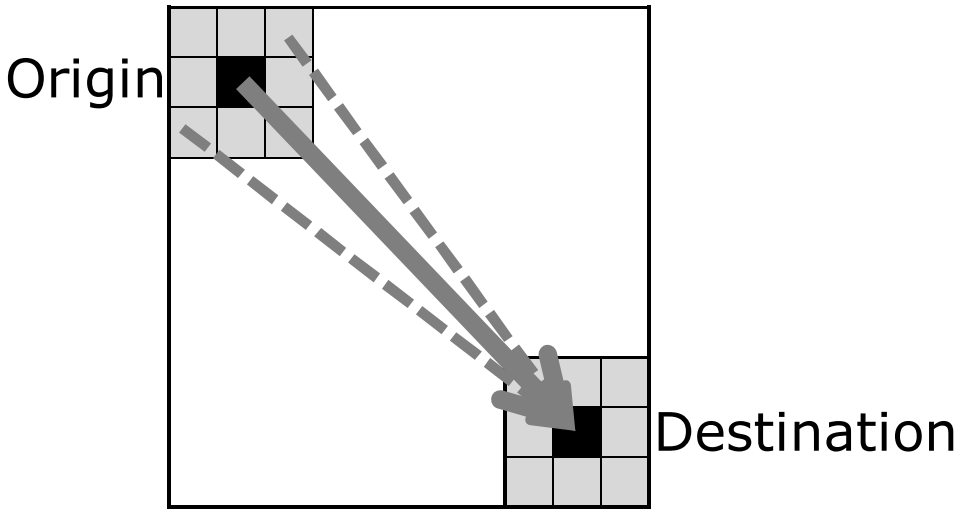

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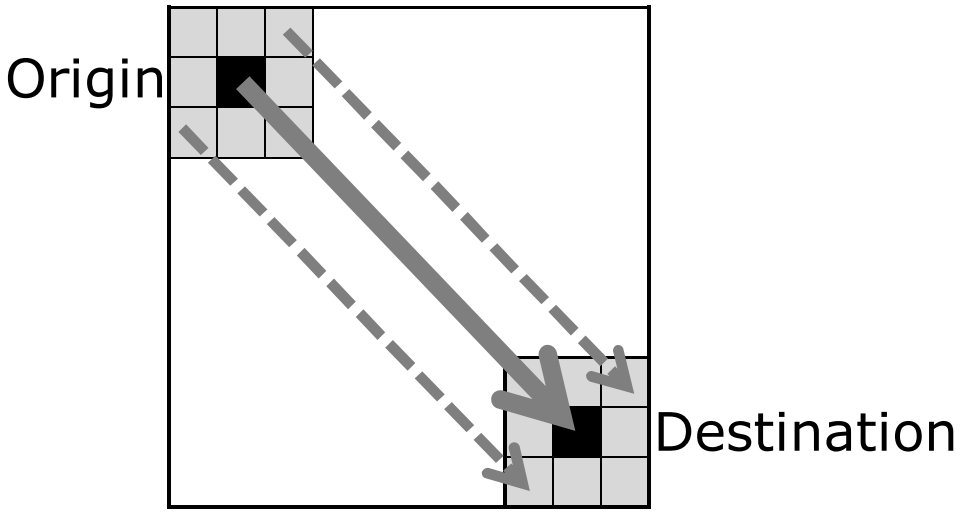


Method

$$y = \rho_d \mathbf{W}_d y + \rho_o \mathbf{W}_o y + \rho_w \mathbf{W}_w y + \\ + \alpha \iota_N + \mathbf{X}_d \beta_d + \mathbf{X}_o \beta_o + \gamma g + \varepsilon$$

„The restriction $\rho_w = -\rho_d \rho_o$ results in a successive filtering or model involving both origin and destination dependence as well as product separable interaction.

Separate model is built for flows from the main diagonal of the flow matrix representing intrastate migration“ (LeSage, Pace 2008).

Method

„No one has as yet seriously exploited the potential of spatial econometrics in the migration literature. This would seem to be a natural extension for migration research and one with potentially greater importance at greater levels of geographic disaggregation.

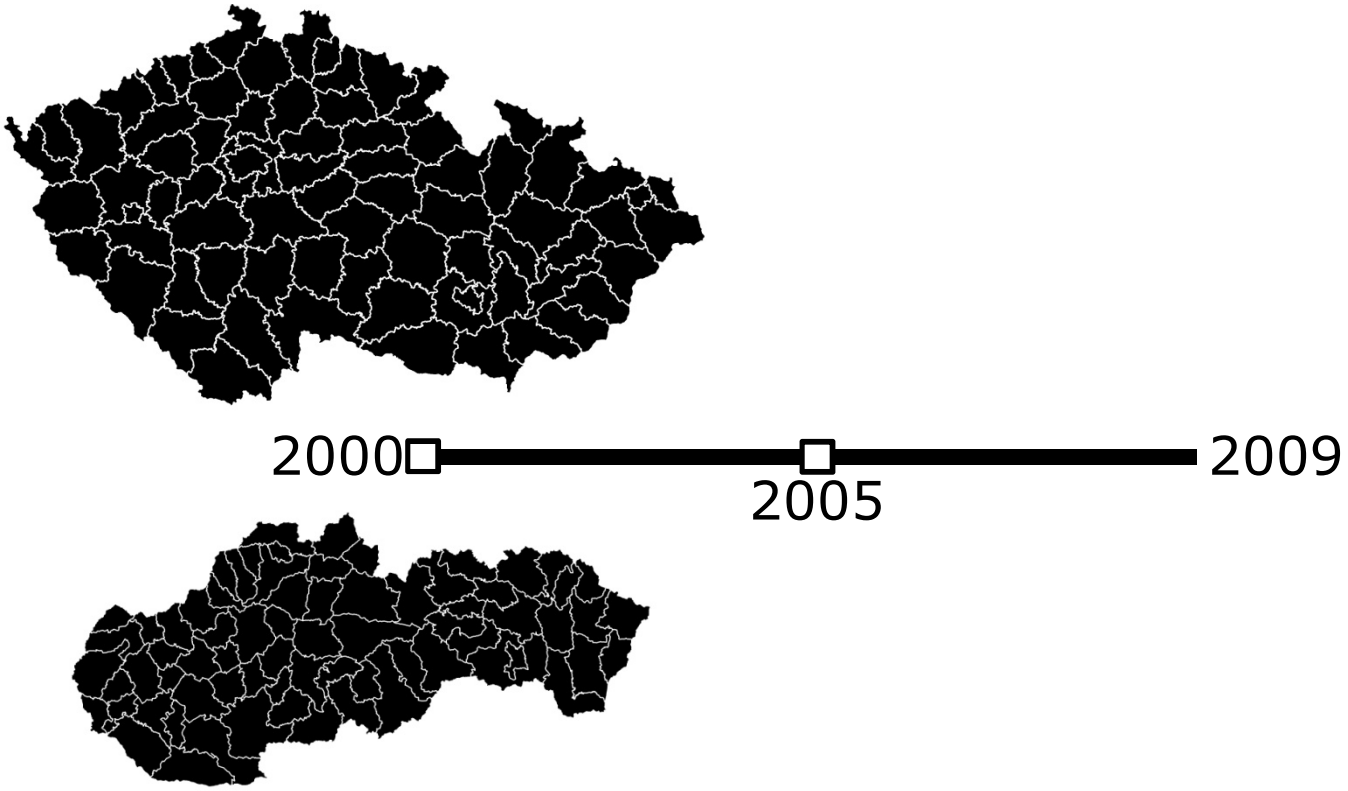
A more complete consideration of the spatial dimension in migration research is one of the key contributions that regional science can make to this literature“ (Cushing, Poot 2004).

Method

„In sharp contrast to most conventional statistical methods, which may only be exactly applied to a handful of relatively simple stylized situations, Bayesian methods are (in theory) totally general.

Markov chain Monte Carlo (MCMC) is numerical integration using Markov chains. Monte Carlo integration proceeds by drawing samples from the required distributions, and computing sample averages to approximate expectations“ (Bernardo 2003).

Data



y = Interregional migration flows 2000-2004 (2005-2009)
X = Mid-year population 2000 (2005)
Average annual unemployment rate 2000 (2005)

n=77 (72); N=5,929 (5,184); T=5

Data

	Number of matrix elements	Migration flows				
		Number	Mean	Standard Deviation	Minimum	Maximum
Slovakia						
2000 - 2004	5,184	415,620	80.17	619.59	0	27,750
2005 - 2009	5,184	437,963	84.48	654.50	0	31,877
Czech Republic						
2000 - 2004	5,929	995,458	192.03	2,021.16	0	128,468
2005 - 2009	5,929	1,276,274	246.19	2,592.70	0	165,163

	Number of vector elements	Variable			
		Mean	Standard Deviation	Minimum	Maximum
Population size					
Slovakia					
2000	72	75,009	61,468	12,676	447,830
2005	72	74,823	59,303	12,364	425,293
Czech Republic					
2000	77	133,409	134,496	42,656	1,183,900
2005	77	132,910	132,918	41,919	1,176,116
Unemployment					
Slovakia					
2000	72	19.30	6.05	5.04	32.02
2005	72	13.03	6.39	2.09	29.24
Czech Republic					
2000	77	9.11	3.87	2.89	20.99
2005	77	9.92	3.91	3.13	23.25

Note: Data construction based on various datasets provided by the Statistical Office of the Slovak Republic (2011) and the Czech Statistical Office (2011).

Results (sk0004)

Variables	Bayesian MCMC		
	Lower 0.05 credible interval	Posterior mean	Upper 0.05 credible interval
Intercept	0.7659	0.8155	0.8632
Internal flow	-2.2613	-1.8124	-1.3863
D_Population	0.5445	0.5848	0.6241
D_Unemployment	-0.2919	-0.2337	-0.1761
O_Population	0.5300	0.5695	0.6086
O_Unemployment	-0.0390	0.0177	0.0727
I_Population	-0.8501	-0.5841	-0.3333
I_Unemployment	0.0923	0.5624	1.0272
Distance	-0.2703	-0.2505	-0.2316
ρ_D	0.3712	0.3932	0.4146
ρ_O	0.3741	0.3970	0.4218
ρ_W	-0.1682	-0.1561	-0.1437
σ_2		0.5453	

Note: Model implementation by James P. LeSage (2011).

Results (sk0509)

Variables	Bayesian MCMC		
	Lower 0.05 credible interval	Posterior mean	Upper 0.05 credible interval
Intercept	0.6986	0.7408	0.7846
Internal flow	-1.6436	-1.2312	-0.8122
D_Population	0.5010	0.5366	0.5736
D_Unemployment	-0.2089	-0.1720	-0.1332
O_Population	0.4947	0.5300	0.5681
O_Unemployment	0.0180	0.0542	0.0944
I_Population	-0.7865	-0.5220	-0.2551
I_Unemployment	0.0195	0.3168	0.6260
Distance	-0.2366	-0.2195	-0.2022
ρ_D	0.4122	0.4309	0.4511
ρ_O	0.4127	0.4314	0.4522
ρ_W	-0.1969	-0.1858	-0.1743
σ_2		0.5015	

Note: Model implementation by James P. LeSage (2011).

Results (cz0004)

Variables	Bayesian MCMC		
	Lower 0.05 credible interval	Posterior mean	Upper 0.05 credible interval
Intercept	0.9875	1.0331	1.0796
Internal flow	-2.3209	-1.9791	-1.6423
D_Population	0.4596	0.4925	0.5233
D_Unemployment	-0.1505	-0.1170	-0.0822
O_Population	0.4722	0.5074	0.5384
O_Unemployment	0.0087	0.0442	0.0766
I_Population	-1.1833	-0.9316	-0.6967
I_Unemployment	-0.0361	0.2406	0.5309
Distance	-0.2528	-0.2382	-0.2235
ρ_D	0.4361	0.4540	0.4715
ρ_O	0.4310	0.4497	0.4661
ρ_W	-0.2146	-0.2041	-0.1938
σ_2		0.2821	

Note: Model implementation by James P. LeSage (2011).

Results (cz0509)

Variables	Bayesian MCMC		
	Lower 0.05 credible interval	Posterior mean	Upper 0.05 credible interval
Intercept	0.9854	1.0395	1.0918
Internal flow	-2.2207	-1.8457	-1.4777
D_Population	0.4573	0.4921	0.5264
D_Unemployment	-0.2304	-0.1950	-0.1599
O_Population	0.4972	0.5300	0.5631
O_Unemployment	0.0117	0.0483	0.0864
I_Population	-1.3310	-1.0774	-0.8313
I_Unemployment	0.2953	0.5979	0.9124
Distance	-0.2463	-0.2298	-0.2136
ρ_D	0.4141	0.4332	0.4497
ρ_O	0.4771	0.4963	0.5162
ρ_W	-0.2276	-0.2150	-0.2031
σ_2		0.2832	

Note: Model implementation by James P. LeSage (2011).

Conclusions

Four versions of gravity model suggest a more complex behavior in the Czech regional system, compared to the Slovak, which gets less predictable in time.

Without any exception, spatial effects of origin, destination and origin-destination based neighboring flows are significant. The Czech system is more spatially dependent, but the Slovak system changes towards. In other words, geography matters.

Conclusions

Geographical distance is, in all four cases, considered a significant negative predictor. In other words, models point at the decision pattern of migrants, who prefer closer destinations to more distant.

This tendency used to be more influencing in Slovakia, but tends to diminish with time observed. The migrants in Czech Republic now prefer shorter moves more than the migrants in Slovakia.

Conclusions

Population size of sending and receiving region have significant positive effects in all cases observed. The smaller origin/destination, the smaller number of migrants move between them.

The effect decreases in Slovakia and slightly increases in the Czech Republic. Origin size effect is exactly same during the later period.

Destination size effect decreases in both countries and remains stronger in Slovakia.

Conclusions

One more observation, origin size is a more important predictor in the Czech Republic. In Slovakia, a more important predictor is destination size.

Unemployment is according to expectations, a positive predictor on the origin side of flow and a negative predictor on destination side. In other words, the higher unemployment in the region, the more people tend to move out of it, but also the less people tend to move in it.

Conclusions

There are signs of economically motivated out-migration in both countries. This effect gets more influential especially in Slovakia where it used to be insignificant before. The economy in general matters more for Czech migrants.

Higher regional unemployment levels prevent a significant number of migrants from a decision to move in. Pople in general prefer economically better performing parts of both countries. This effect used to be stronger in Slovakia, but the roles get inversed latter.

Conclusions

Completing the picture of migration patterns, internal migration is significantly punished by a negative coefficient in all cases, smaller in Slovakia and decreasing in both countries.

The larger a region is and the better a region is performing economically, the smaller internal migration is observed.

This result is not altered if regional population is decomposed in central city and hinterland.

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