Exploring European Regional Trade

Marta Santamaría, Jaume Ventura and Uğur Yeşilbayraktar

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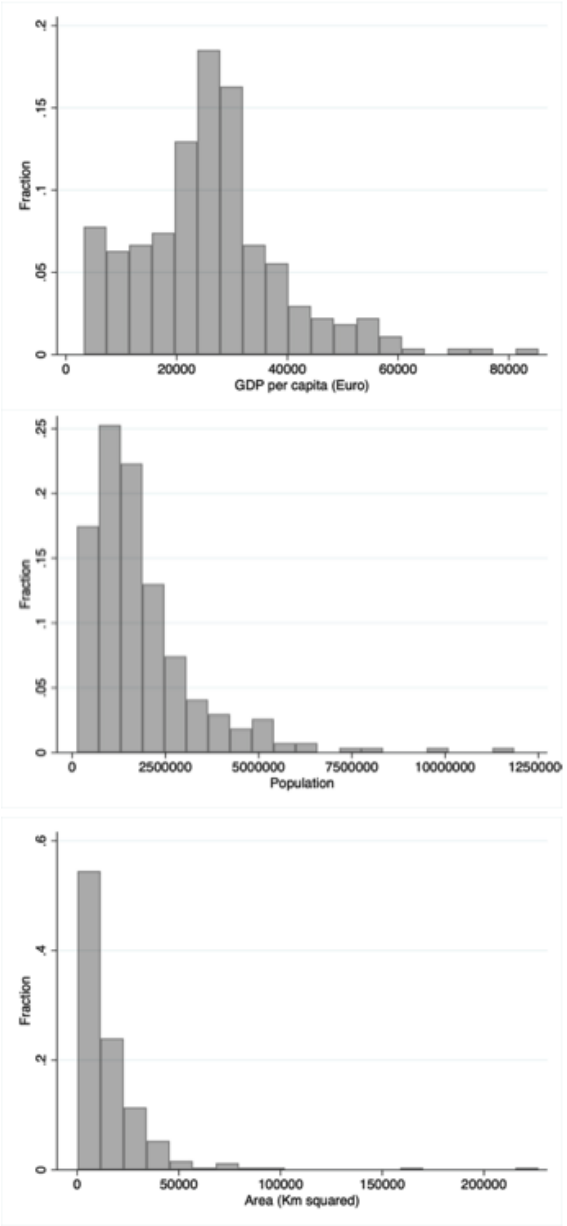
European regions

European regions



Bilateral trade matrix for European regions

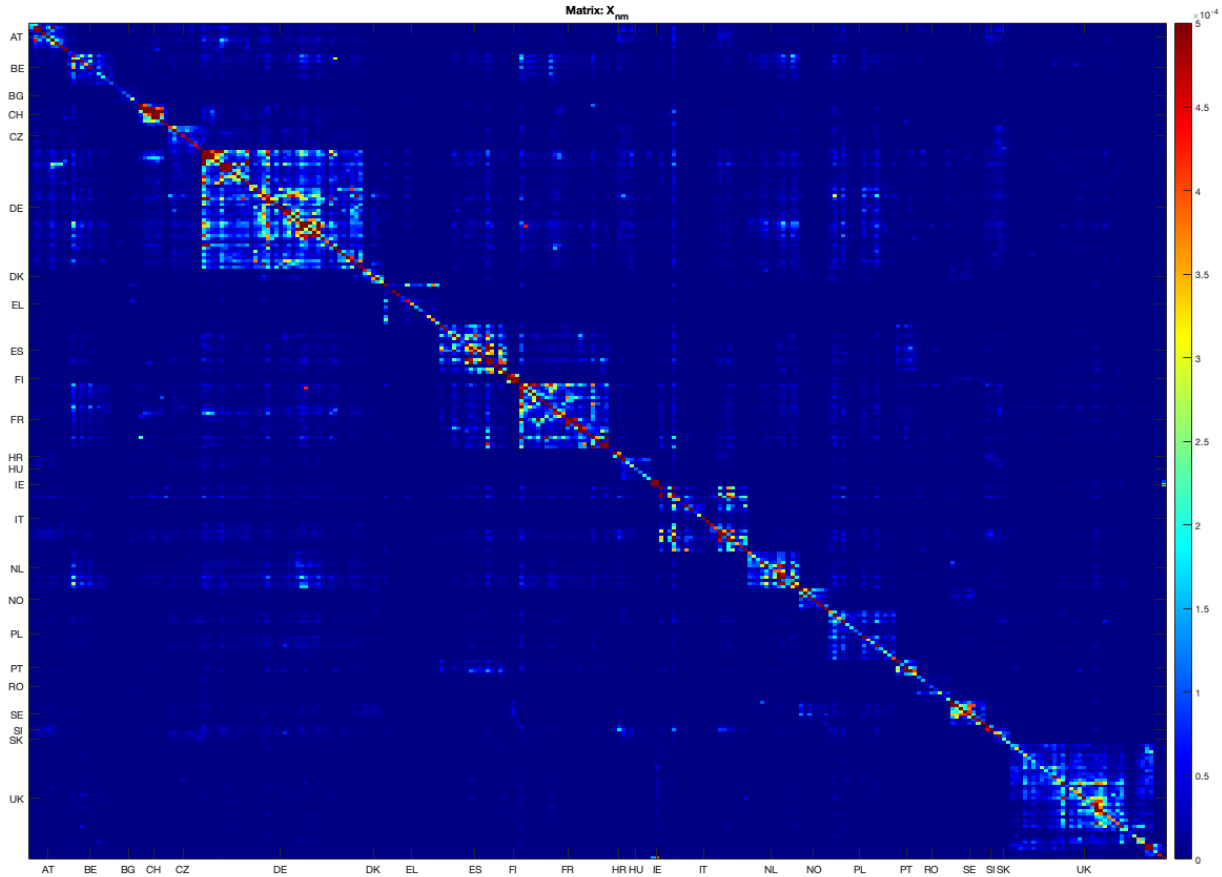
- The matrix of bilateral regional trade:

$$\mathbf{X} = \begin{bmatrix} X_{11} & X_{12} & \cdots & X_{1N} \\ X_{21} & X_{22} & \cdots & X_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ X_{N1} & X_{N2} & \cdots & X_{NN} \end{bmatrix}$$

  Since $\sum_n \sum_m X_{nm} = 1$, entries are trade probabilities.

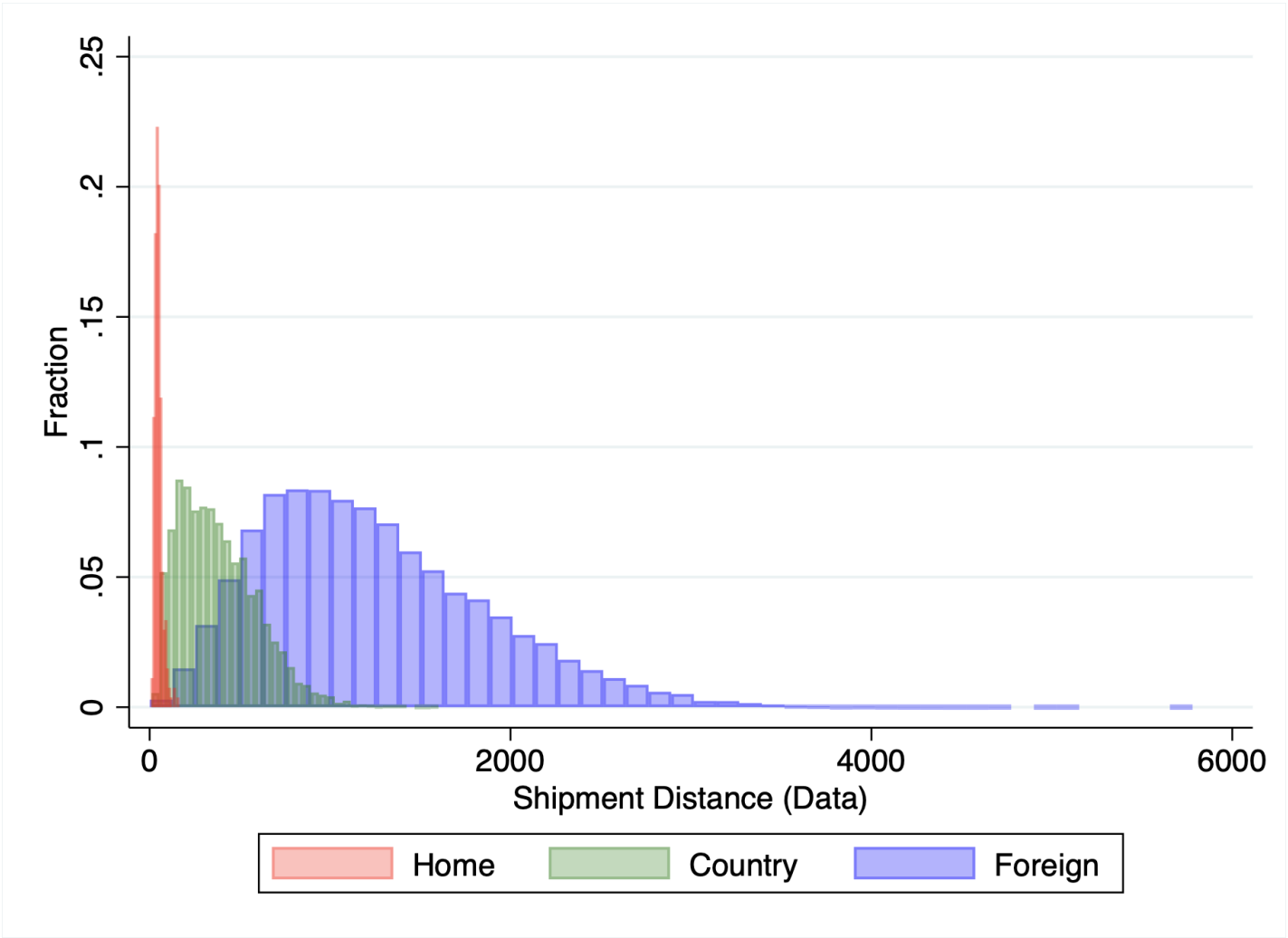
- 269 European regions covering 24 countries, 12 industries and 7 years:
  - Agricultural, manufacturing and mining goods, but no services;
  - Goods shipped by road (about half of all European goods trade), but not by other means. Modal split

Bilateral trade matrix for European regions



- Home: 40%. Country: 41%. Foreign: 19%.

Actual distance traveled



- Home: 21.2 Km. Country: 223.0 Km. Foreign: 631.9 Km.

The independence benchmark

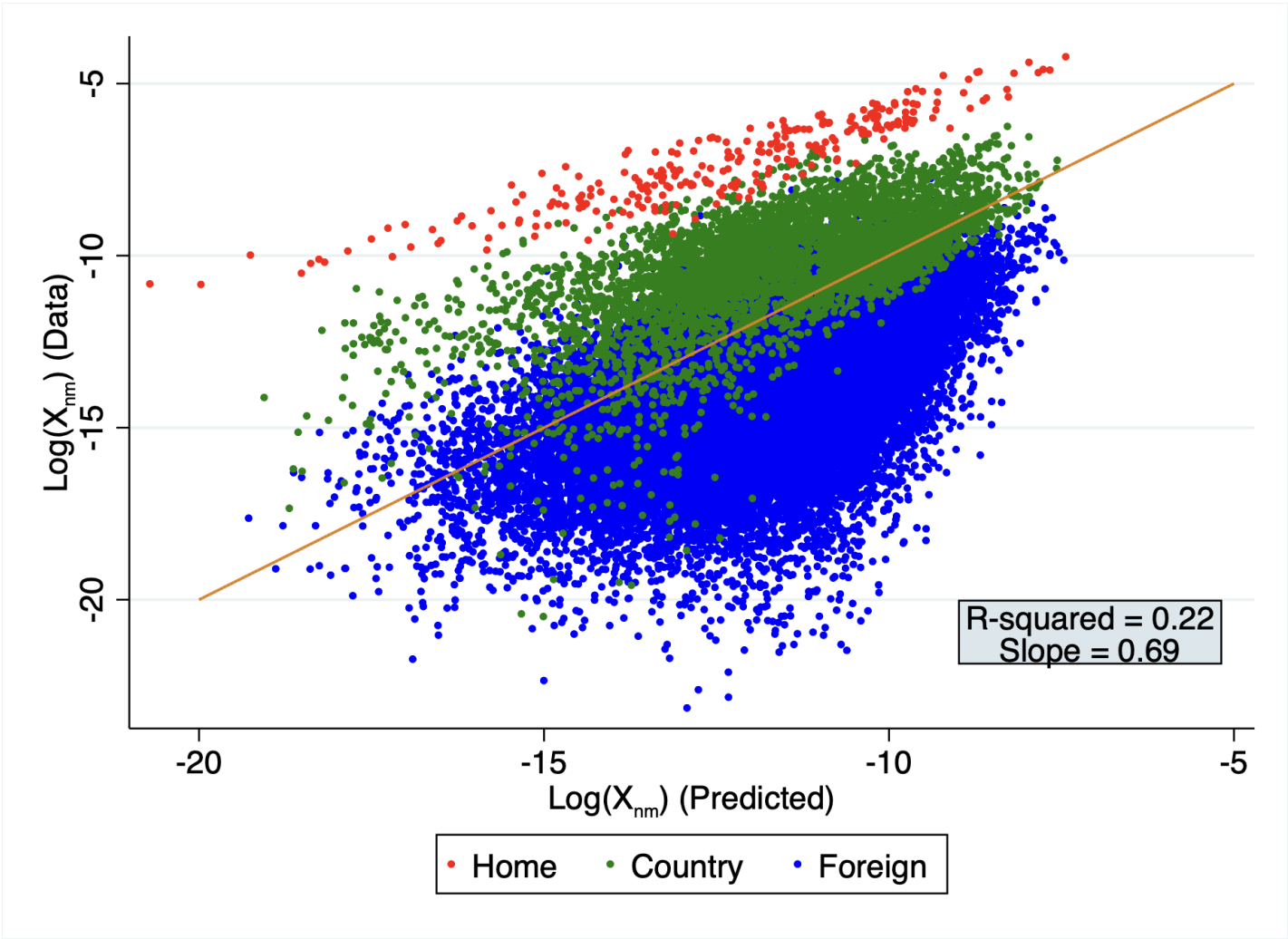
- The matrix of bilateral regional trade:

$$\mathbf{X} = \begin{bmatrix} X_{11} & X_{12} & \cdots & X_{1N} \\ X_{21} & X_{22} & \cdots & X_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ X_{N1} & X_{N2} & \cdots & X_{NN} \end{bmatrix}$$

  - Define $X_n^O \equiv \sum_l X_{nl}$ and $X_m^D \equiv \sum_k X_{km}$.

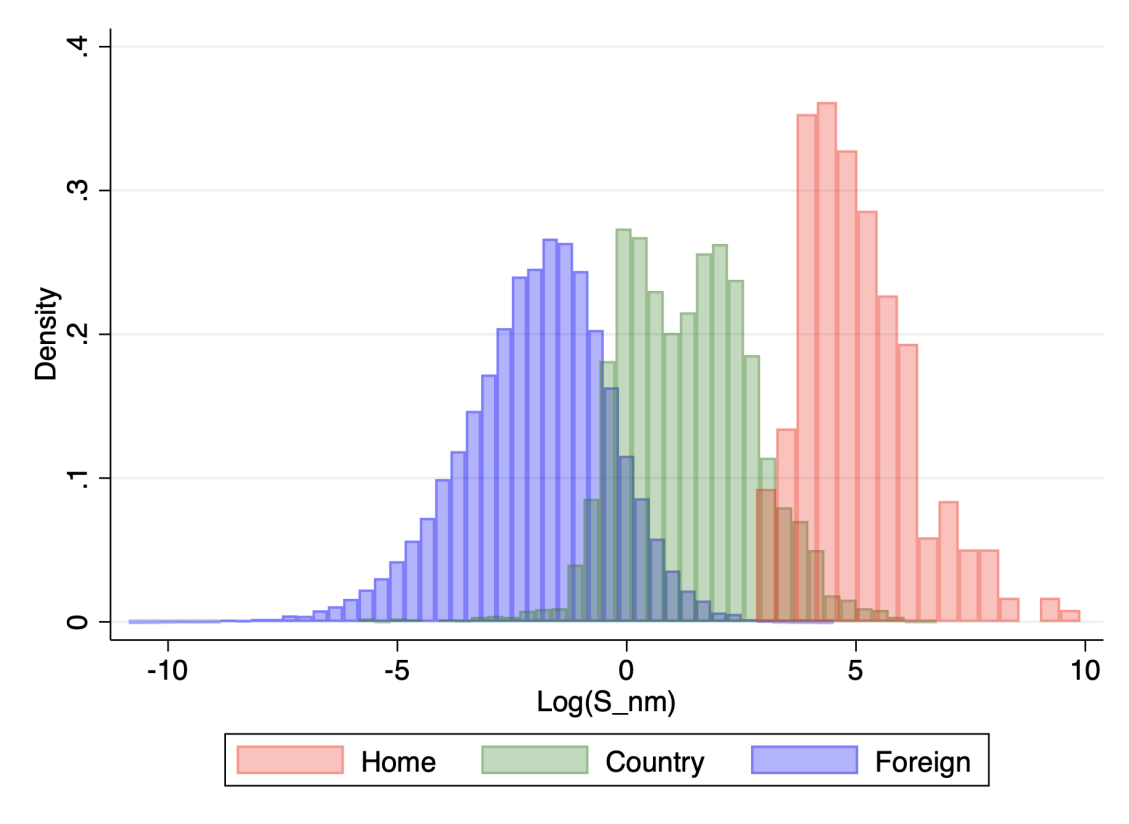
- *Independence benchmark*: "the probability of a shipment from origin n to destination m should be $X_n^O X_m^D$."
  - Theoretical prediction?
  - Forecast with limited information?

Actual vs "predicted" trade (log) probabilities



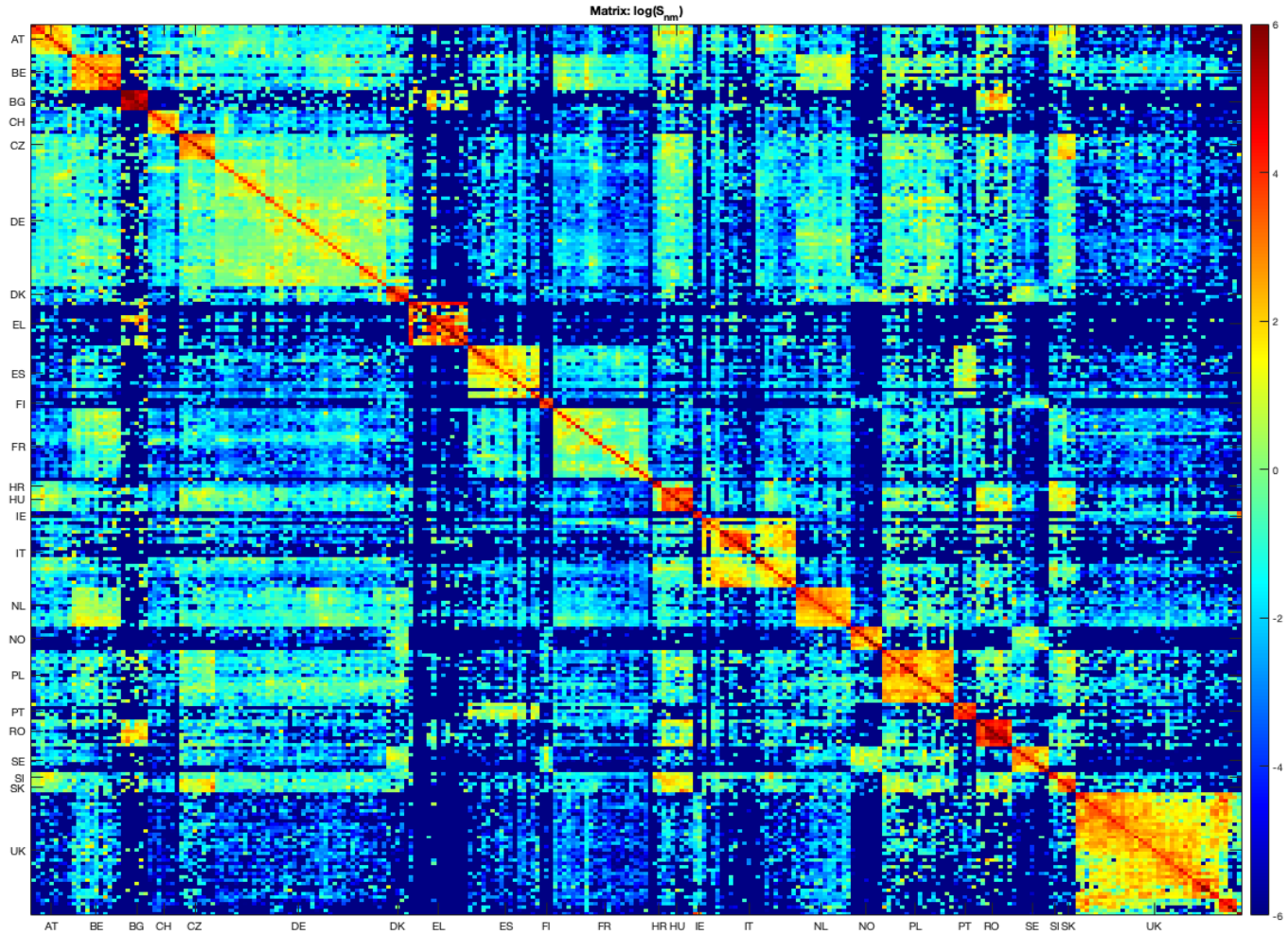
- Home: 40% vs 1%. Country: 41% vs 14%. Foreign: 19% vs 85%.

Home, country and foreign normalized market shares



- Normalized market shares: $S_{nm} = \frac{X_{nm}}{X_n^O X_m^D}$.
- Home: 469.5. Country: 11.22. Foreign: 0.44. S_{nm} and distance

Bilateral matrix of (log) normalized market shares



The gravity framework

- Cost of shipping goods from n to m: $M_{nm} = \exp\left\{{}_i\theta^i Z^i_{nm}\right\}$
- The gravity framework:

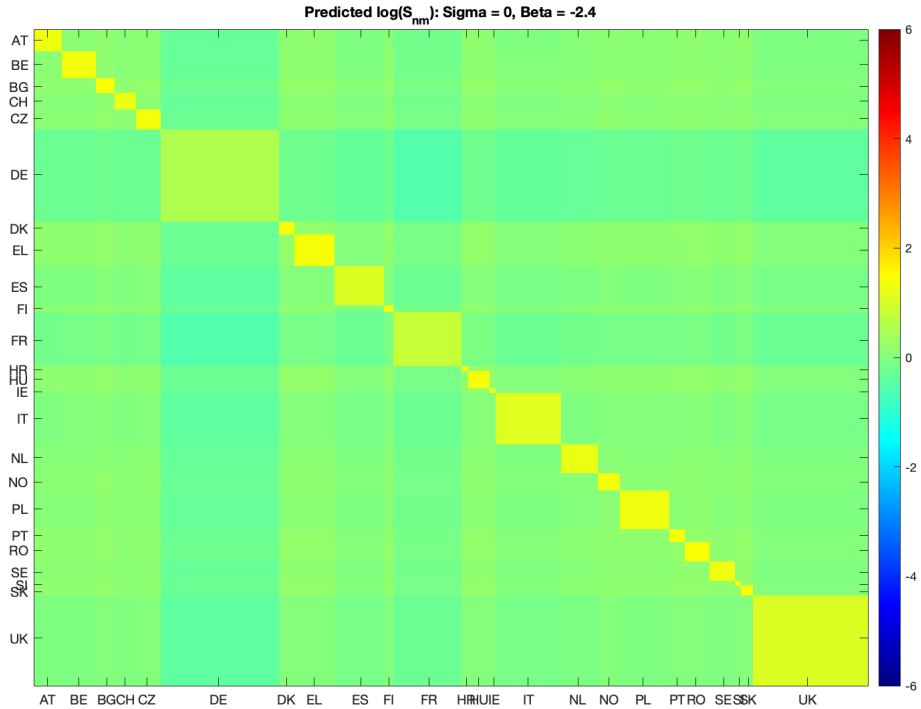
$$S_{nm} = \frac{M_{nm}}{M^O_n M^D_m} \qquad (\text{or} \quad X_{nm} = \frac{M_{nm}}{M^O_n M^D_m} X^O_n X^D_m) \tag{1}$$

where M^O_n and M^D_m are defined as:

$$1 = \sum_m X^D_m \frac{M_{nm}}{M^O_n M^D_m} \tag{2}$$

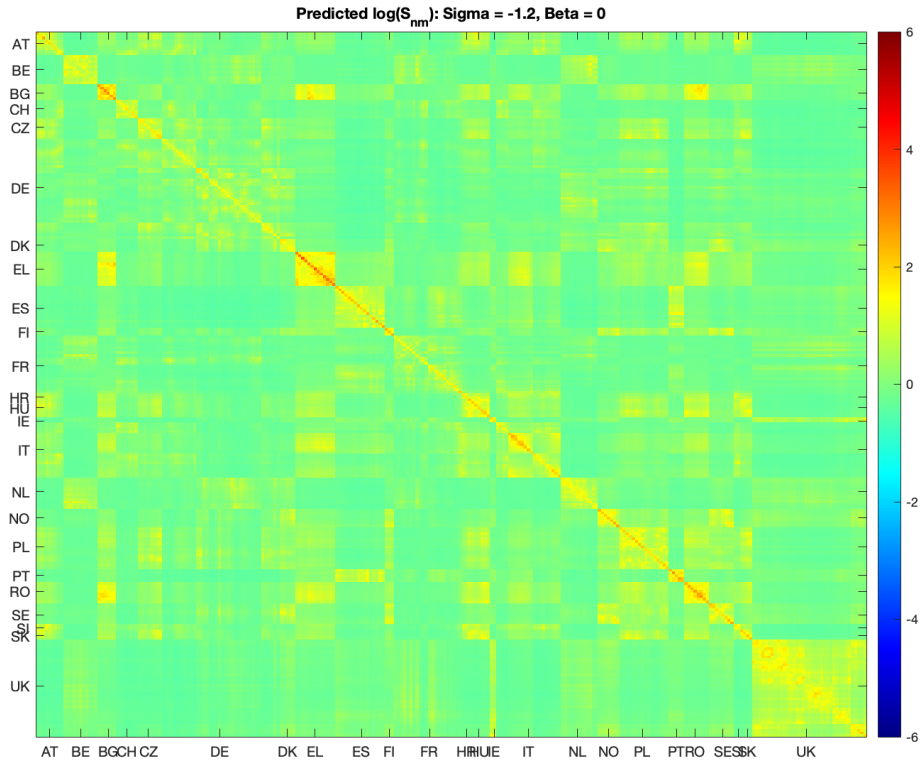
$$1 = \sum_n X^O_n \frac{M_{nm}}{M^O_n M^D_m} \tag{3}$$

An important example: border effect only



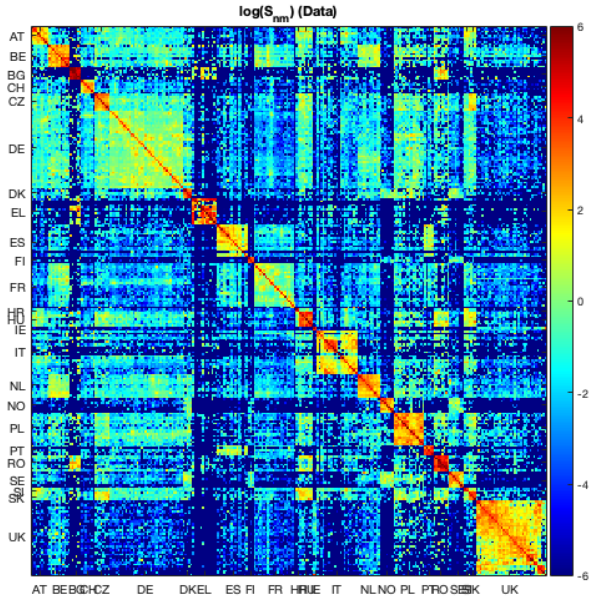
- Border effect only: $M_{nm} = \exp\{\beta B_{nm}\}$
  - Home/country bias;
  - Small-country effect Small country effect

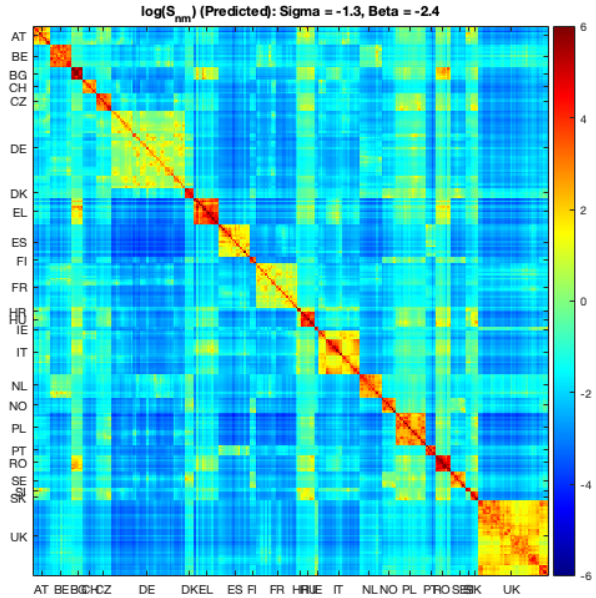
An important example: distance effect only



- Distance effect only: $M_{nm} = \exp\{\sigma D_{nm}\}$
  - Home/country bias;
  - Remoteness effect Remoteness effect

An important example: border and distance effects





- Border and distance effects: $M_{nm} = \exp\{\sigma D_{nm} + \beta B_{nm}\}$ S_{nm}: predicted vs data

Fixed-effects regressions

Table: Gravity: Fixed Effects Regressions

	(1) Log(S_nm)	(2) Log(S_nm)	(3) Log(S_nm)	(4) Log(S_nm)	(5) Log(S_nm)	(6) Log(S_nm)
Border dummy	-2.384***	-2.340***				
	(0.260)	(0.243)				
Border / common language / common currency dummy			-1.530***	-1.491***		
			(0.189)	(0.185)		
Border / common language / different currency dummy			-1.799***	-1.742***		
			(0.228)	(0.221)		
Border / different language / common currency dummy			-2.267***	-2.242***		
			(0.183)	(0.171)		
Border / different language / different currency dummy			-2.777***	-2.744***		
			(0.221)	(0.208)		
Border dummies for each country pair	No	No	No	No	Yes	Yes
Distance (constant-elasticity)	-1.190***		-1.071***		-1.006***	
	(0.0668)		(0.0607)		(0.0712)	
Distance (variable-elasticity)	No	Yes	No	Yes	No	Yes
Origin FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	46505	46505	46505	46505	46505	46505
R^2	0.610	0.611	0.623	0.624	0.666	0.668

Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

- Distance and border effects: Histogram Table Maps
  - $\sigma = -1$: double the distance, half the trade.
  - $\beta = -2.4$ (-2.8 or -1.5) : add a border, trade drops to 10% (6% or 22%).

The home bias effect

Table: Gravity: Fixed Effects Regressions

	(1) Log(S_nm)	(2) Log(S_nm)	(3) Log(S_nm)	(4) Log(S_nm)	(5) Log(S_nm)	(6) Log(S_nm)
Border dummy	-2.380***	-2.321***				
	(0.261)	(0.241)				
Border / common language / common currency dummy			-1.499***	-1.466***		
			(0.182)	(0.179)		
Border / common language / different currency dummy			-1.763***	-1.726***		
			(0.228)	(0.218)		
Border / different language / common currency dummy			-2.265***	-2.217***		
			(0.176)	(0.165)		
Border / different language / different currency dummy			-2.782***	-2.729***		
			(0.222)	(0.208)		
Border dummies for each country pair	No	No	No	No	Yes	Yes
Home Bias	1.013***	2.079***	1.271***	2.166***	1.424***	2.233***
	(0.259)	(0.409)	(0.218)	(0.352)	(0.184)	(0.289)
Distance (constant-elasticity)	-1.150***		-1.016***		-0.903***	
	(0.0689)		(0.0604)		(0.0670)	
Distance (variable-elasticity)	No	Yes	No	Yes	No	Yes
Origin FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	46505	46505	46505	46505	46505	46505
R^2	0.611	0.613	0.625	0.627	0.669	0.671

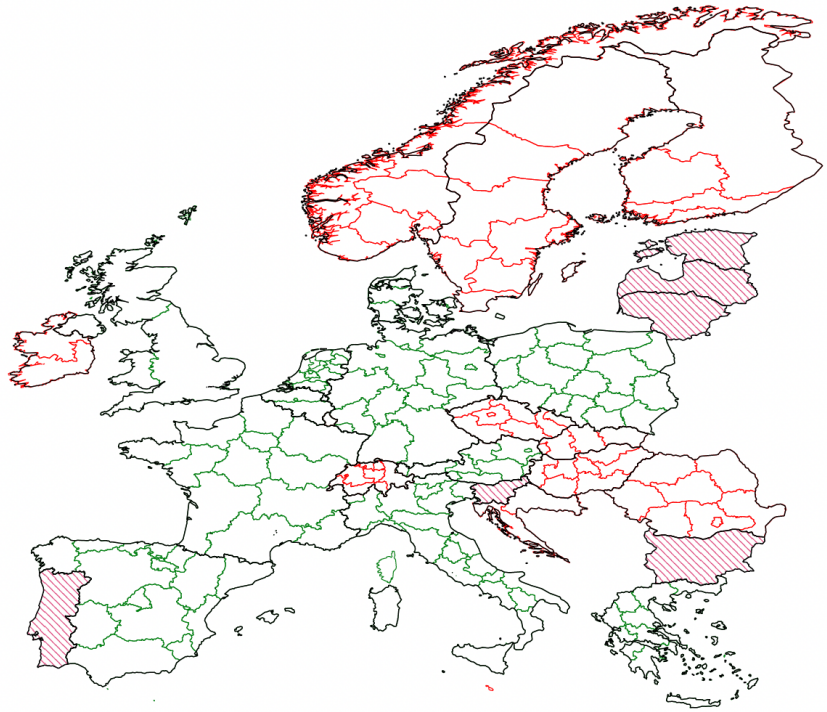
Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

S_{nm} home | Determinants

Statistical and political borders

Statistical (NUTS2) regions



Political Regions

Empirical strategy

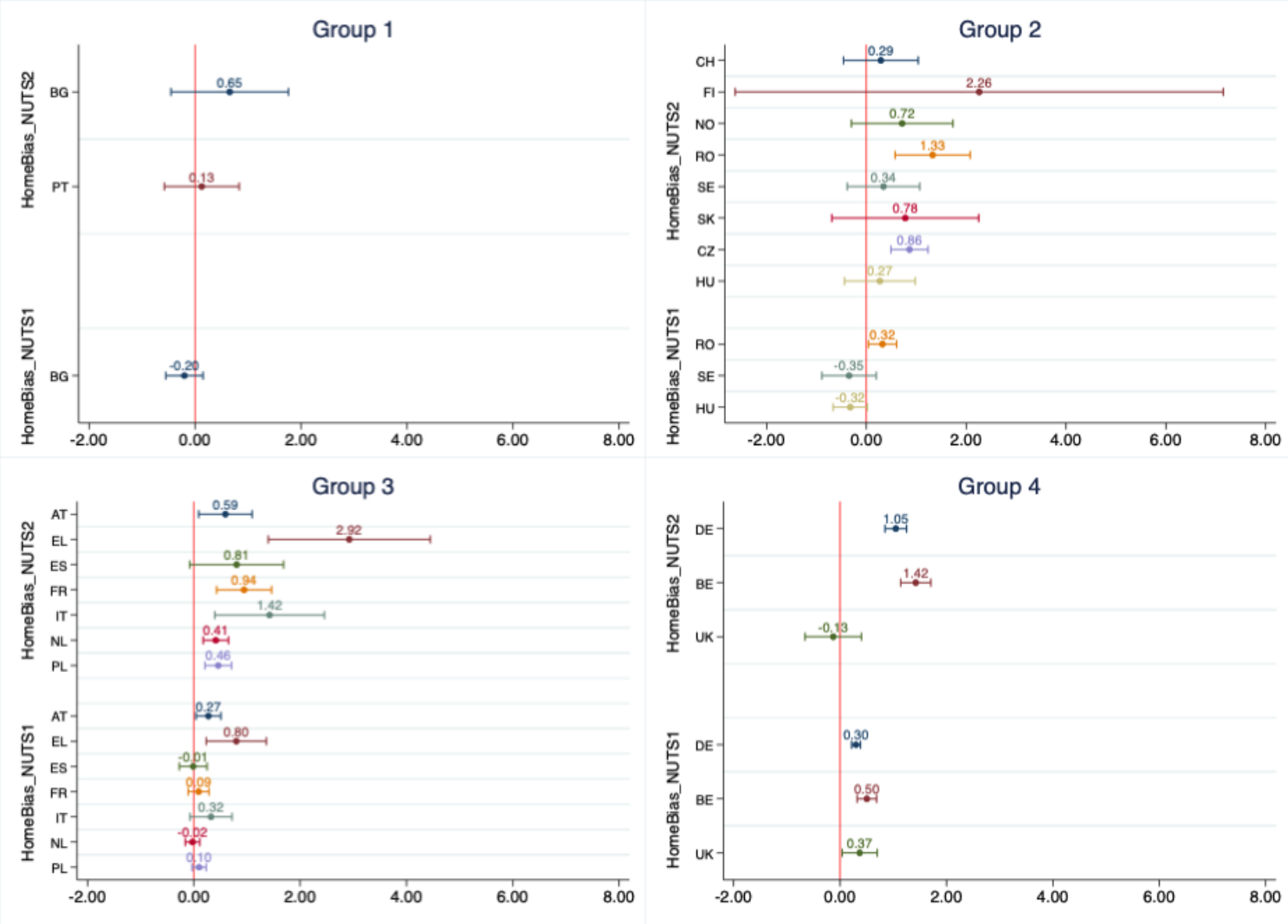
- Using only country trade, we estimate this regression for each country

$$\ln S_{nm} = \phi_n^O + \phi_m^D + \sigma D_{nm} + \beta_1 HB1_{nm} + \beta_2 HB2_{nm} + u_{nm}$$

  where $HB1_{nm}$ and $HB2_{nm}$ are home bias dummies at NUTS1 and NUTS2 level.

- Expected results:
  - *Group 1*: There are no regional governments ($\beta_1 = \beta_2 = 0$):
    - ⋆ Portugal (5), Bulgaria (6), Slovenia (2)
  - *Group 2*: NUTS2 coarser than political units ($\beta_1 = 0$, $\beta_2 \geq 0$):
    - ⋆ Finland (5), Romania (8), Slovakia (4), Switzerland (7), Norway (7), Hungary (8), Croatia (2), Czech Republic (8)
  - *Group 3*: NUTS2 coincides with political units ($\beta_1 = 0$, $\beta_2 > 0$):
    - ⋆ Austria (9), Denmark (5), France (22), Greece (13), Ireland (3), Italy (21), Netherlands (12), Poland (16), Spain (16)
  - *Group 4*: NUTS finer than political units ($\beta_1 > 0$, $\beta_2 > 0$ or $\beta_2 = 0$):
    - ⋆ UK (39), Germany (39), Belgium (11)

Regional borders results



Additional exercises

1. Decomposition of extensive and intensive margins

Table: Contribution to variance of $\ln(X_{nm})$

	Num. of industries	Mean shipments per ind	Mean kg per shipment
Home	0.139	0.317	0.544
Country	0.146	0.133	0.721
Foreign	0.066	0.039	0.895

   - Variation within home trade is explained by both margins, variation in foreign trade explained by intensive margin (+90%).

2. Comparison of trade interactions and social interactions (Bailey et al 2021).
   - Social connectedness is - correlated with home trade, (strongly) + correlated with country trade and (weakly) + correlation with foreign trade.
   - Border effect is larger (more negative) in social interactions
   - Distance effect is larger (more negative) in trade interactions

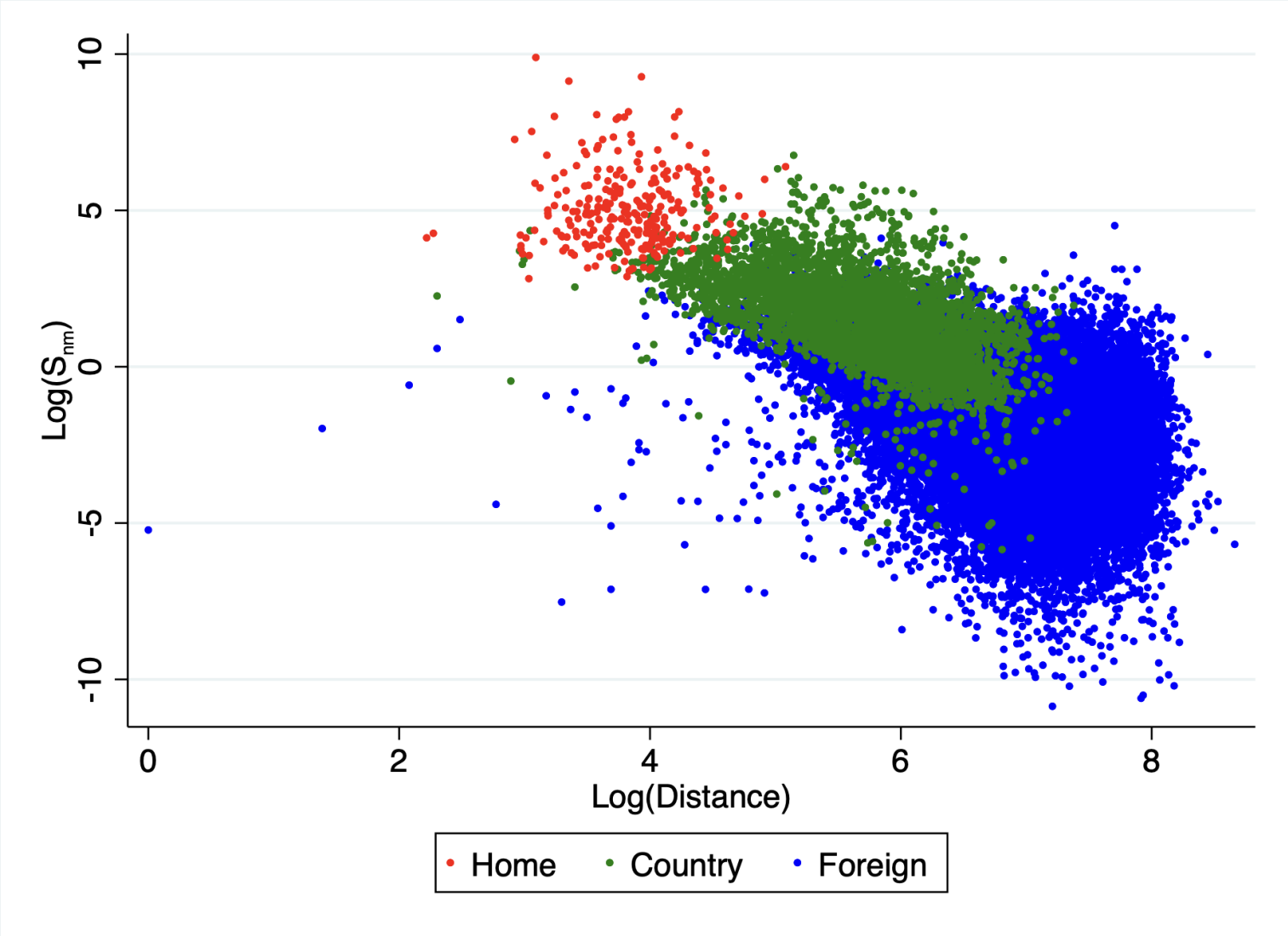
Concluding remarks

- Exploration of main patterns in European regional trade
- Strong home and country bias in trade, about 81% of all regional trade
- National borders and geographic distance explain two-thirds of the variation in country and foreign trade
- Home bias seems related to the presence of regional political borders

Modal split: Inland Intra-EU trade

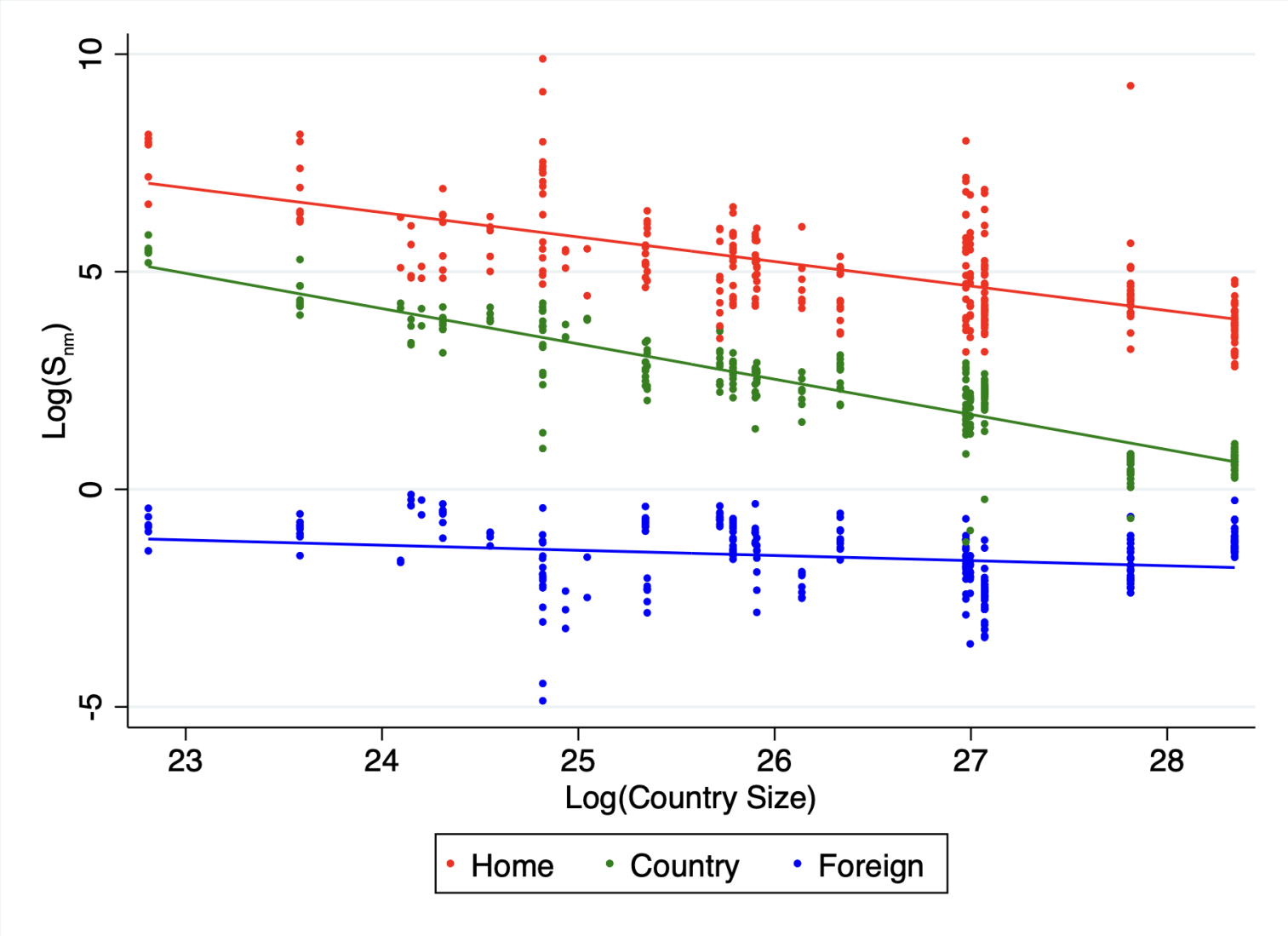
Back

Log(S_{nm}) vs log(Distance)



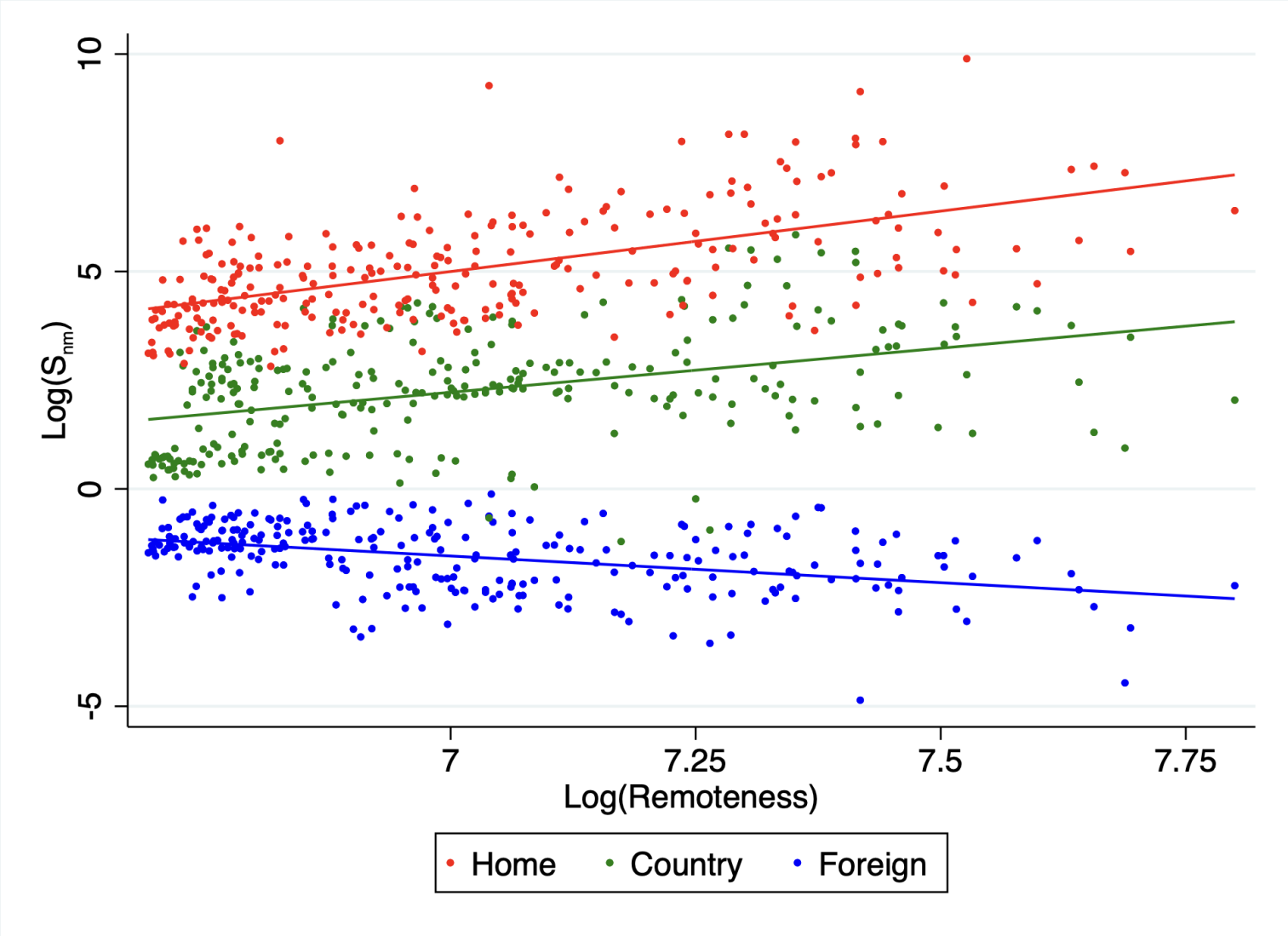
Back

Small country effect



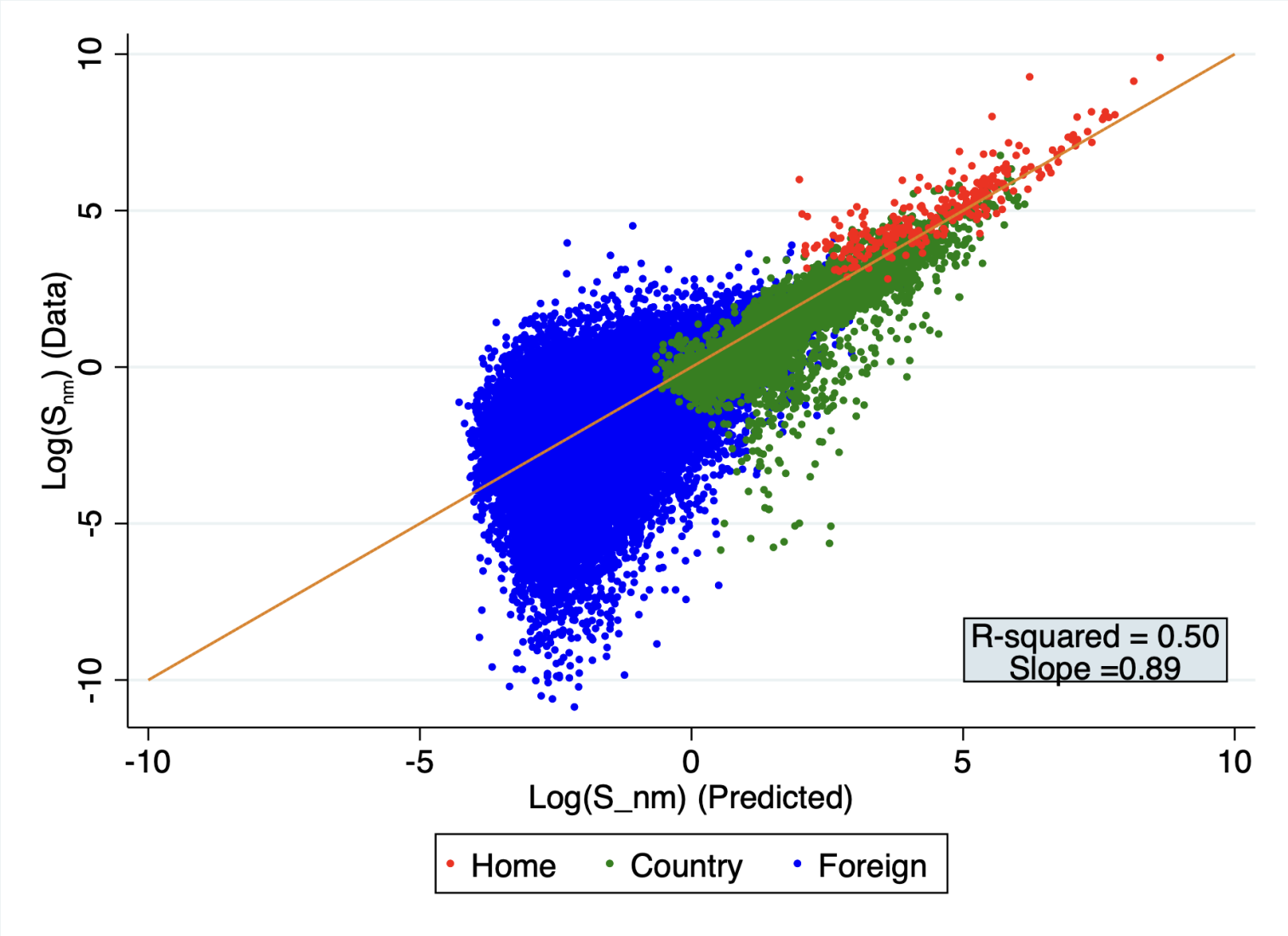
Back

Remoteness effect



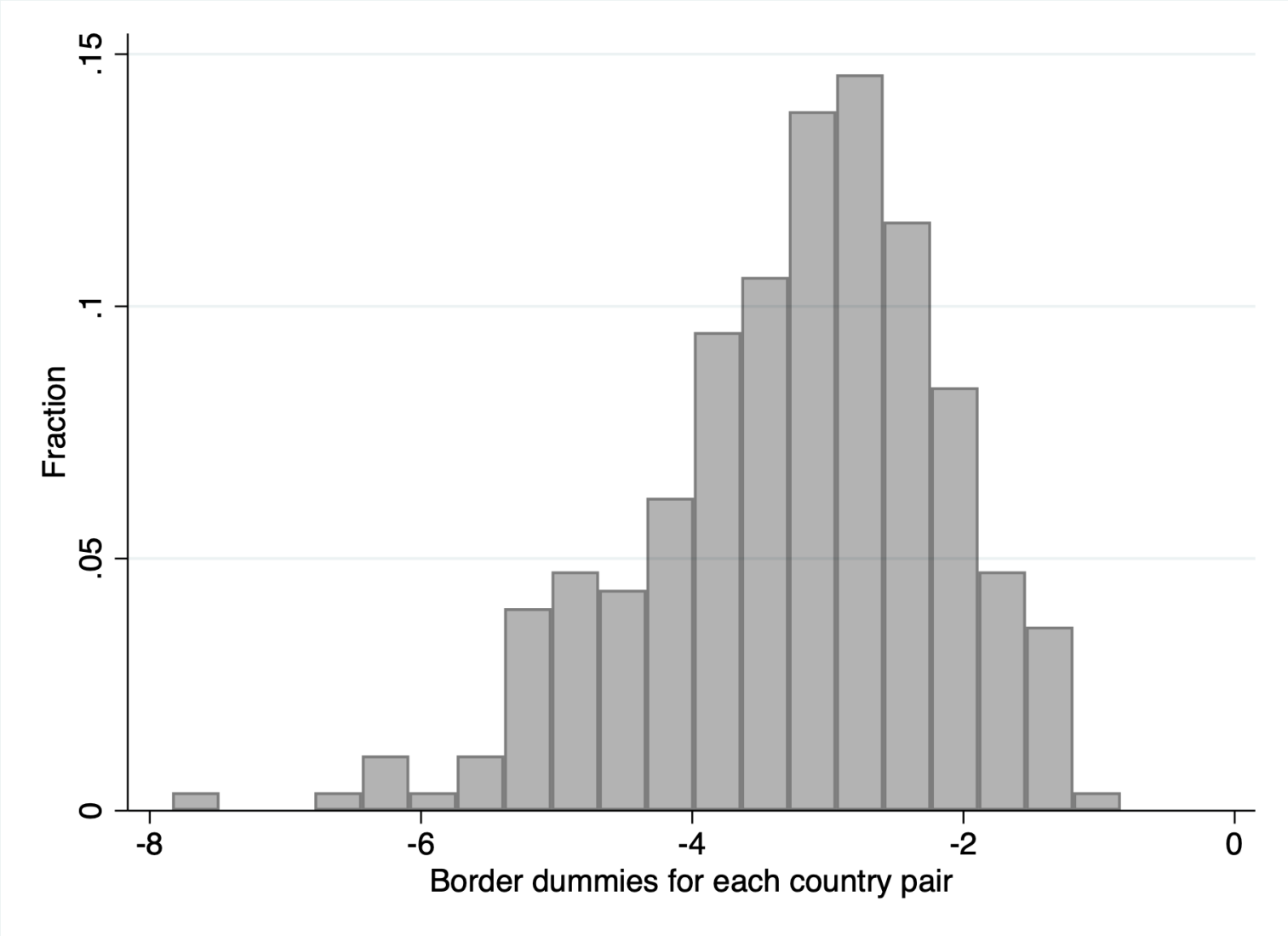
Back

S_{nm}: Predicted vs data



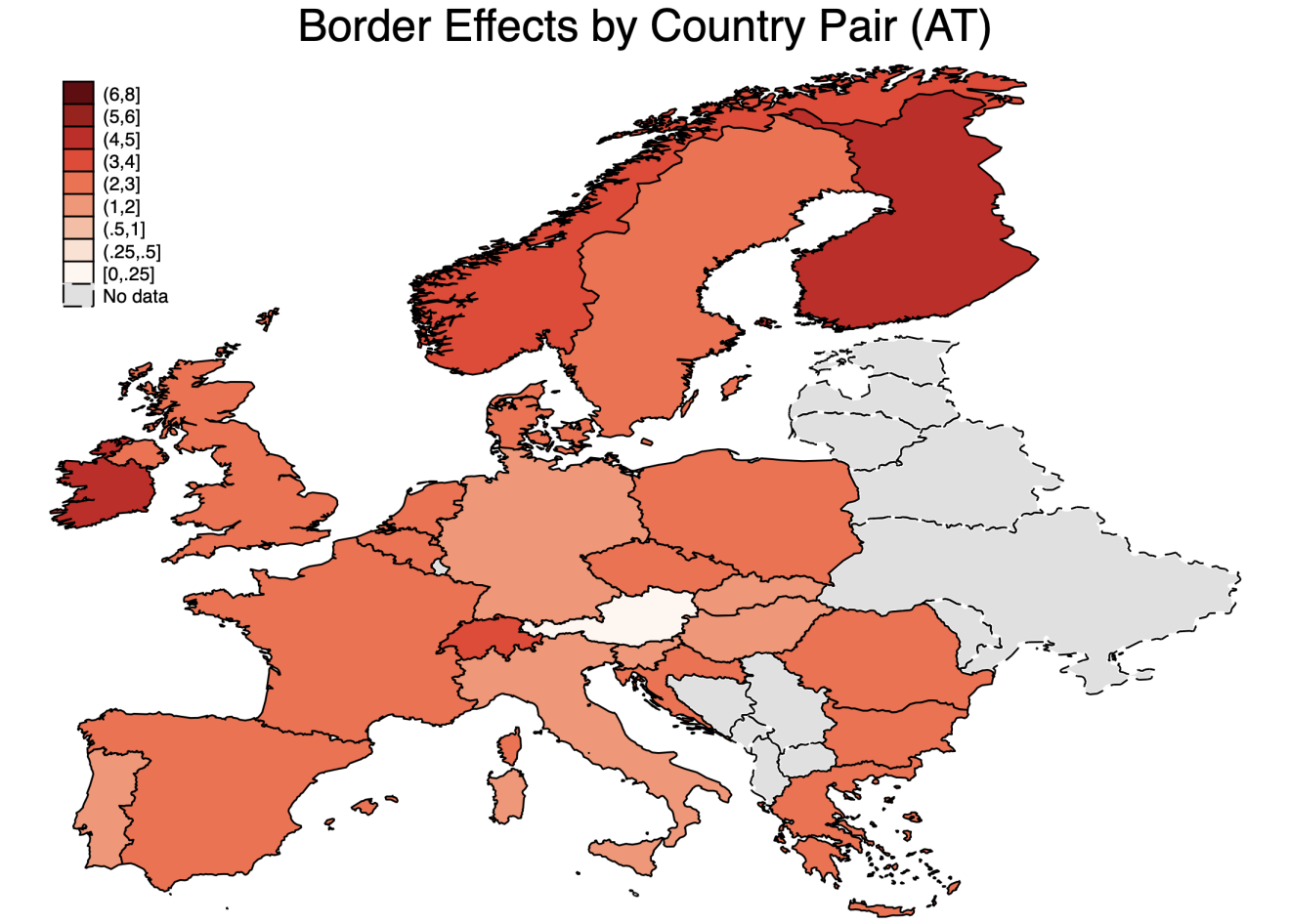
Back

Border effect for country pairs



Back

Border effect maps



Back

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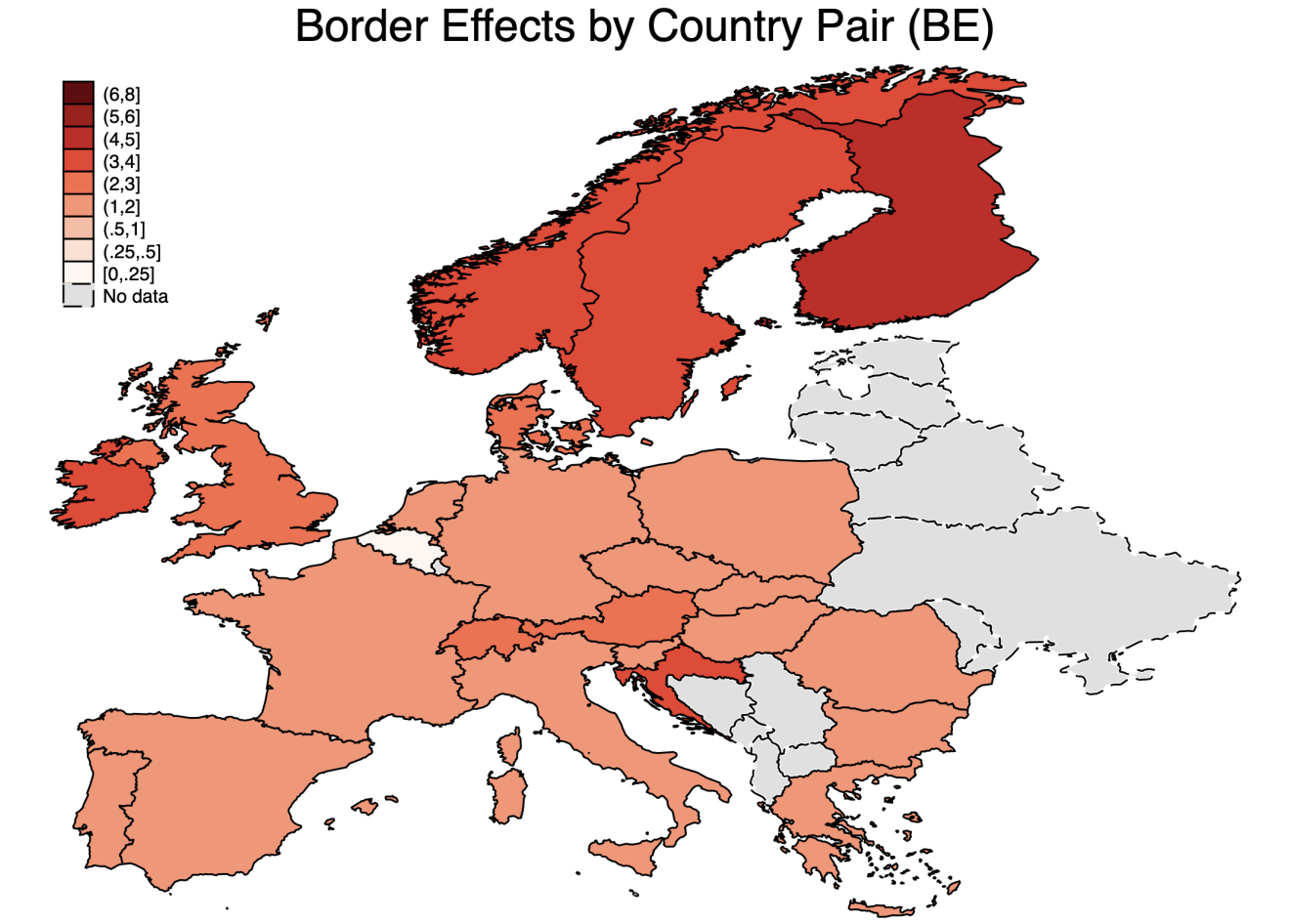

Back

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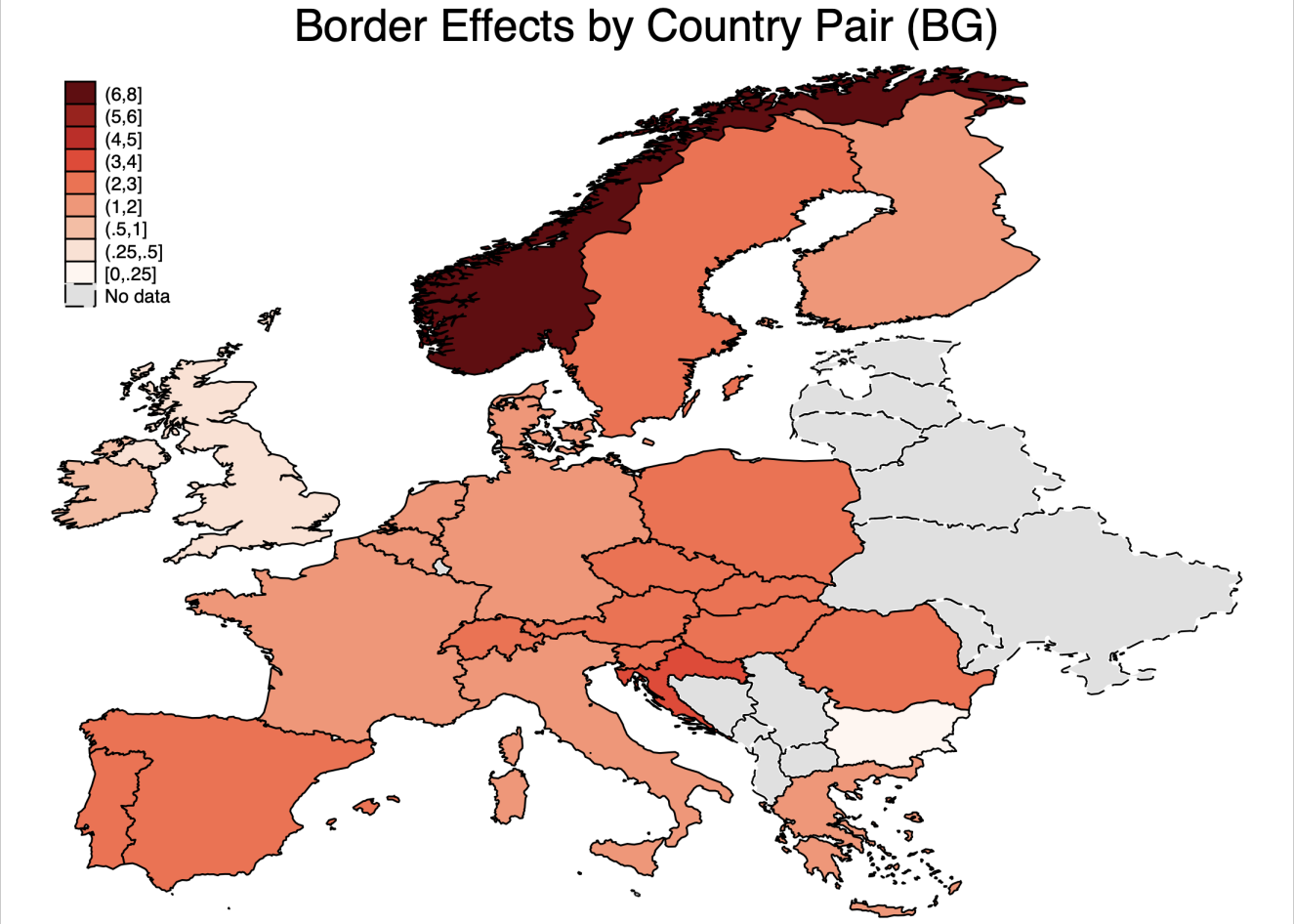

Back

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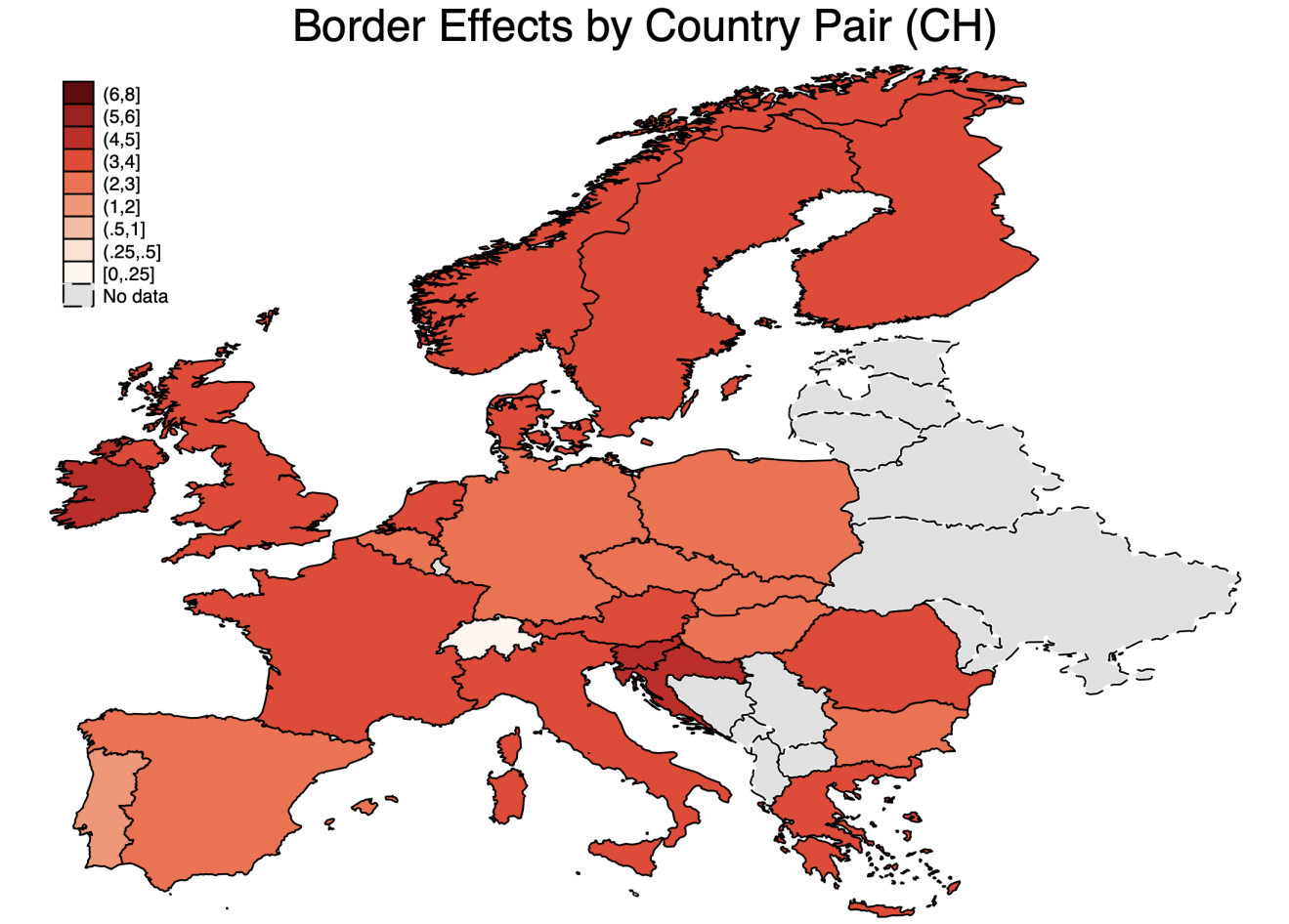

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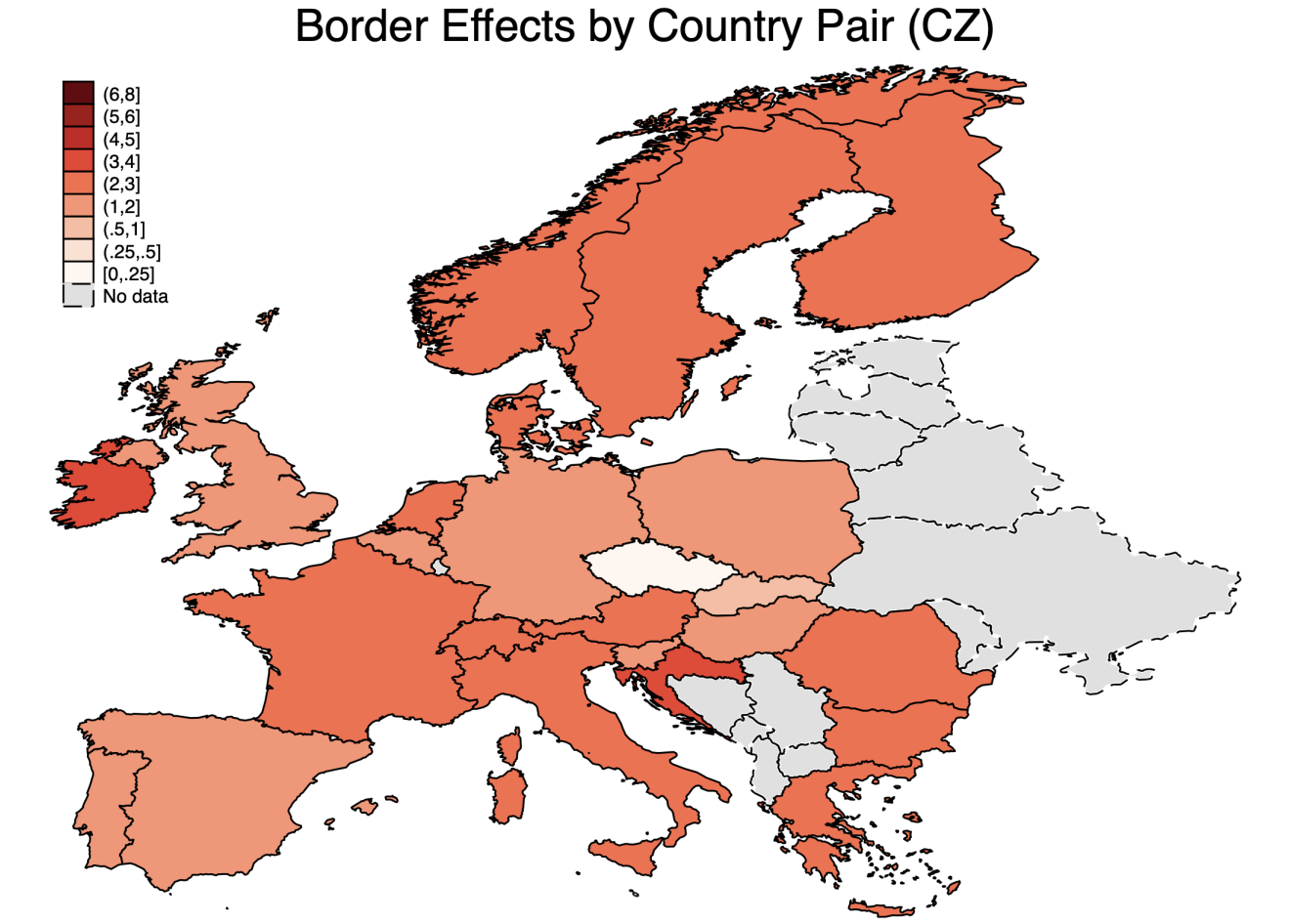

Back

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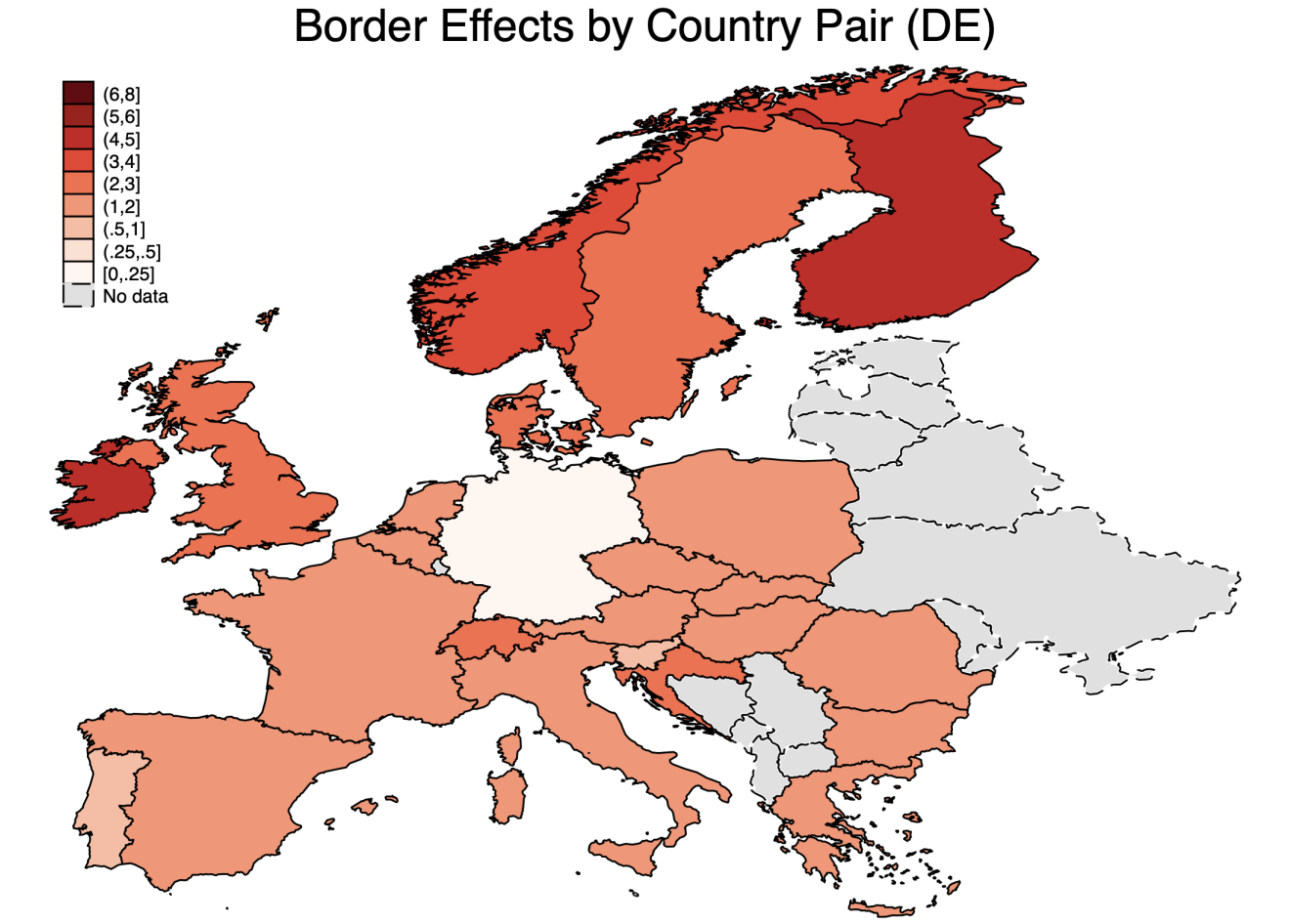

Back

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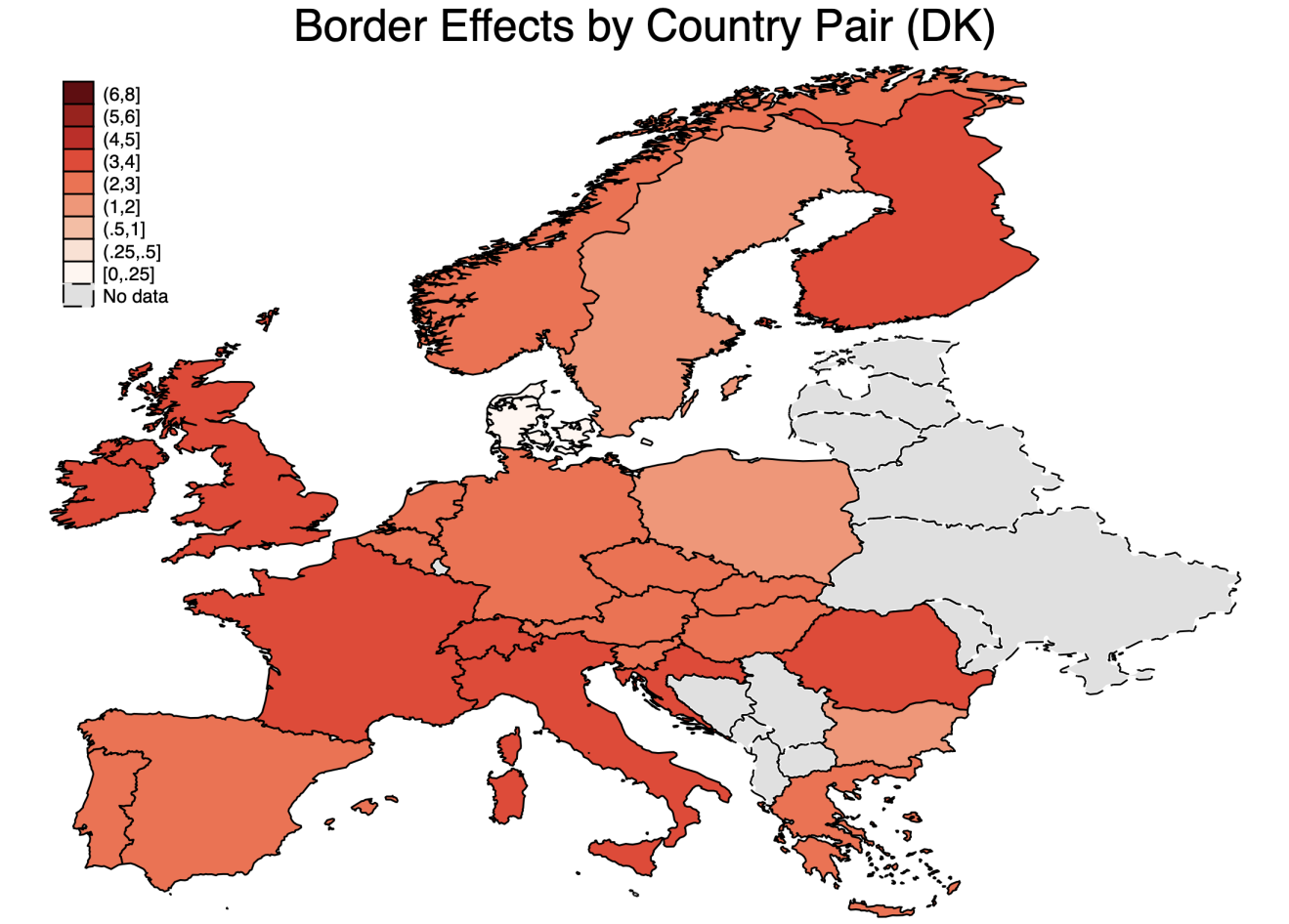

Back

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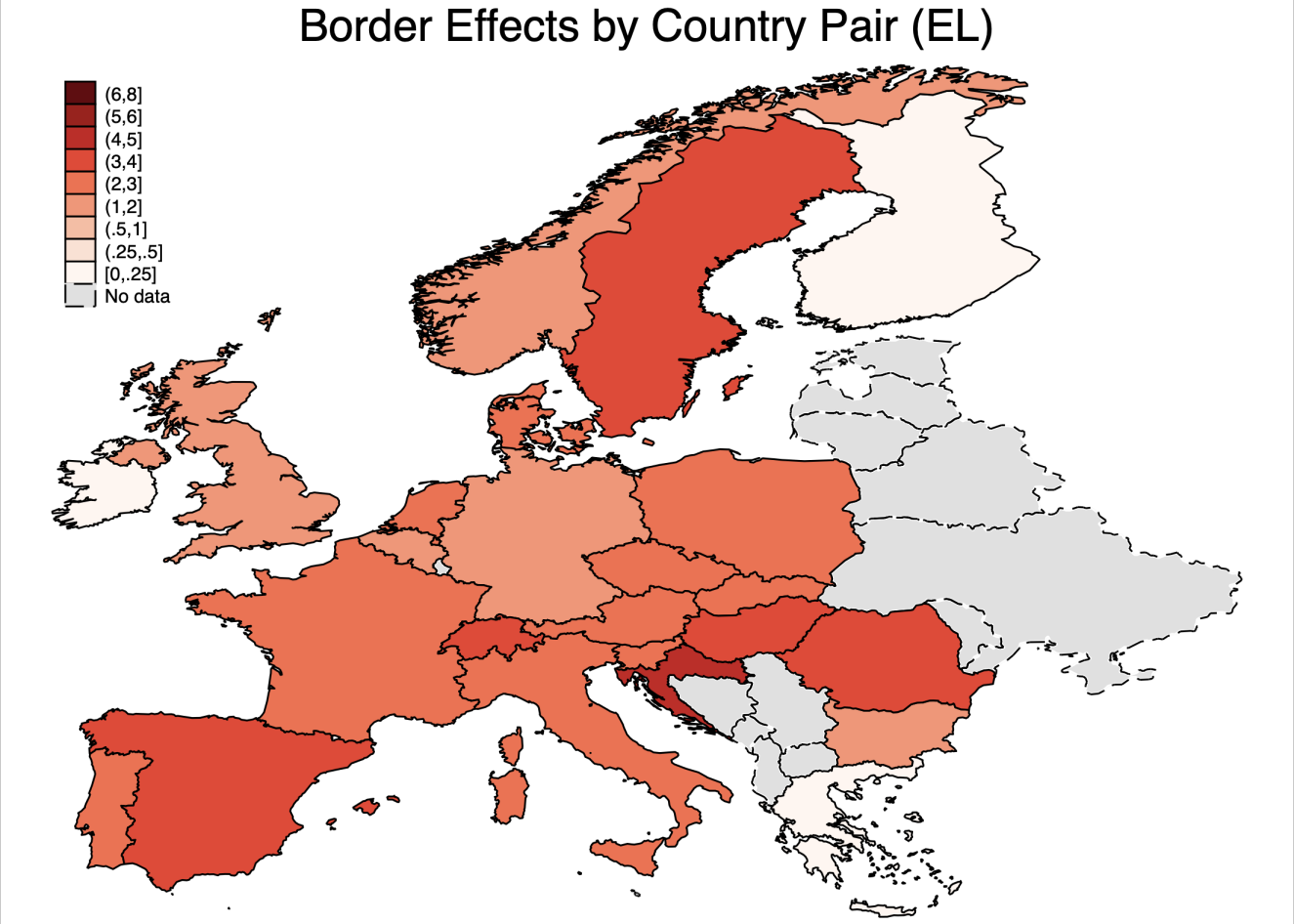

Back

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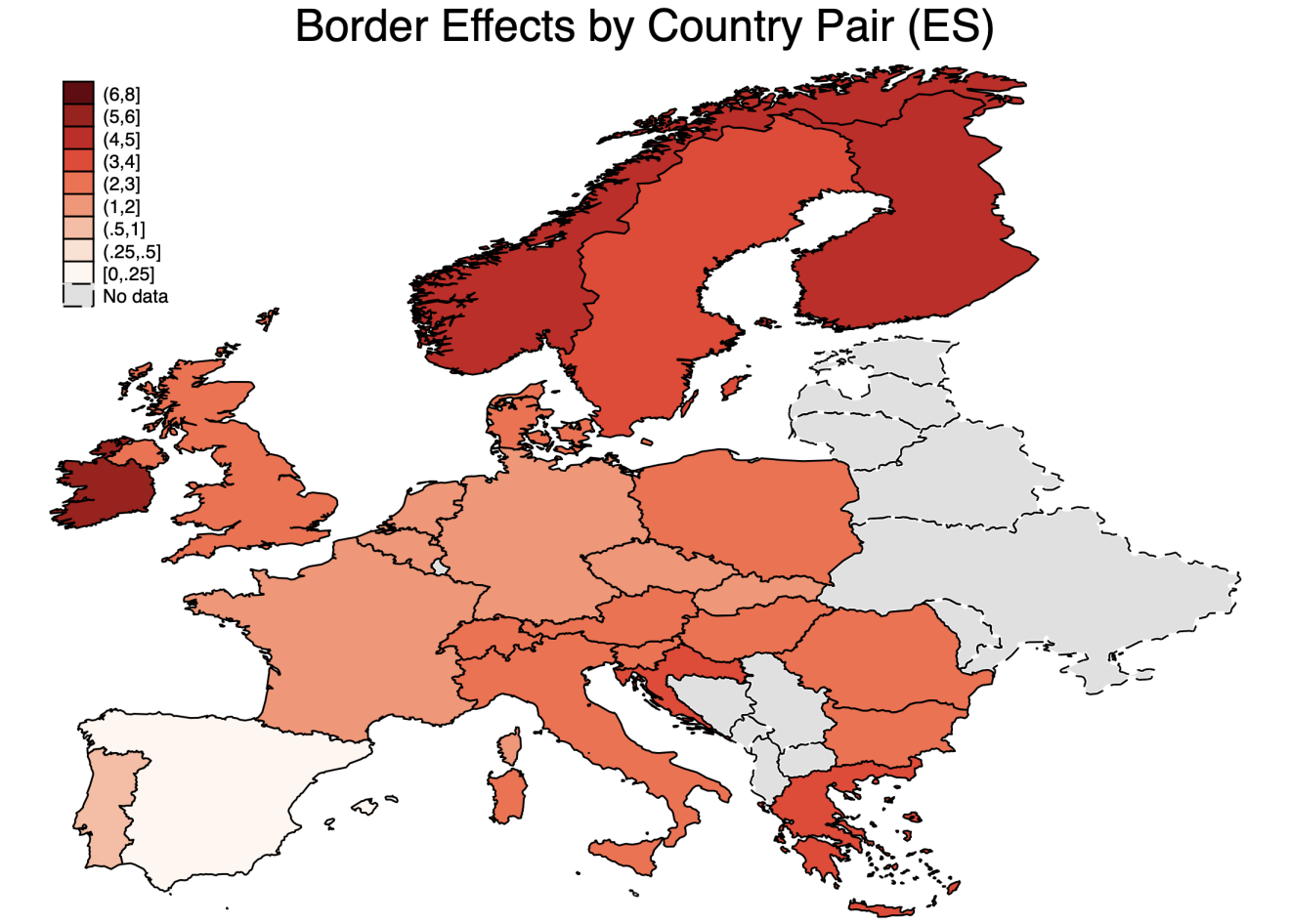

Back

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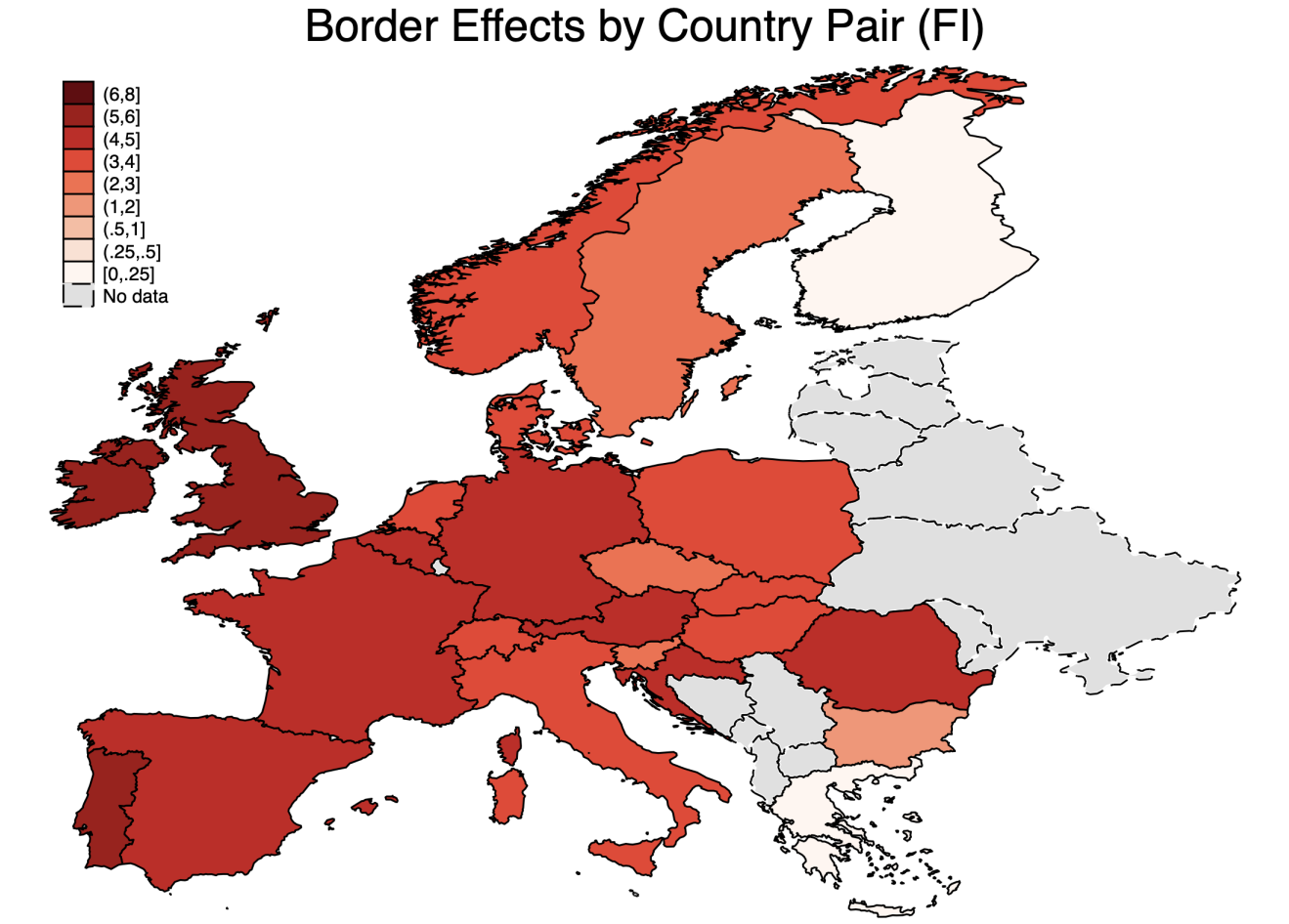

Back

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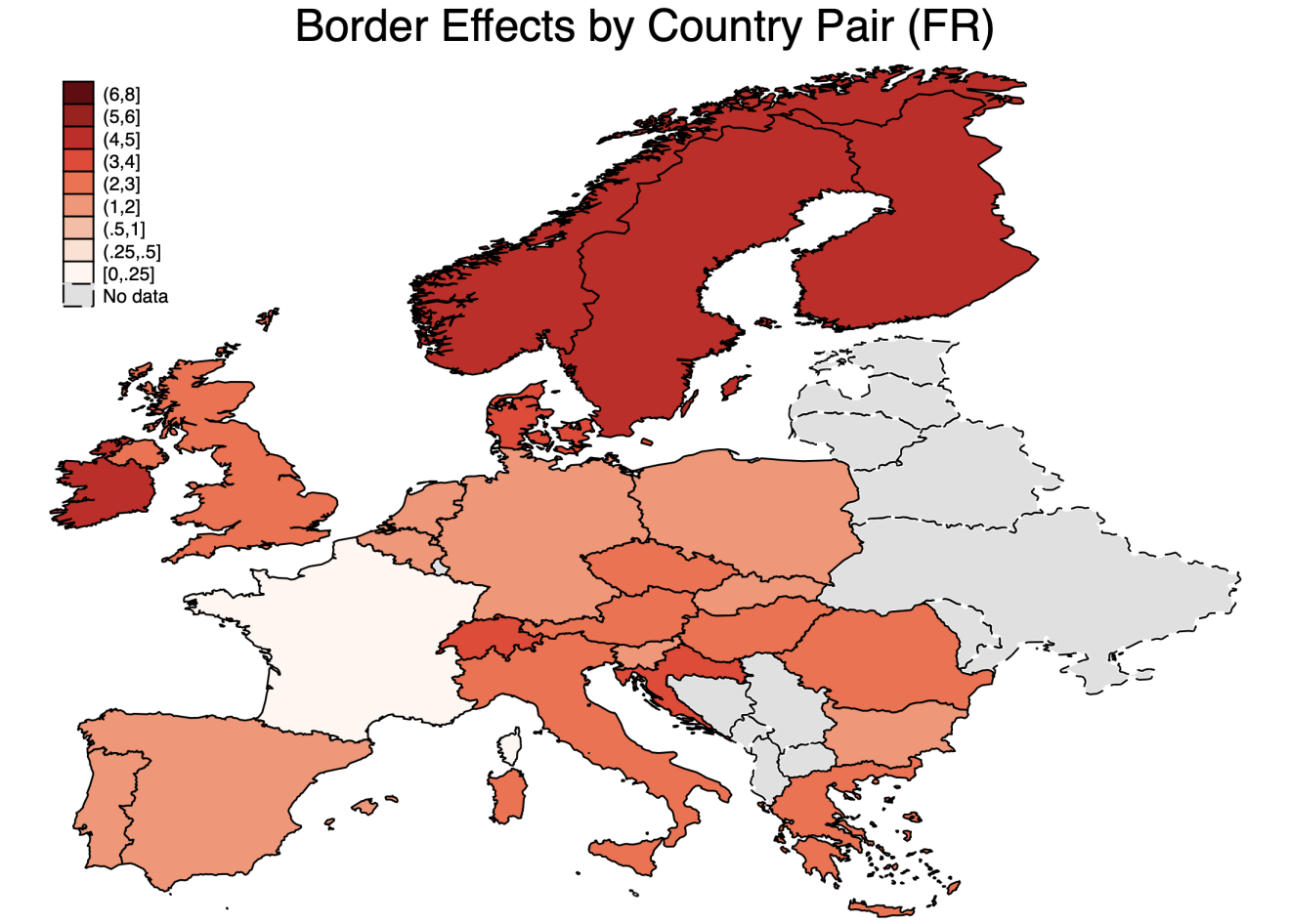

Back

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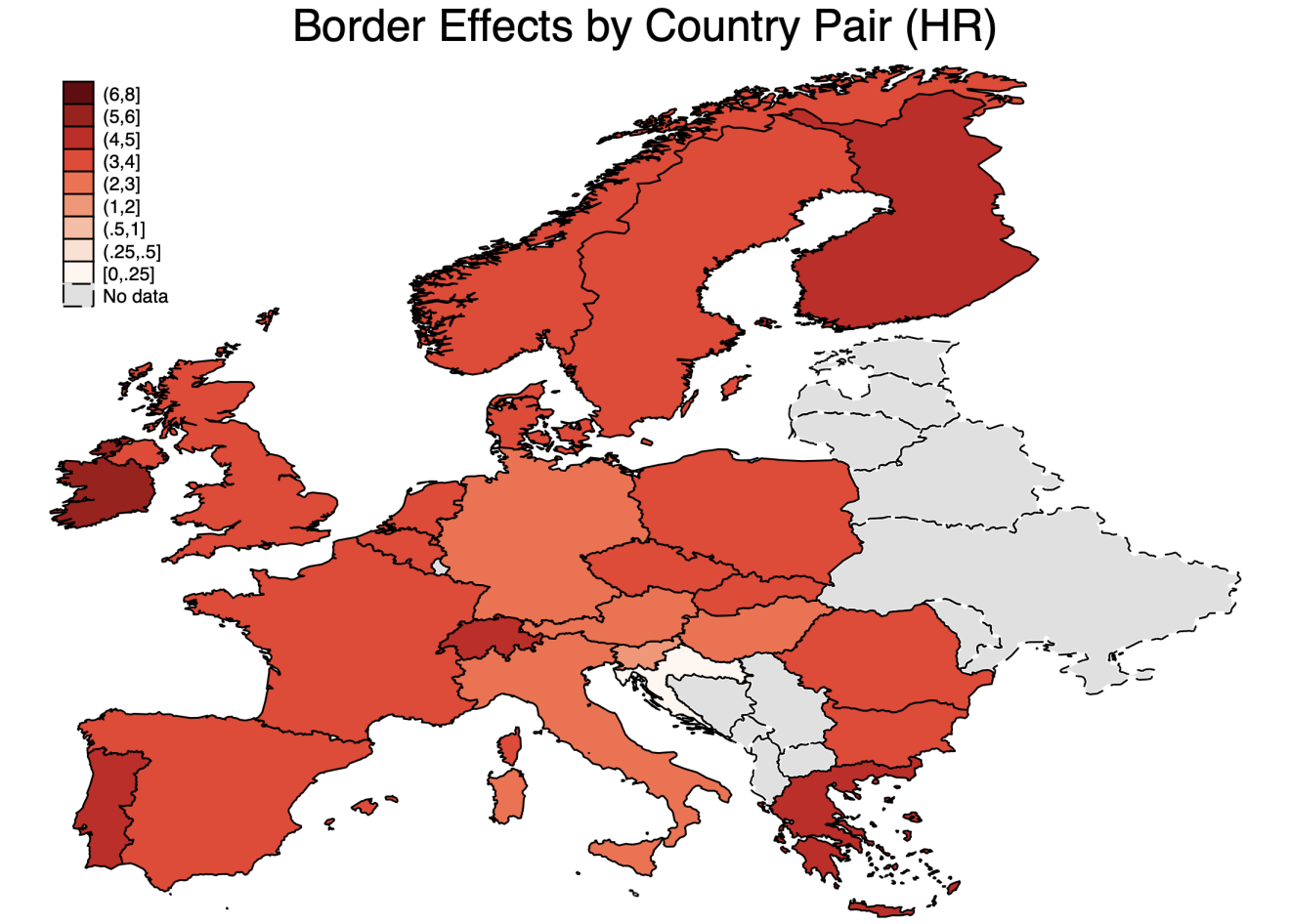

Back

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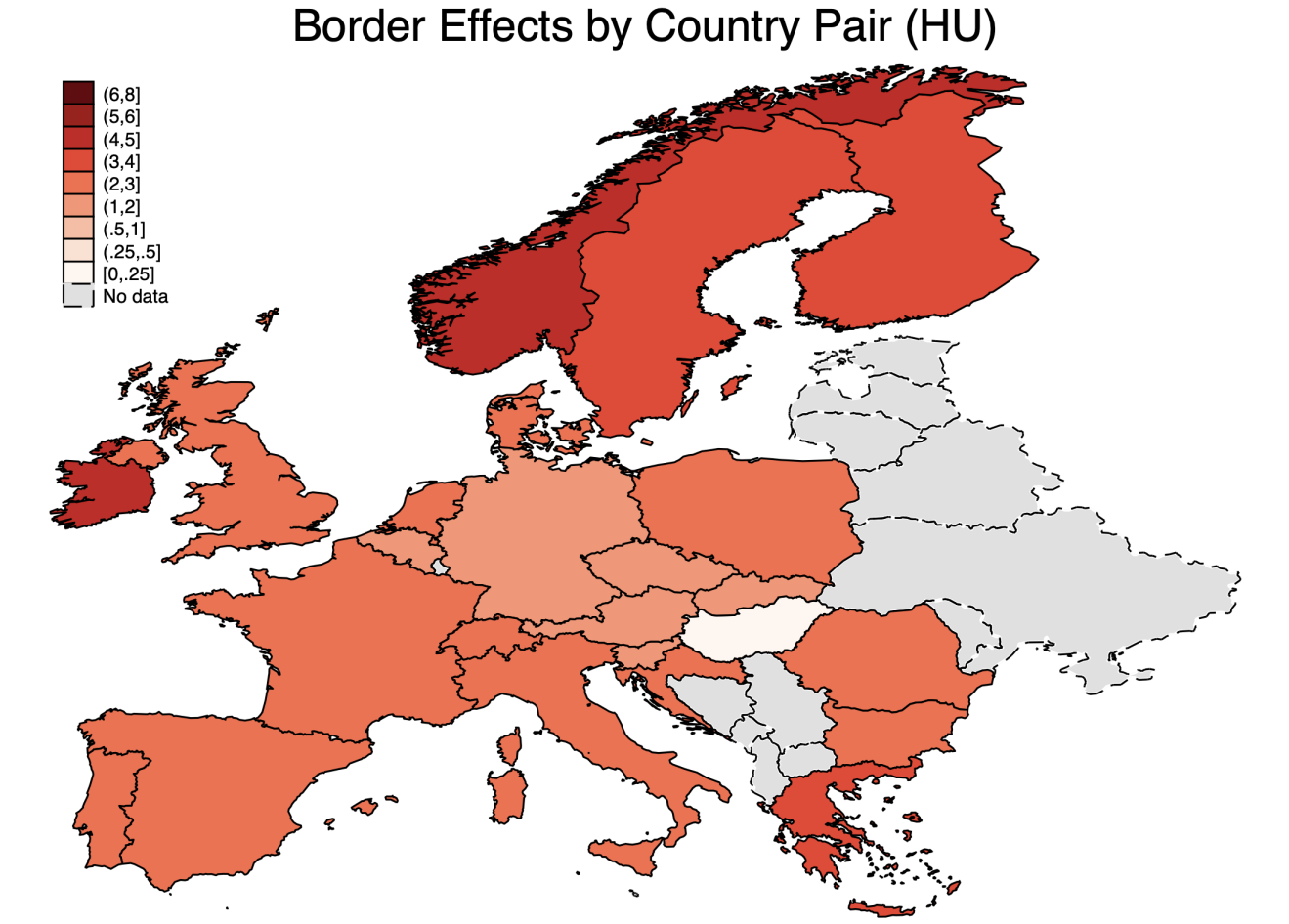

Back

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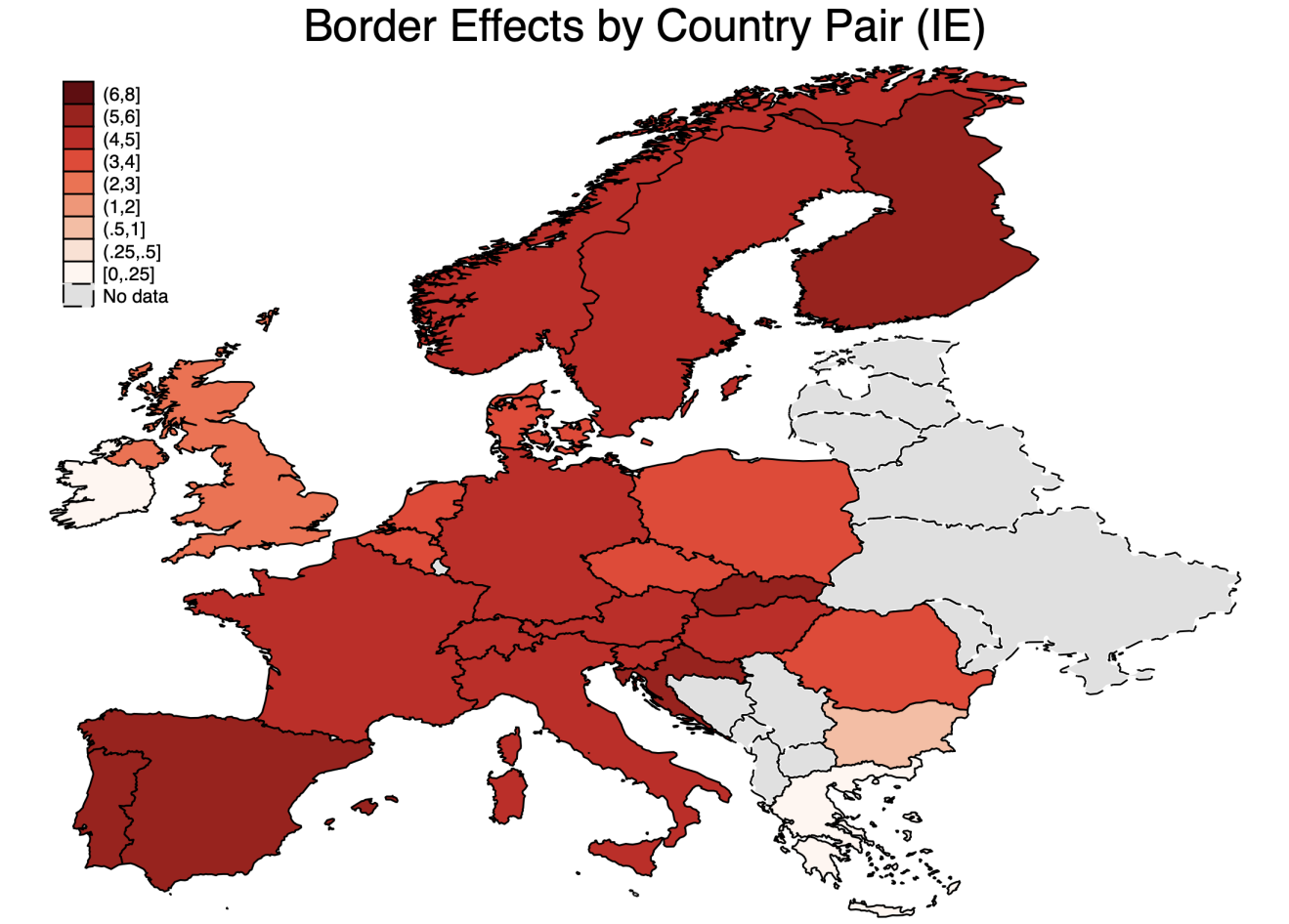

Back

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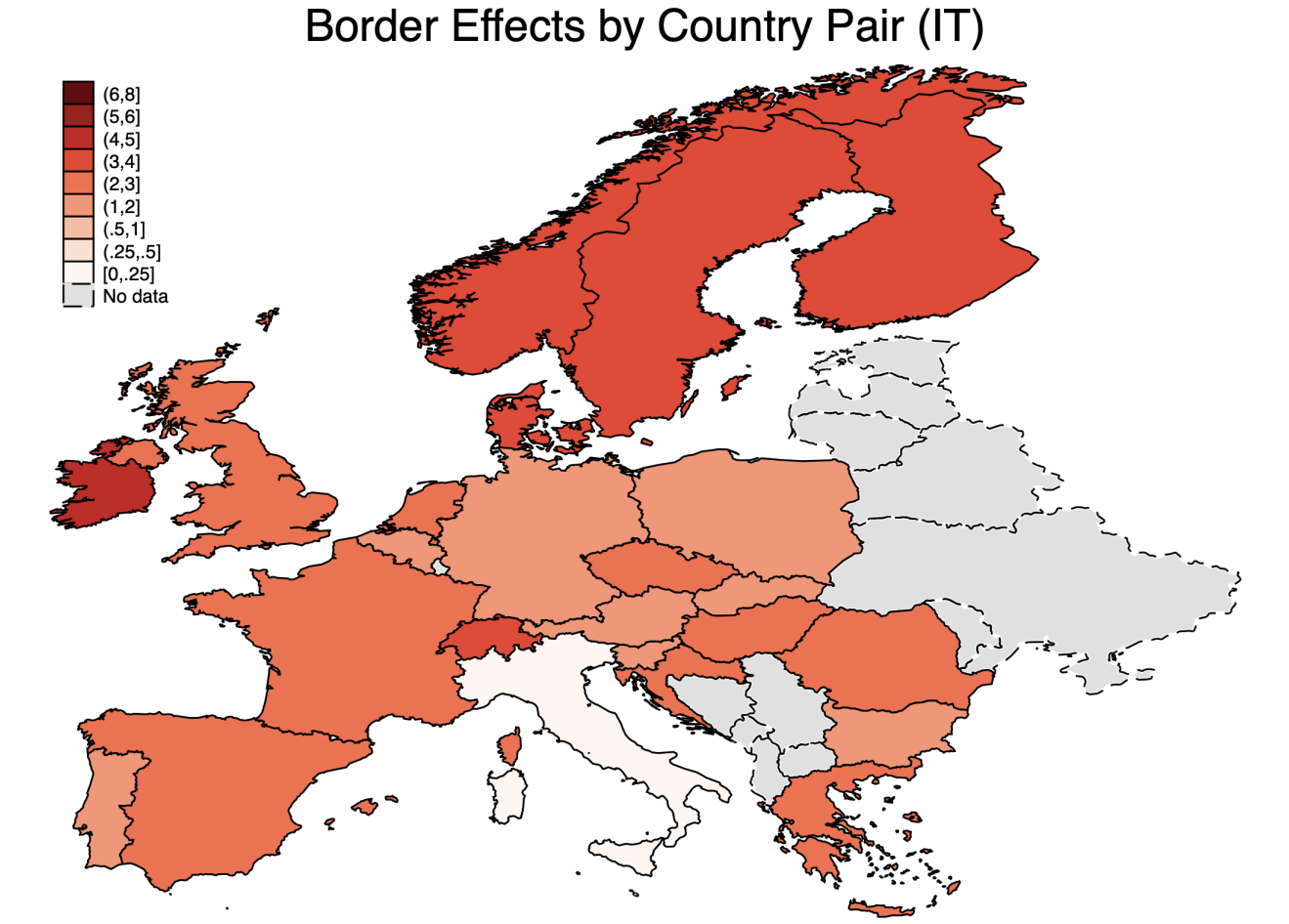

Back

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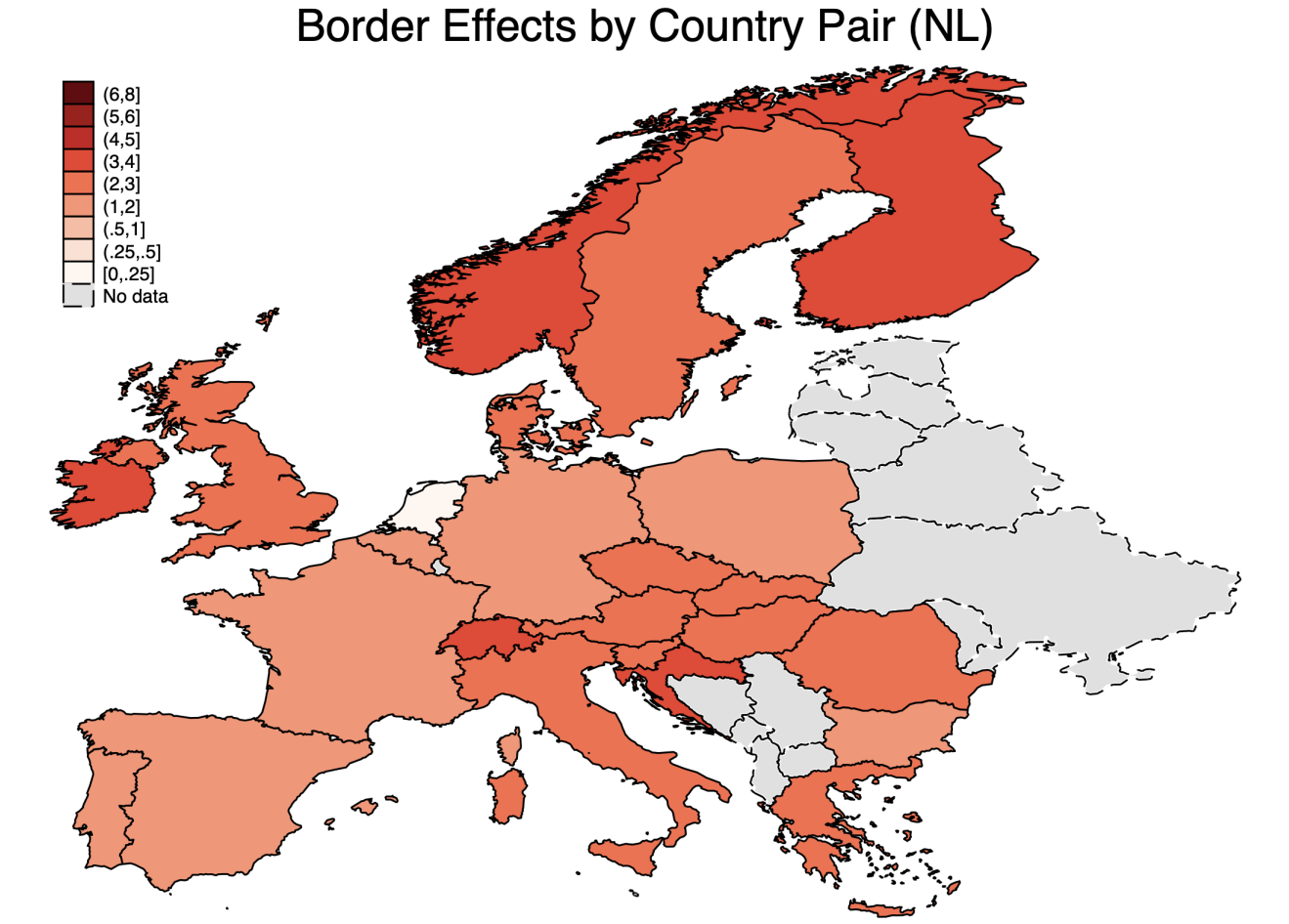

Back

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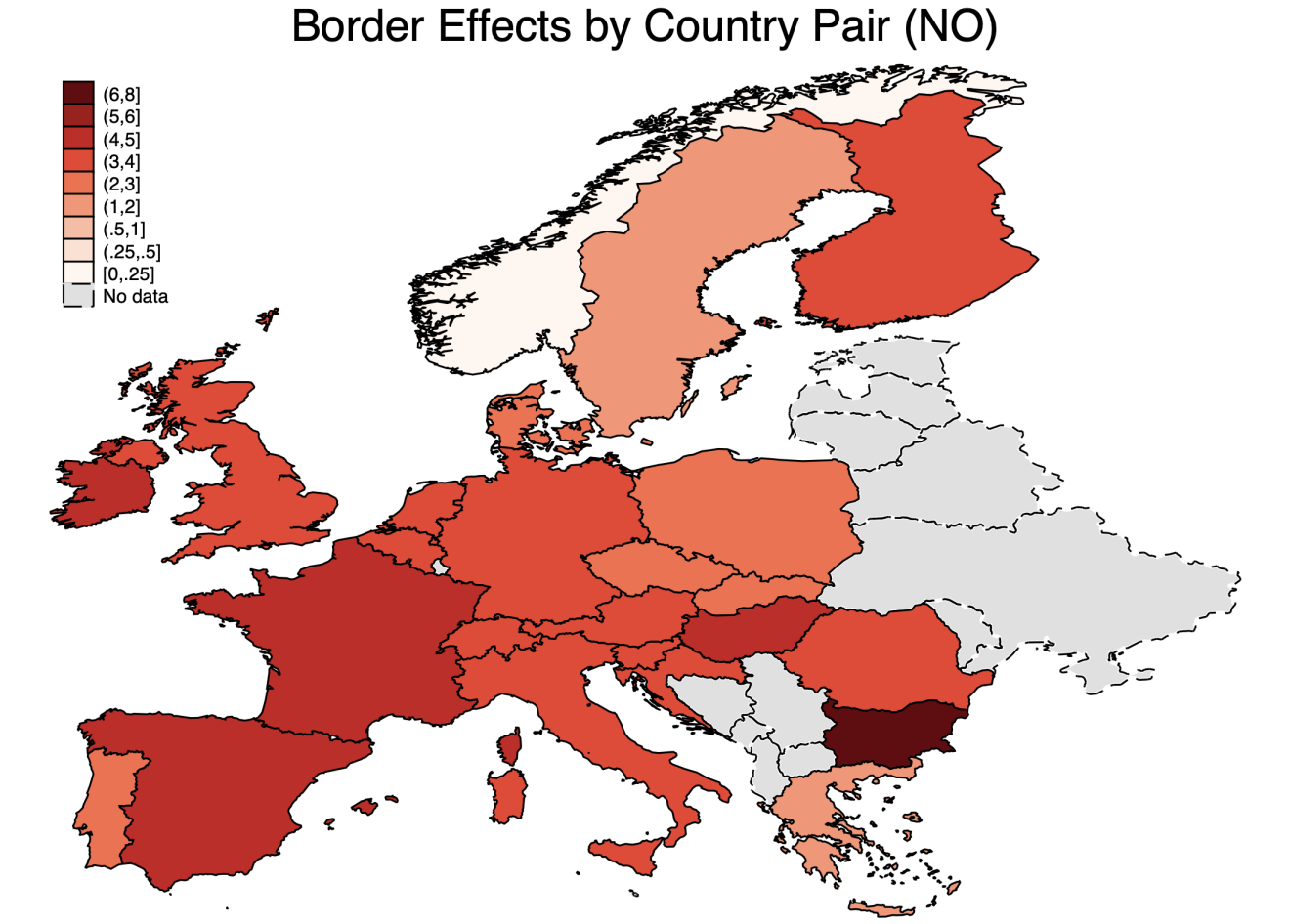

Back

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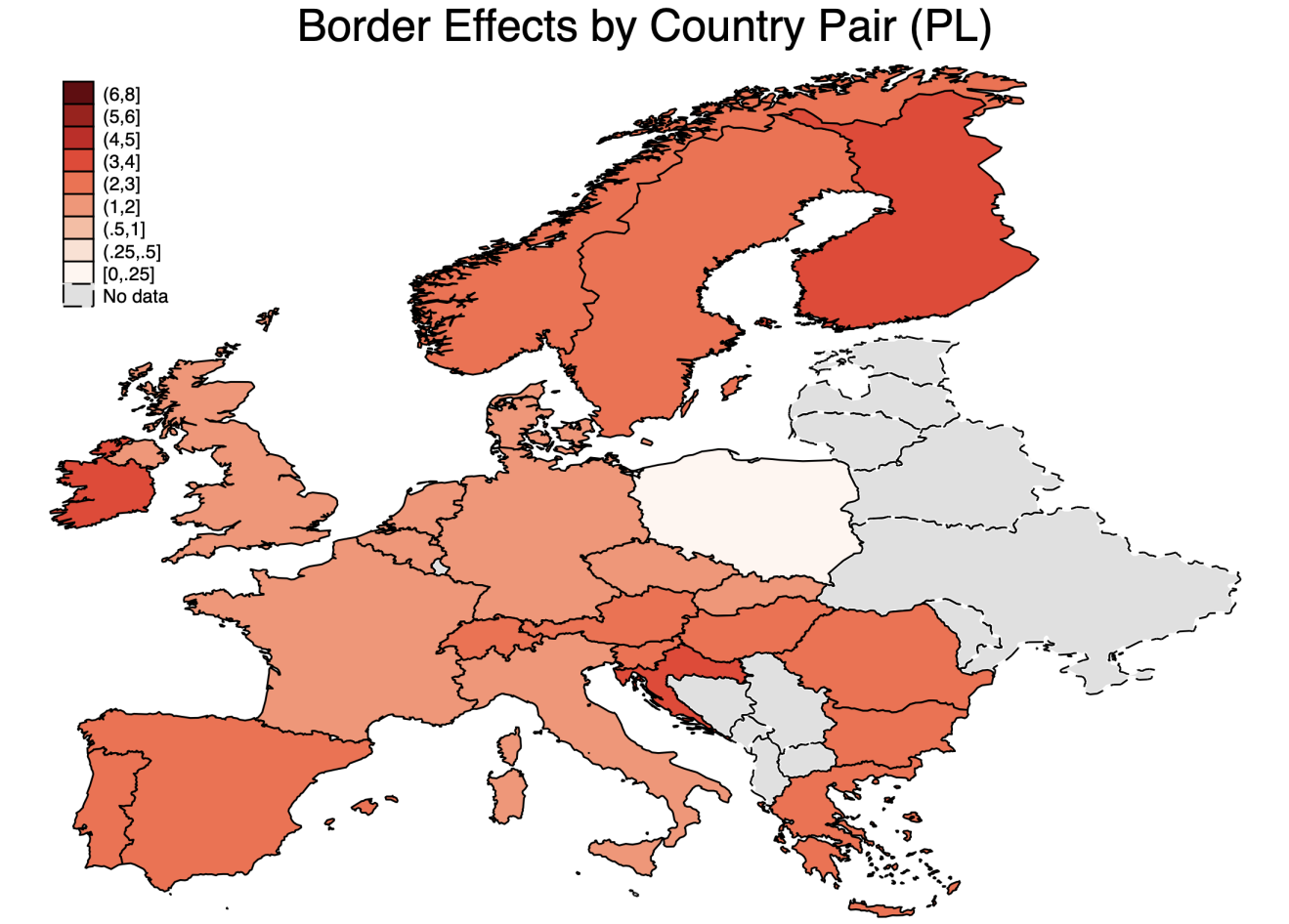

Back

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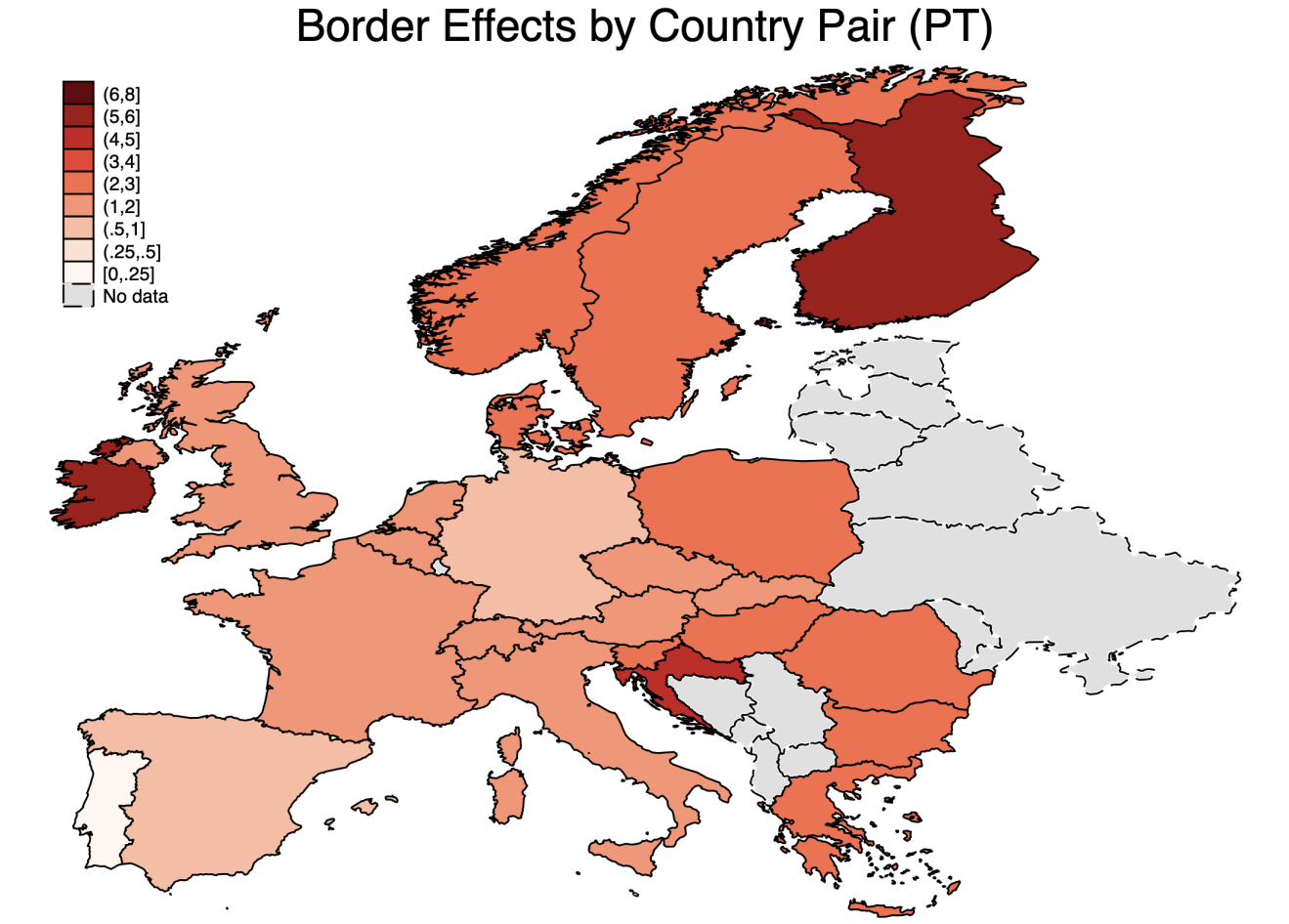

Back

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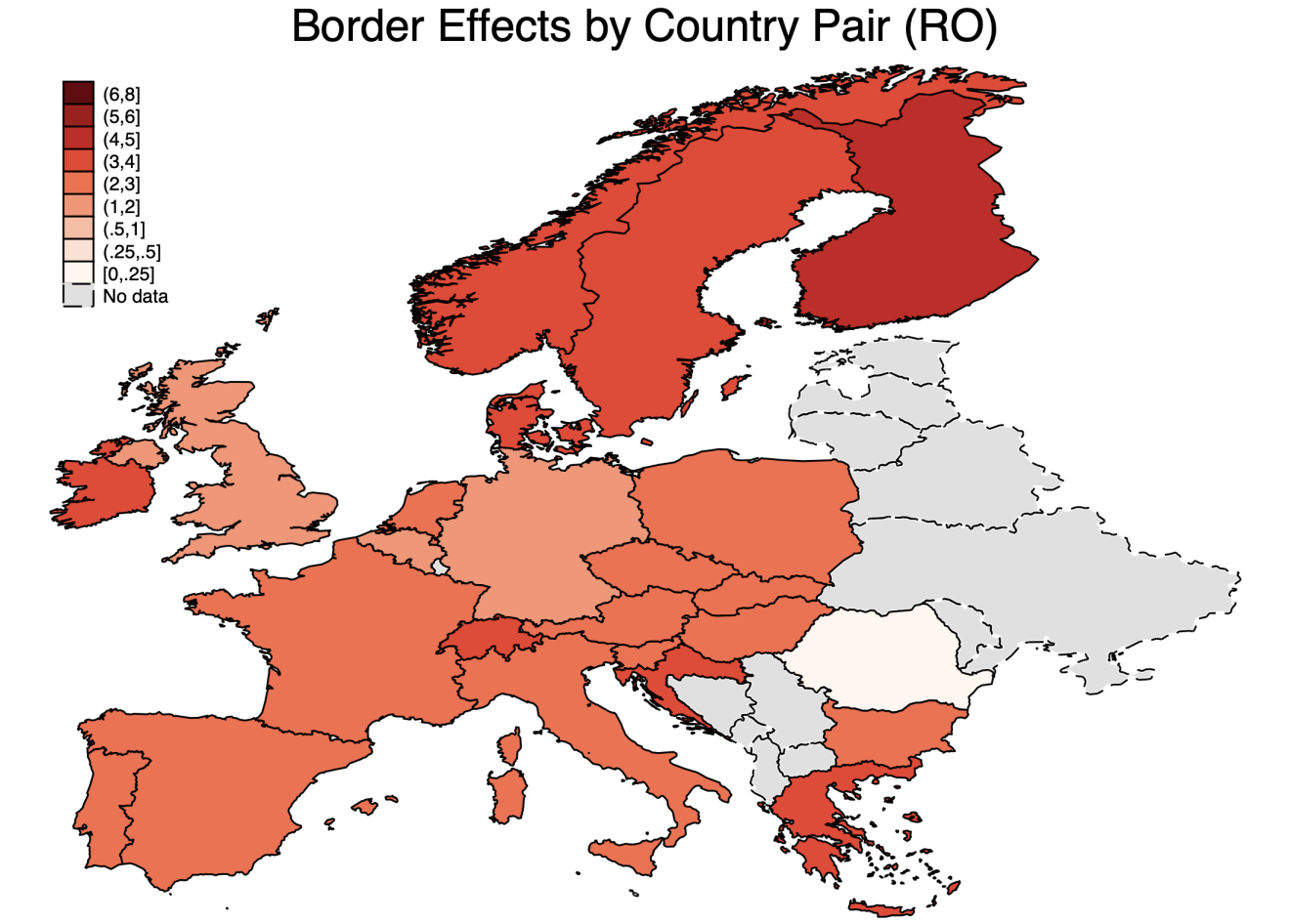

Back

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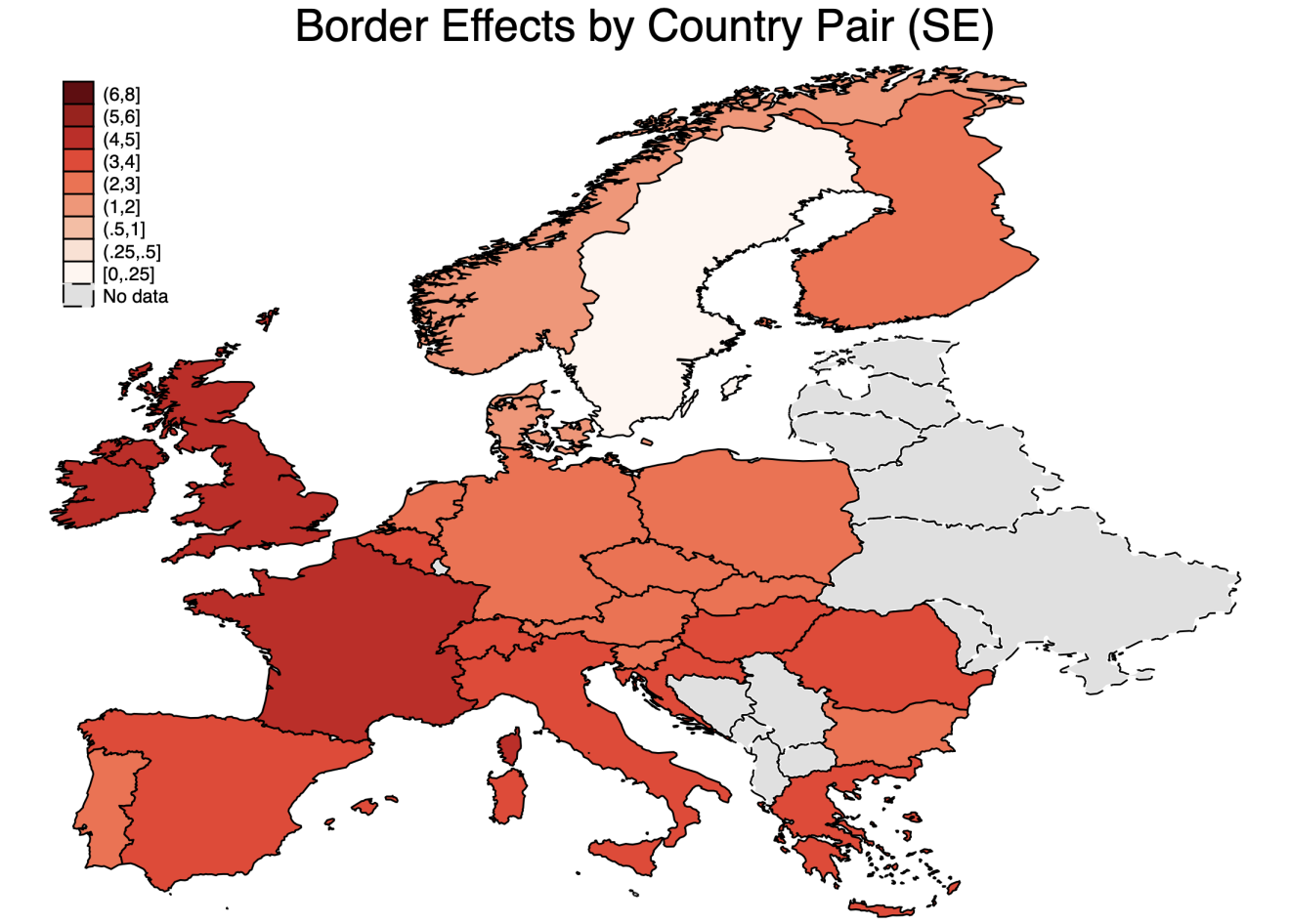

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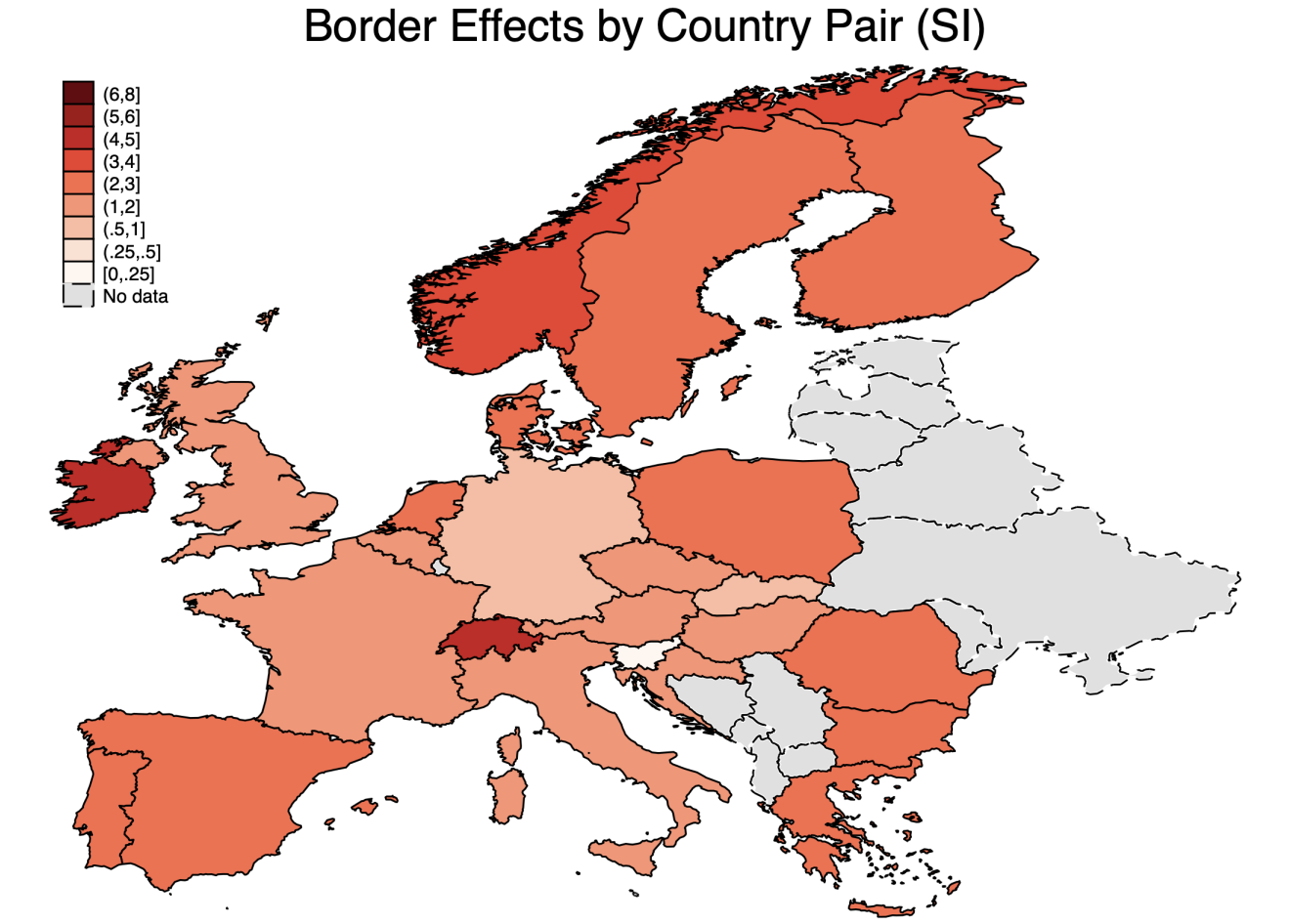

Back

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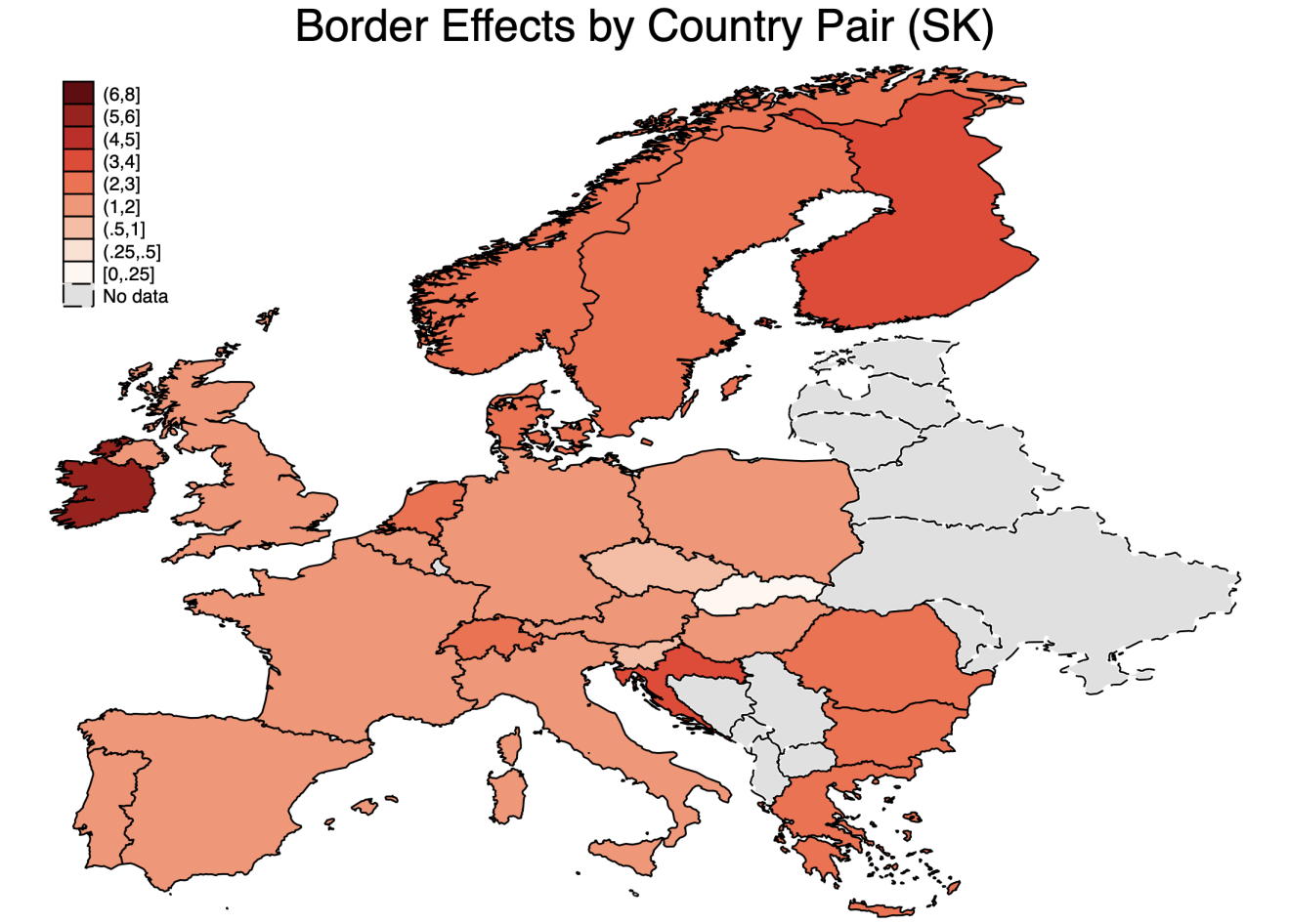

Back

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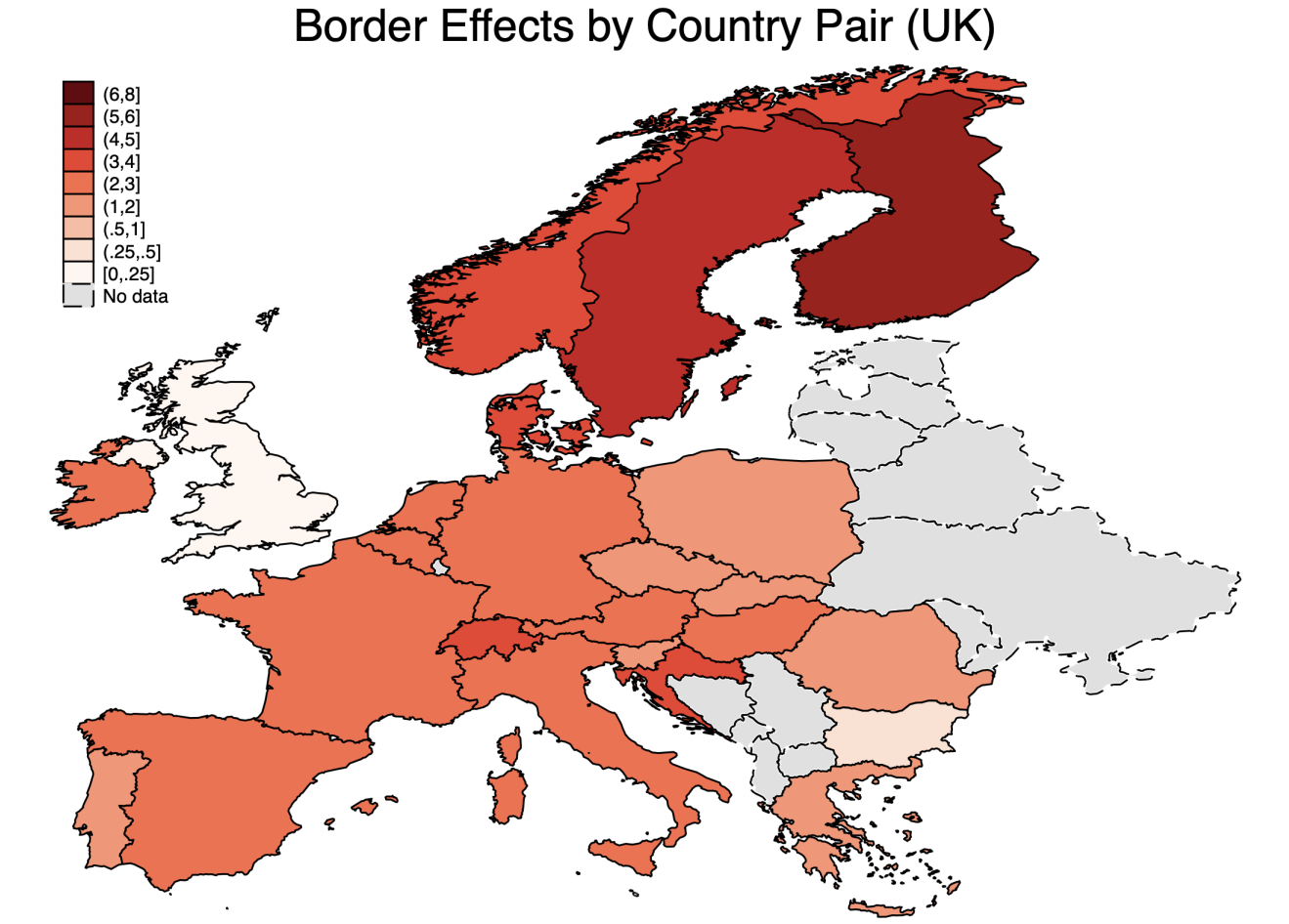


Back

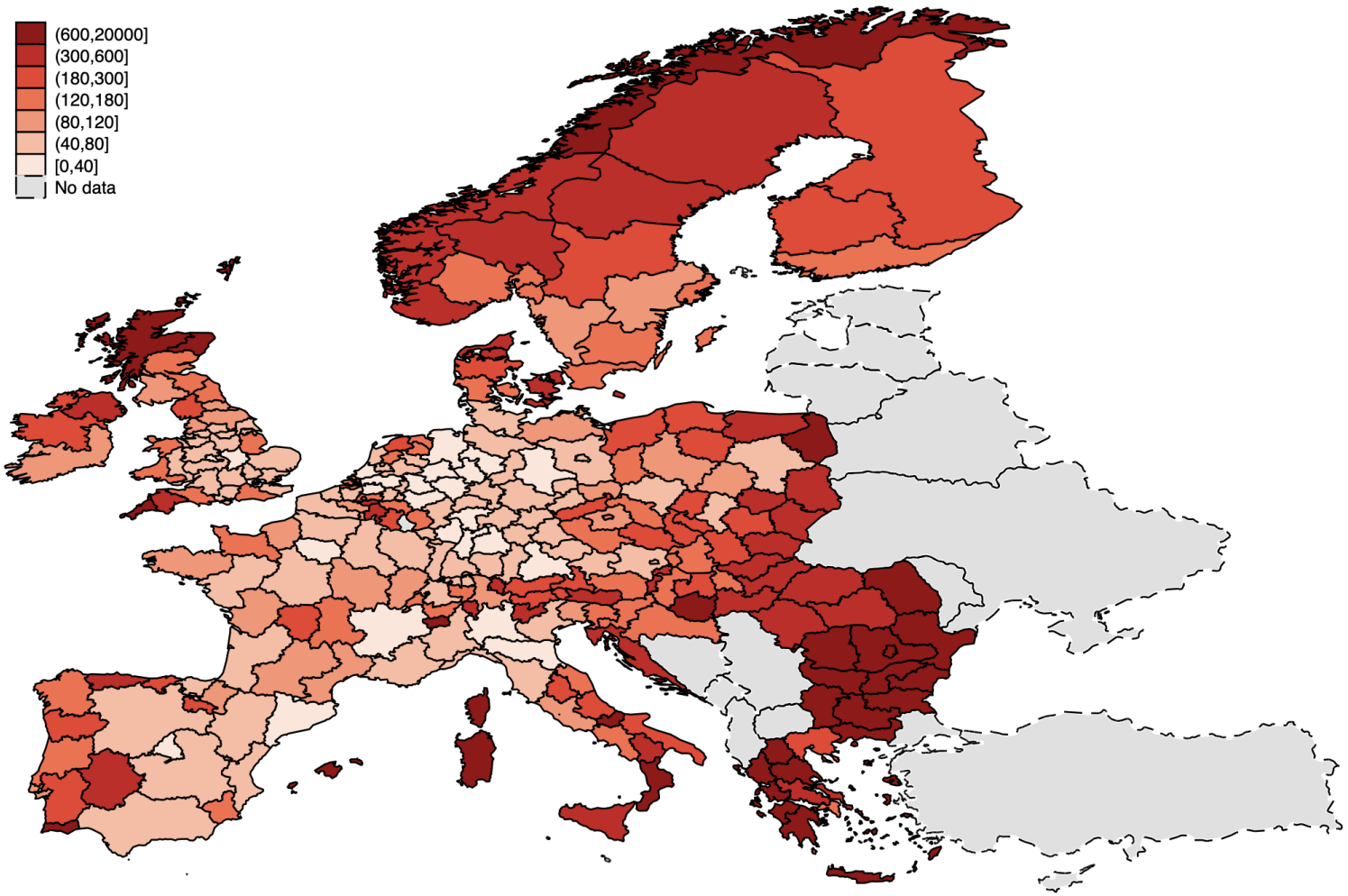
Heterogeneity in border effects

Table: Border effects for country pairs

Country	Border (Mean)	Border (SD)	Highest (1)	Highest (2)	Highest (3)	Lowest (1)	Lowest (2)	Lowest (3)
AT	-2.93	0.88	-5.24 (FI)	-4.68 (IE)	-3.84 (NO)	-1.45 (DE)	-1.55 (SI)	-1.96 (SK)
BE	-2.71	1.03	-5.30 (FI)	-4.57 (IE)	-4.32 (NO)	-1.35 (FR)	-1.53 (NL)	-1.68 (CZ)
BG	-3.18	1.25	-7.84 (NO)	-4.57 (HR)	-3.93 (PT)	-1.21 (IE)	-1.67 (UK)	-2.28 (EL)
CH	-3.50	0.77	-5.18 (IE)	-4.90 (SI)	-4.88 (HR)	-2.14 (DE)	-2.77 (SK)	-2.77 (BE)
CZ	-2.58	0.76	-4.07 (IE)	-3.82 (FI)	-3.65 (HR)	-0.84 (SK)	-1.48 (DE)	-1.68 (BE)
DE	-2.53	1.07	-5.17 (FI)	-4.99 (IE)	-3.92 (NO)	-1.43 (SK)	-1.45 (AT)	-1.48 (CZ)
DK	-3.18	0.68	-4.61 (FI)	-4.44 (UK)	-4.42 (IE)	-2.28 (BG)	-2.29 (PL)	-2.33 (SE)
EL	-2.90	1.15	-5.19 (HR)	-4.05 (SE)	-3.83 (ES)	-1.80 (NO)	-2.28 (BG)	-2.36 (UK)
ES	-3.17	1.10	-5.60 (IE)	-5.18 (FI)	-4.82 (NO)	-1.43 (PT)	-1.70 (FR)	-2.01 (BE)
FI	-4.47	1.39	-6.50 (PT)	-6.39 (IE)	-6.39 (UK)	-2.60 (BG)	-2.99 (SE)	-3.82 (CZ)
FR	-3.10	1.12	-5.36 (IE)	-5.06 (FI)	-4.89 (NO)	-1.35 (BE)	-1.70 (ES)	-1.93 (SI)
HR	-4.11	0.91	-5.87 (IE)	-5.59 (PT)	-5.27 (FI)	-1.91 (SI)	-3.02 (AT)	-3.13 (HU)
HU	-2.94	0.97	-5.09 (IE)	-4.69 (NO)	-4.29 (FI)	-1.50 (SI)	-1.59 (DE)	-1.72 (SK)
IE	-4.57	1.47	-6.39 (FI)	-6.19 (PT)	-5.87 (HR)	-1.21 (BG)	-3.31 (UK)	-4.02 (NL)
IT	-2.98	0.84	-4.93 (IE)	-4.68 (FI)	-4.48 (NO)	-1.88 (SI)	-2.04 (SK)	-2.13 (PL)
NL	-2.84	0.76	-4.89 (FI)	-4.02 (IE)	-3.93 (NO)	-1.53 (BE)	-1.72 (DE)	-2.08 (PL)
NO	-4.07	1.17	-7.84 (BG)	-4.97 (IE)	-4.89 (FR)	-1.80 (EL)	-2.13 (SE)	-2.72 (DK)
PL	-2.73	0.69	-4.13 (HR)	-4.07 (IE)	-3.94 (FI)	-1.58 (DE)	-1.76 (BE)	-2.08 (NL)
PT	-3.38	1.24	-6.50 (FI)	-6.19 (IE)	-5.59 (HR)	-1.43 (ES)	-2.11 (SK)	-2.20 (FR)
RO	-3.25	0.66	-4.70 (FI)	-4.32 (HR)	-4.27 (NO)	-2.28 (BE)	-2.43 (HU)	-2.48 (UK)
SE	-3.65	0.79	-5.39 (IE)	-4.97 (UK)	-4.64 (FR)	-2.13 (NO)	-2.33 (DK)	-2.86 (PL)
SI	-2.86	1.11	-5.01 (IE)	-4.90 (CH)	-4.30 (NO)	-1.31 (SK)	-1.50 (HU)	-1.54 (DE)
SK	-2.60	1.00	-5.64 (IE)	-3.91 (FI)	-3.51 (HR)	-0.84 (CZ)	-1.31 (SI)	-1.43 (DE)
UK	-3.37	1.03	-6.39 (FI)	-4.97 (SE)	-4.78 (NO)	-1.67 (BG)	-2.29 (PL)	-2.36 (EL)

Back

S_{nm} Home



Back

Home bias: determinants

Table: Home Bias: Determinants

	(1) Home	(2) Home	(3) Home
Log(Distance)	-0.0171	0.229**	-0.0266
	(0.145)	(0.0904)	(0.187)
Log(European Remoteness)	2.345***	1.353***	1.551***
	(0.265)	(0.194)	(0.466)
Island Region	1.872***	0.915**	0.988***
	(0.509)	(0.364)	(0.328)
Mountain Region	0.304**	0.154**	0.193**
	(0.118)	(0.0722)	(0.0831)
Major Port Region		-0.197	-0.127
		(0.129)	(0.107)
Motorway Density		-6.379***	-6.510***
		(1.179)	(1.454)
Log(Population)		-0.819***	-0.758***
		(0.0488)	(0.0590)
Share of Emp. (Manuf.)		-10.48***	-10.01***
		(1.174)	(1.905)
Share of Emp. (Public)		-16.84***	-0.410
		(1.634)	(3.917)
Sh. Secondary or tertiary educ		1.511***	-1.399
		(0.398)	(0.903)
Share Migrant Pop.		-2.287***	-0.386
		(0.500)	(0.702)
Country FE	No	No	Yes
Observations	269	265	265
R^2	0.410	0.799	0.890

Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

Back