Can internet infrastructure help reduce regional disparities? Evidence from Turkey

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RELEVANCE

Night map, Turkey (2012)

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- high residential rents,
- perception of fairness and loss of trust within the population, etc.

Information, communication, and economic geography

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- changing the NEG equilibrium through decreasing the costs of communication,
- increasing the demand for product variety and attracting firms to the region, etc.

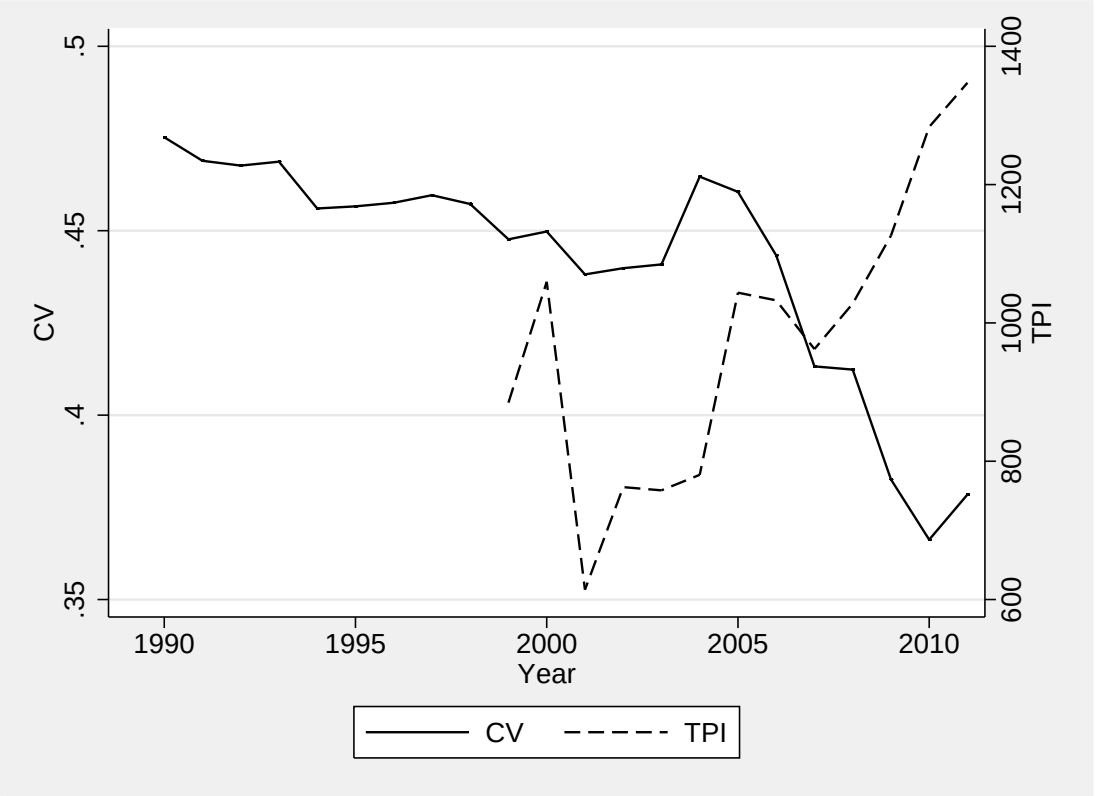
THEORETICAL BACKGROUND

$$(1/T)ln\left(\frac{y_{i,t_0+T}}{y_{i,t_0}}\right) = \alpha - \underbrace{\left(\frac{1-e^{-bT}}{T}\right)}_{\beta} ln(y_{i,t_0}) + \varepsilon_i \qquad (1)$$

$$ln(y_{i,t_0+T}) = \theta + (1+\beta)ln(y_{i,t_0}) + \nu_i \qquad (2)$$

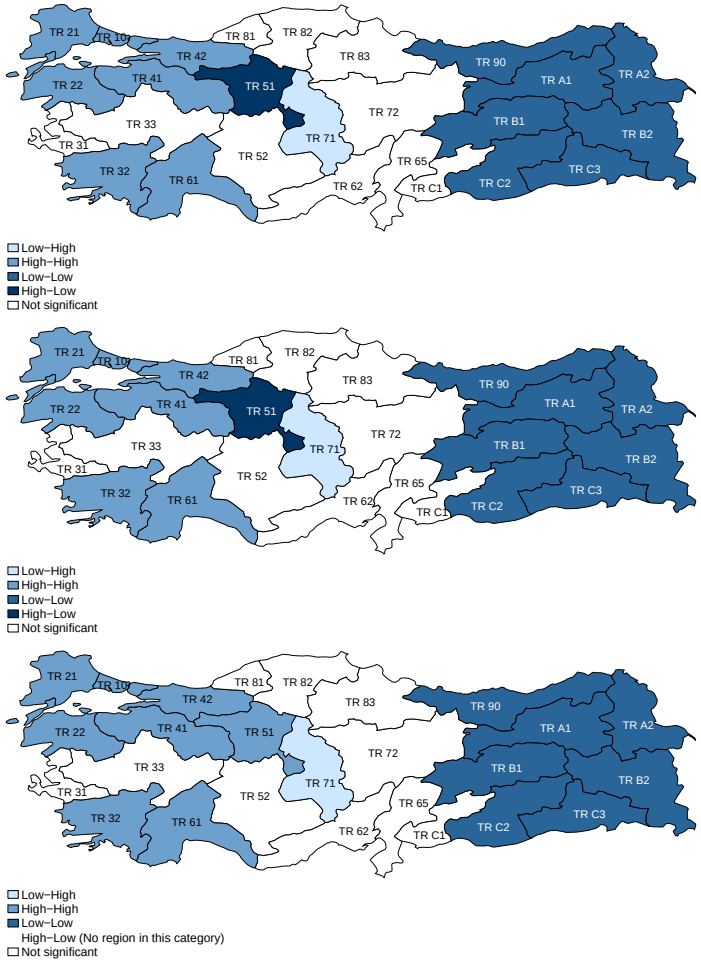
REGIONAL PATTERNS OF INCOME PER CAPITA IN TURKEY

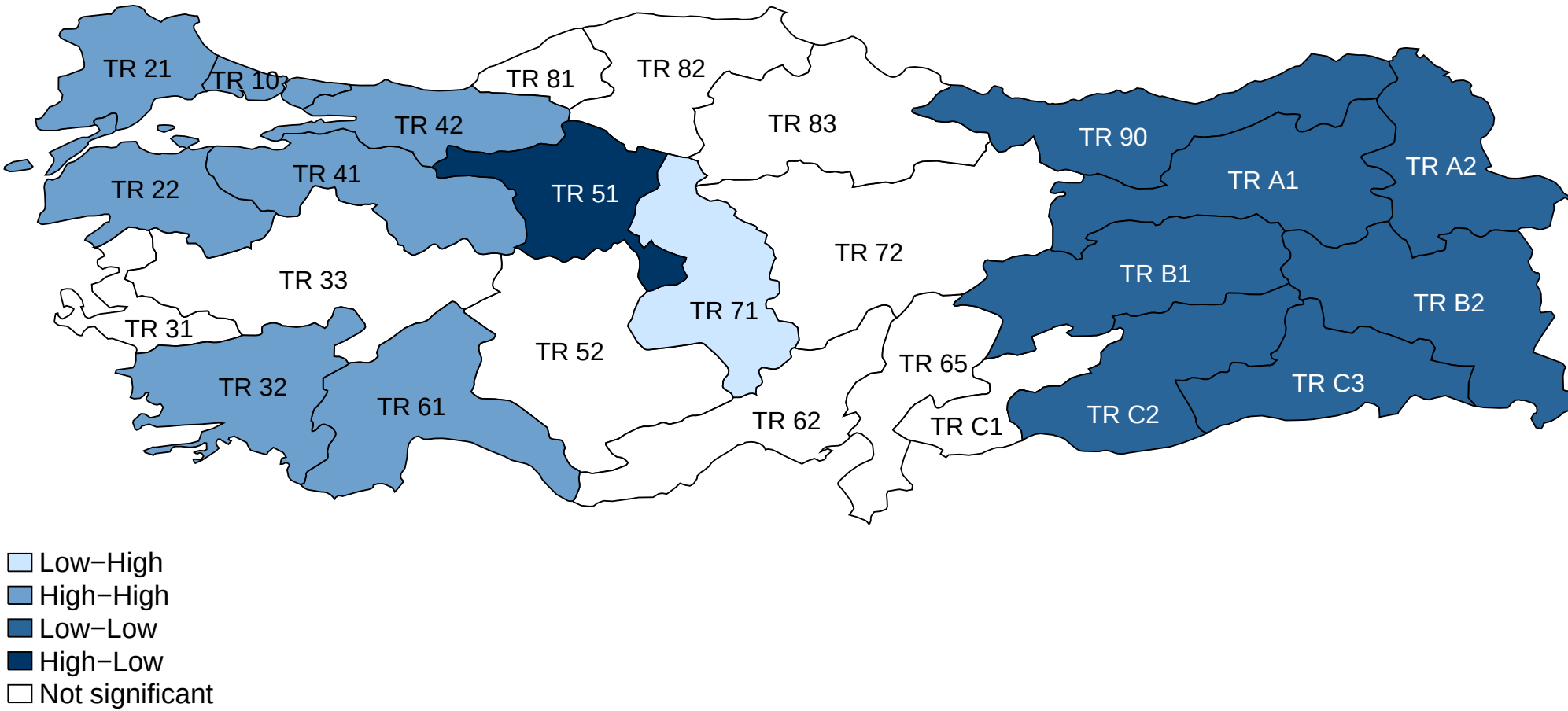
Sigma convergence represented by the coefficient of variation, and TPI (millions), 1990-2011



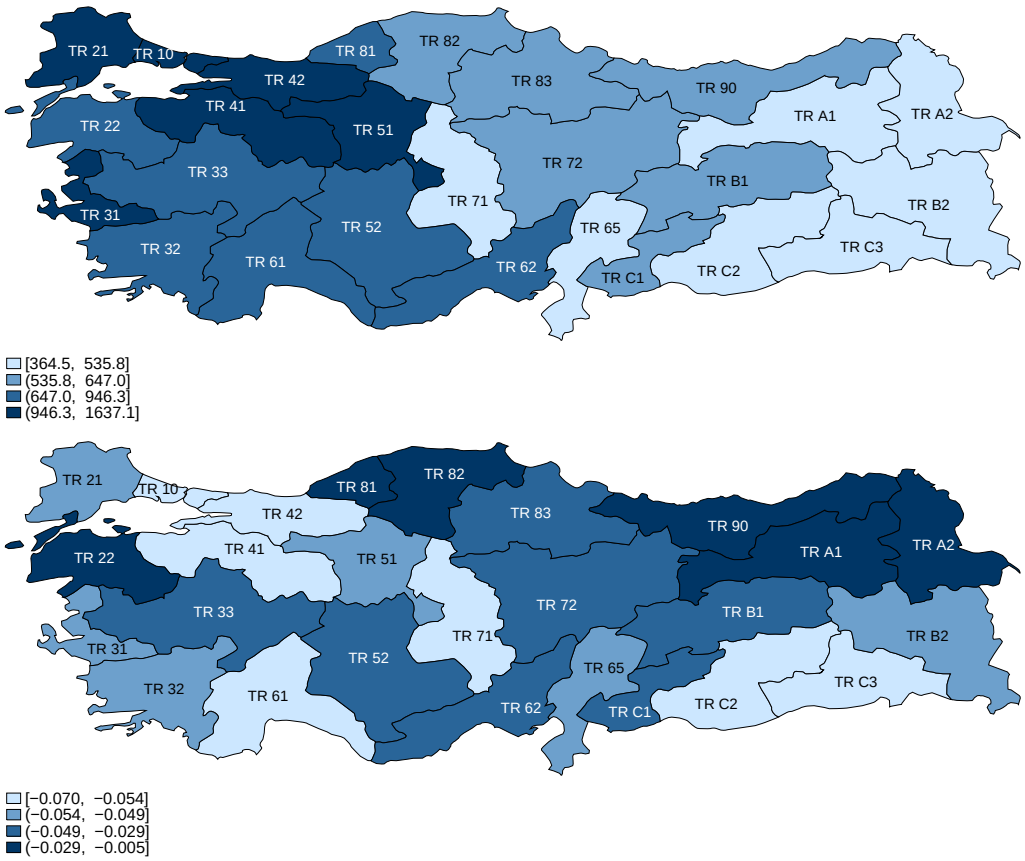
- Local Moran's I: shows the extent of significant local spatial clustering around individual regions for 1990, 1999, and 2011 ($I_i = z_i \sum_j w_{ij} z_j$).

- Moran significance map.

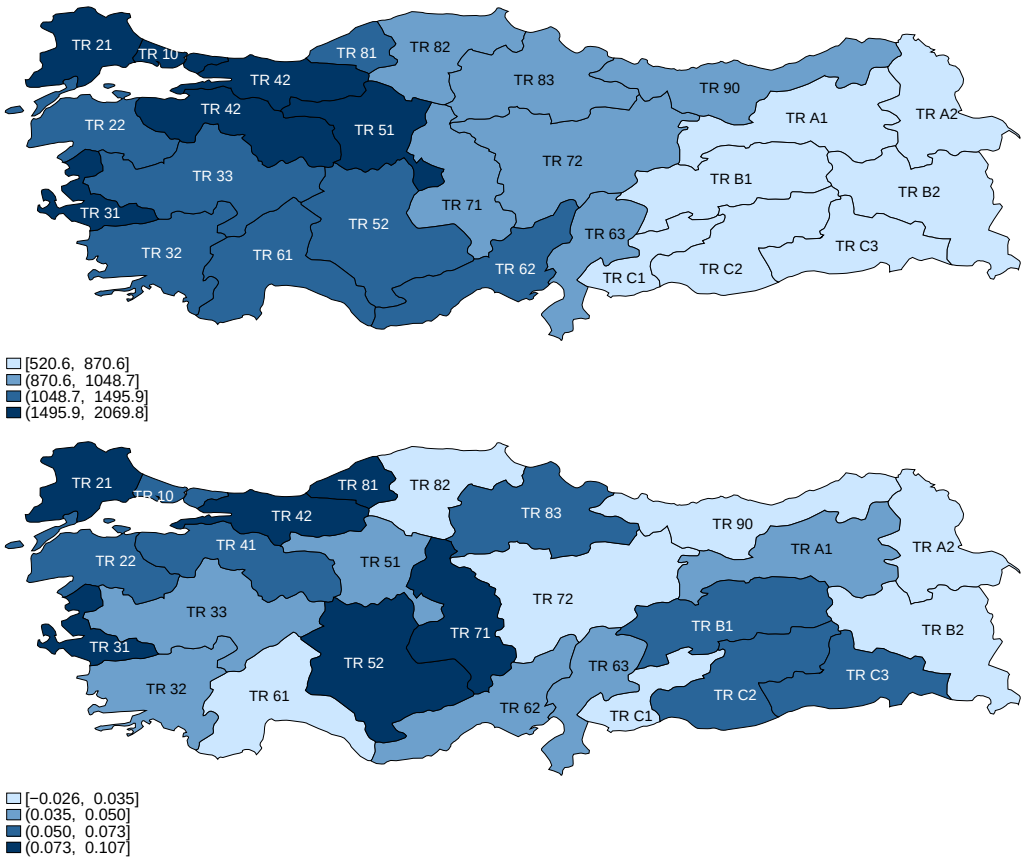



TR 21
TR 10
TR 81
TR 82
TR 42
TR 83
TR 90
TR 41
TR 51
TR 22
TR A1
TR A2
TR 72
TR 33
TR B1
TR 71
TR B2
TR 31
TR 52
TR 65
TR 32
TR 61
TR C3
TR 62
TR C1
TR C2
Low−High
High−High
Low−Low
High−Low
Not significant

- Income per capita and its growth rate, 1999.



- Income per capita and its growth rate, 2011.



EMPIRICAL APPROACH

- SAR:

$$ln(y_{i,t_0+T}) = \alpha + \rho \sum_{j=1}^{N} w_{ij} ln(y_{j,t_0+T}) + (1+\beta) ln(y_{i,t_0}) + \nu_i \quad (3)$$

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- SEM:

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$$\text{where} \quad \nu_i = \lambda \sum_{j=1}^{N} w_{ij} \nu_j + \zeta_i \quad (4)$$

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- GSM:

$$ln(y_{i,t_0+T}) = \alpha + \rho \sum_{j=1}^{N} w_{ij} ln(y_{j,t_0+T}) + (1+\beta) ln(y_{i,t_0}) + \nu_i$$

$$\text{where} \quad \nu_i = \lambda \sum_{i=1}^{N} c_{ij} \nu_j + \zeta_i \quad (5)$$

... and panel variants with regional characteristics, fixed regional effects, year dummies, and interaction between internet infrastructure and past GVA per capita:

$$\sum_{k=1}^{m} \gamma_k x_{k,it} = \gamma_1 lnc_{it} + \gamma_2 ln\ y_{i,t-1} \times ln\ c_{it} + \gamma_3 lna_{it} + \gamma_4 r_{it}$$

so marginal effect of $ln\ y_{i,t-1}$ is now defined as $e^{-b(ln\ c_{it})T}$ (i.e the speed of convergence is a function of internet infrastructure)

ESTIMATION RESULTS

Table 2.2
Cross-sectional estimation results

	(1) Base Model	(2) SAR	(3) SEM	(4) GSM
$ln\ y_0$	0.865***	0.744***	0.907***	0.769***
	(0.0472)	(0.0695)	(0.0253)	(0.0714)
α	1.322***	-0.563	1.047***	-0.334
	(0.318)	(0.890)	(0.167)	(0.741)
β	-0.135***	-0.256***	-0.0934***	-0.231***
	(0.0472)	(0.0695)	(0.0253)	(0.0714)
ρ		0.381**		0.325**
		(0.174)		(0.164)
λ			-1.403**	-0.856
			(0.596)	(0.757)
Convergence speed	0.0121	0.0246	0.00817	0.0219
Half-life	57.23	28.16	84.87	31.62
Observations	26	26	26	26
Log-likelihood	25.55	28.41	27.38	29.06
AIC	-47.11	-48.83	-46.76	-48.11
BIC	-44.59	-43.79	-41.73	-41.82

Stata module for spatial models: SPAUTOREG (see footnote 28).
SAR: Spatial Autoregressive Model.
SEM:Spatial Error Model.
GSM: General Spatial Model.
Standard errors in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 2.3
PANEL ESTIMATION RESULTS

	(1) Base Model	(2) Base Model	(3) SAR	(4) SEM	(5) GSM
$ln\ y_{i,t\text{-}1}$	0.987***	0.819***	0.819***	0.822***	0.821***
	(0.00503)	(0.0397)	(0.0325)	(0.0322)	(0.0325)
β	-0.0126***	-0.181***	-0.181***	-0.178***	-0.179***
	(0.00503)	(0.0397)	(0.0325)	(0.0322)	(0.0325)
ρ			0.141		-0.0288
			(0.103)		(0.140)
λ				0.323**	0.343**
				(0.128)	(0.157)
Convergence speed	0.0127	0.200	0.199	0.196	0.197
Half-life (years)	54.79	3.467	3.482	3.541	3.520
Observations	338	338	338	338	338
Observations per region	13	13	13	13	13
Log-likelihood	641.8	662.2	663.1	665.0	665.0
Fixed effects	No	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes

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TABLE 2.4
PANEL ESTIMATION RESULTS

	(1) Base Model	(2) SAR	(3) SEM	(4) GSM
$ln\ y_{i,t\text{-}1}$	1.002***	0.997***	1.001***	0.999***
	(0.0702)	(0.0599)	(0.0601)	(0.0606)
$ln\ y_{i,t\text{-}1} \times ln\ c_{it}$	-0.0204***	-0.0199***	-0.0201***	-0.0200***
	(0.00565)	(0.00472)	(0.00476)	(0.00482)
$ln\ c_{it}$	0.145***	0.142***	0.143***	0.142***
	(0.0377)	(0.0312)	(0.0316)	(0.0319)
$ln\ a_{it}$	0.0795**	0.0784**	0.0767**	0.0768**
	(0.0343)	(0.0306)	(0.0308)	(0.0308)
r_{it}	-0.0178	-0.0172	-0.0177	-0.0175
	(0.0126)	(0.0129)	(0.0128)	(0.0129)
ρ		0.0538		0.0243
		(0.104)		(0.126)
λ			0.100	0.0808
			(0.154)	(0.185)
Observations	338	338	338	338
Observations per region	13	13	13	13
Log-likelihood	681.3	681.4	681.5	681.5
Fixed effects	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes

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Table 2.5
Convergence factors, speeds, and associated half-lives
(Base model)

Percentile of c	Convergence factor	Convergence speed	Half-life (years)
1%	-0.138	0.148	4.671
5%	-0.158	0.172	4.019
25%	-0.199	0.222	3.126
50%	-0.213	0.240	2.893
75%	-0.224	0.254	2.734
95%	-0.235	0.268	2.588
99%	-0.241	0.276	2.510

Table 2.6
Model comparison versus GSM

	Base model (FE)	SAR	SEM
(a) Absolute convergence cross-sectional models			
LR test p-value	0.030	0.256	0.067
Wald test p-value	0.020	0.258	0.047
(b) Absolute convergence panel models			
LR test p-value	0.059	0.049	0.836
Wald test p-value	0.035	0.029	0.837
(c) Conditional convergence panel models			
LR test p-value	0.799	0.667	0.848
Wald test p-value	0.797	0.662	0.847

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CONCLUSION

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- Air transport capacity was also found to play a contributing role to a regional economy.
- The economic geography of Turkey is defined by a strong core-periphery pattern.
- However, controlling for spatial effects did not change any of our main findings.

Thank you very much.

Q & A