

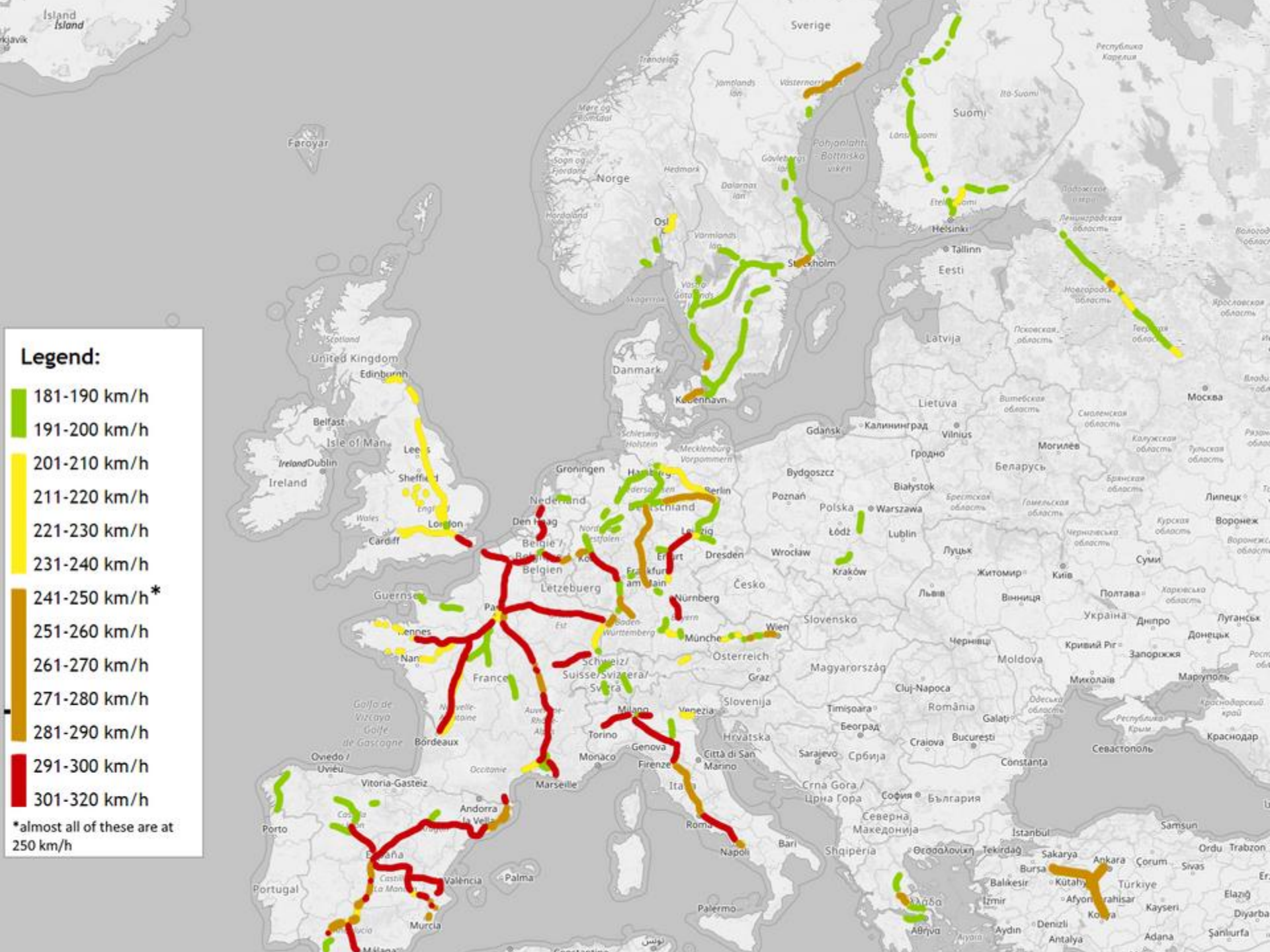


MUNI ECON

Border effect in passenger rail transport in Europe and CEE

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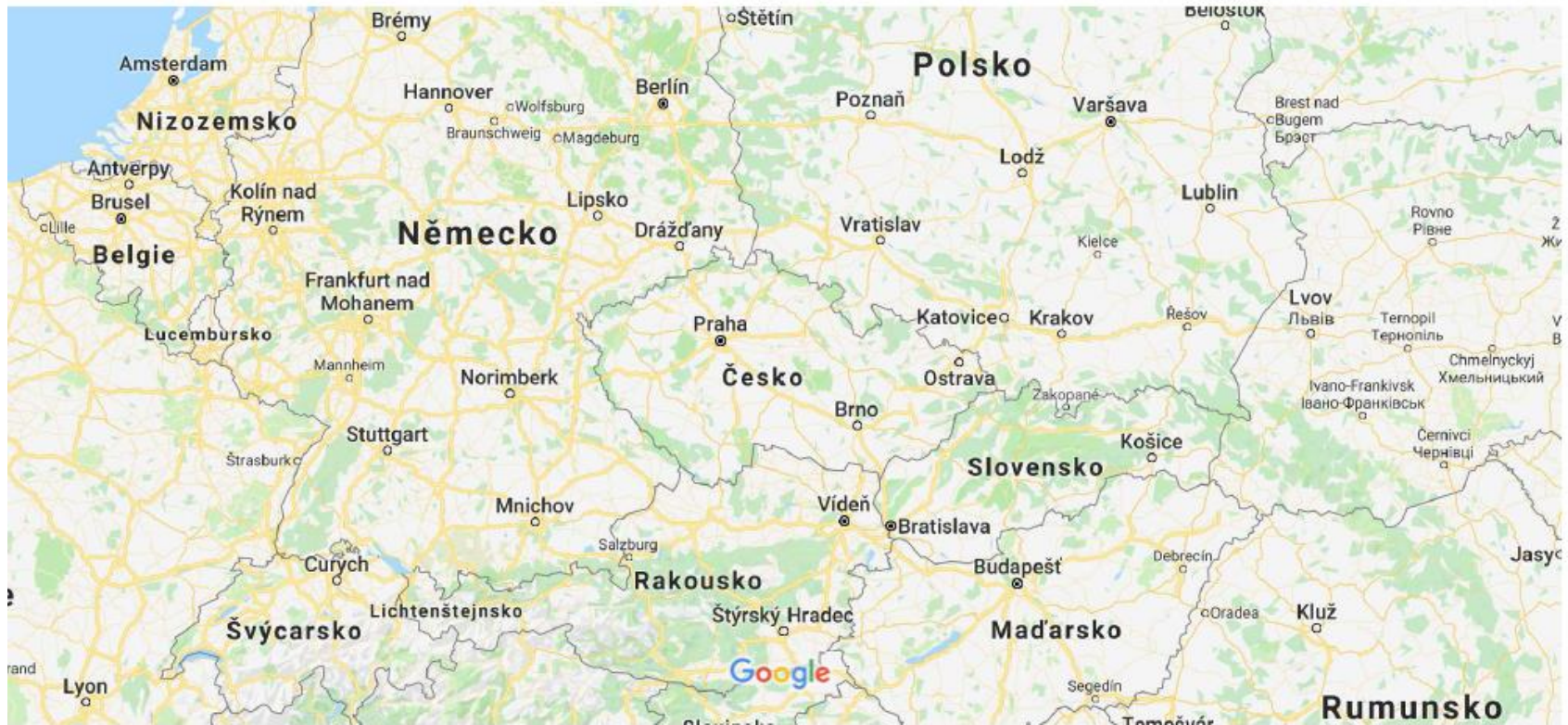


Legend:

- 181-190 km/h
- 191-200 km/h
- 201-210 km/h
- 211-220 km/h
- 221-230 km/h
- 231-240 km/h
- 241-250 km/h*
- 251-260 km/h
- 261-270 km/h
- 271-280 km/h
- 281-290 km/h
- 291-300 km/h
- 301-320 km/h

*almost all of these are at 250 km/h

Central European Geography



TEN T network

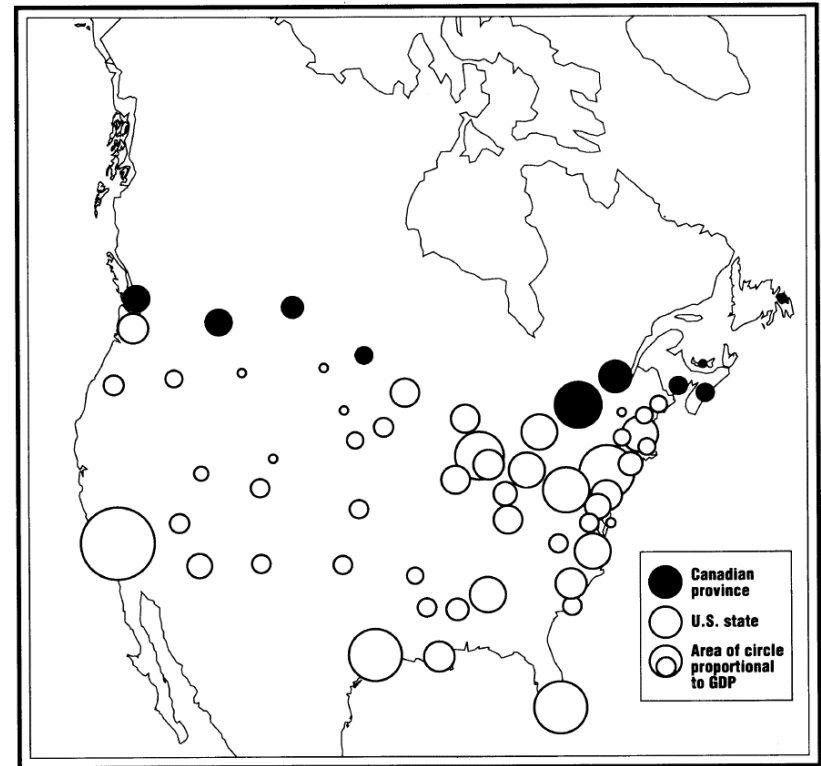


National borders matter

- Traffic flows are significantly diminished when crossing a national border (Gerondeau 1997, Luttmerding - Gather (2013), Nash (2013))
- But how much do they diminish transport (or trade)?

International trade literature

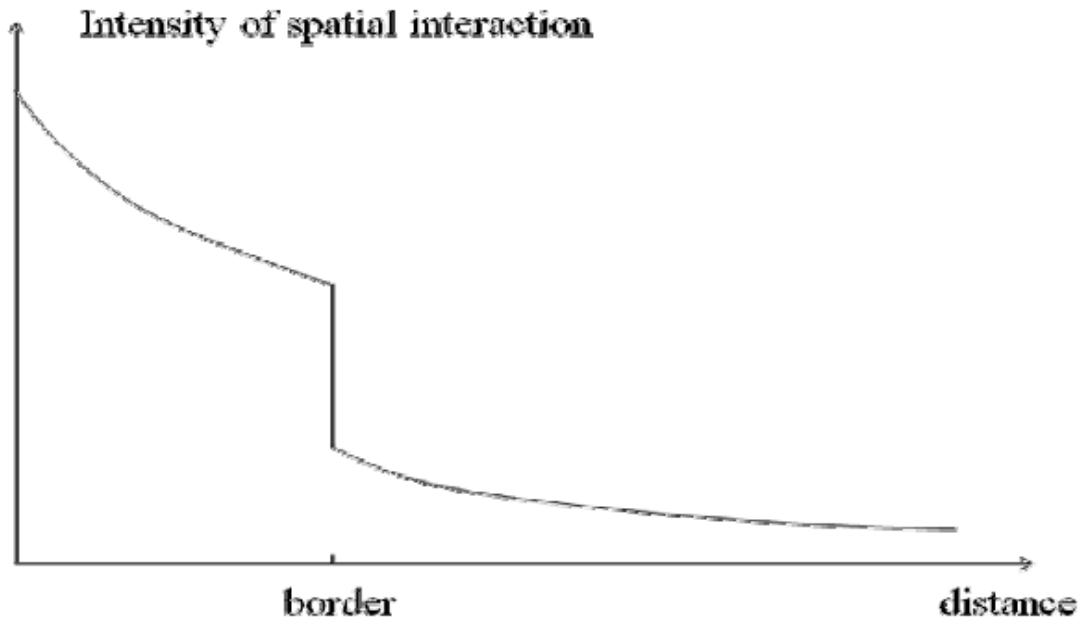
- The national borders diminish significantly international trade
- Mc Callum (1995):
Canada - US trade by a factor 22!



Source: Mc Callum (1995)

Border effect in transport

- Motivation: Knowledge of border effect in passenger transport is almost non-existent
- Aim: Quantifying the border effect in passenger rail transport in Europe, with a focus on CEE countries



Rietveld, 2012

Literature review: Estimation of BE

- Example: A gravity model with border effect by Rietveld (2012)

$$T_{ij} = \frac{C * M_i * M_j * (1 - B_{ij})}{D_{ij}}$$

- B_{ij} is the effect of border between the regions i and j on the traffic
- Control group approach: $B2 = 1 - \{T_{ij} \text{ (domestic)} / T_{jk} \text{ (international)}\}$
- Traffic intensity approach: $B3 = 1 - \{T_j \text{ (at border)} / T_j \text{ (close to border)}\}$
- Infrastructure density approach: $B4 = 1 - \{ID \text{ (border)} / ID \text{ (domestic)}\}$

Quantifying the border effect

- Can be explained as the ratio of domestic traffic to international traffic, or vice versa.
- Example: two routes with similar characteristics, one is domestic, the other is international:
 - Traffic on domestic route = 10 units
 - Traffic on international route = 2 units
- Border effect = 5, 0.2, or 20 percent
- The author should clarify which way is used through the study

Literature review: Estimated BEs

- Border effect in trade
 - USA – Canada border: 0,05 (McCallum, 1995)
 - EU countries: 0,07 - 0,15 (Havránek – Havránková 2015)
- Border effect in air transport
 - Canada: 0,16 Hazeldine (2009)
 - EU: 0,22 Klodt (2004)
0,50 Veselý (2020)

Methodology

$$F_{ij} = \frac{e^{\beta_0} * M_{ij}^{\beta_1} * e^{\beta_3 * B_{ij}}}{D_{ij}^{\beta_2}}$$

- F_{ij} = frequency of direct passenger trains on route ij per day
 - D_{ij} = railway distance between cities i and j
 - M_{ij} is the geometric mean of M_i and M_j
 - M_i and M_j : “size” of cities M_i and M_j
 - B_{ij} is border dummy between i and j
-
- Log-log model:

$$\ln(F_{ij}) = \beta_0 + \beta_1 \ln(M_{ij}) + \beta_2 \ln(D_{ij}) + \beta_3 * B_{ij} + \varepsilon$$

Data

- Cross sectional data – routes: a route consists of city pairs
- Countries: EU28 + EEA + Serbia + Turkey
 - Excluding: Cyprus, Ireland, Iceland, Malta, Liechtenstein
- Triangulation + selected routes
- Routes with at least one direct train: 419
 - of these routes: 279 are domestic, 140 are international
- Dependent variable: Direct passenger trains per day, single direction
- Independent variables:
 - From the basic gravity model: GDP (euros), population, railway distance (kilometres)
 - Border dummies
- Main data sources: Omio.com, Kiwi.com, rome2rio.com, national railway operators, Eurostat, national statistical offices

Estimations: For all Europe

Coefficients	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	-4.74591	0.76396	-6.212	1.27E-09	***
distance	-1.01753	0.05692	-17.876	< 2e-16	***
gdp	0.53373	0.03476	15.353	< 2e-16	***
border	-1.36400	0.08612	-15.839	< 2e-16	***

Residual standard error 0.7861 on 415 degrees of freedom

Multiple R-squared: 0.6304

Adjusted R-squared: 0.6277

F-statistic: 235.9 on 3 and 415 DF, p-value: <2.2e-16

- Interpretation: The border effect is $e^{-1.364} = 0.256$
(or in other way $e^{1.364} = 3.91$)
- With population based gravity model: 0.296 (3.37)

Estimations: Central Europe

- Estimations are done only with routes including countries: Austria, Czech Republic, Germany, Hungary, Poland, Slovakia

GDP based	Austria	Czechia	Germany	Hungary	Poland	Slovakia
Austria		0.71	0.53	0.32	0.17	0.45
Czechia	0.71		0.31	N/A	0.31	1.42
Germany	0.53	0.31		N/A	0.15	N/A
Hungary	0.32	N/A	N/A		0.33	0.39
Poland	0.17	0.31	0.15	0.33		0.31
Slovakia	0.45	1.42	N/A	0.39	0.31	

- Other borders: 0.25

Estimations: Central Europe

- Estimations are done only with routes including countries: Austria, Czech Republic, Germany, Hungary, Poland, Slovakia

Pop. based	Austria	Czechia	Germany	Hungary	Poland	Slovakia
Austria		0.75	0.68	0.32	0.15	0.47
Czechia	0.75		0.31	N/A	0.22	1.36
Germany	0.68	0.31		N/A	0.13	N/A
Hungary	0.32	N/A	N/A		0.28	0.34
Poland	0.15	0.22	0.13	0.28		0.31
Slovakia	0.47	1.36	N/A	0.34	0.31	

- Other borders: 0.29

Estimations: Czech Republic

- Only using routes including Czech Republic

	GDP based	Population based
Austria	0.44	0.52
Germany	0.19	0.22
Poland	0.22	0.17
Slovakia	0.90	0.92

Estimations: Slovakia

- Only using routes including Slovakia

	GDP based	Population based
Austria	0.22	0.21
Czech Republic	0.68	0.56
Hungary	0.16	0.11
Poland	0.12	0.09

Conclusions

- International passenger rail transport frequency in Europe is almost a quarter of domestic transport frequency
- The effect is different for all countries. It depends on the specific border.
- The effect of border in passenger rail transport between countries sharing similar language and culture is lower
- Limitations:
 - Frequency as dependent variable
 - Limited number of train connections
- Further research:
 - Adding prices
 - Adding competing modes



List of literature

- Havránek, T. & Havránková, Z. (2015). Do borders really slash trade? A meta analysis. IES Working Paper, No. 3/2015, Charles University in Prague, Institute of Economic Studies (IES), PragueAttachments.
- Klodt, H. (2004). Border Effects in Passenger Air Traffic. KYKLOS, Vol. 57 – 2004 – Fasc. 4, pp.519–532.
- McCallum, J. (1995). National Borders Matter: Canada-U.S. Regional Trade Patterns. The American Economic Review, Vol. 85, No. 3 (Jun., 1995), pp. 615-623.
- Rietveld, P. (2012). Barrier Effects of Borders: Implications for Border-Crossing Infrastructures. EJTIR 12(2), pp.150-166. ISSN: 1567-7141.