EU Cohesion Policy on the Ground: Analyzing Small-Scale Effects Using Satellite Data

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Motivation

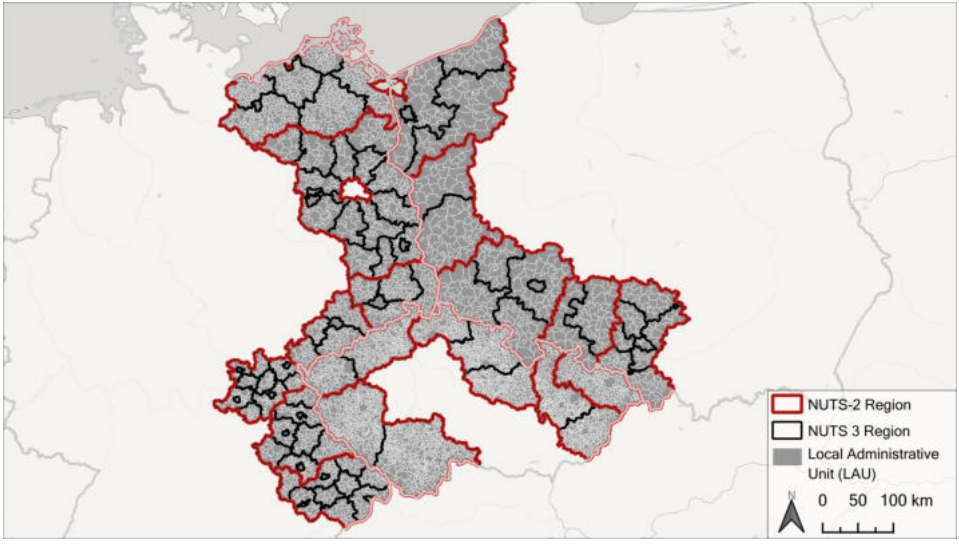
What are the small-scale effects of the EU's cohesion policy, and which types of funding have stronger or weaker local effects?

- Lack of consensus and clear-cut empirical evidence on the effectiveness of cohesion policy
  - Most evaluation literature on the level of NUTS-2 (or NUTS-3) regions
  - Most papers report positive association between funding and growth, others insignificant or negative effects (Dall'Erba and Fang, 2017)
  - Few studies studying economic effects of EU cohesion policy at the municipality level for single countries (Cerqa and Pellegrini 2018, Mayerhofer et al. 2020)
- Lack of more granular data on both funding and outcome variables

Aim of our Project

- Employ a novel approach for **analyzing the effects of EU cohesion policy on local economic activity**
- Link comprehensive **project-level EU funding database** with satellite imagery
- Exploit the potential of **remote sensing data at spatially granular level**
- Assess effects for sample region of municipalities in the border regions in the Czech Republic, Germany, and Poland
- Spatial granularity allows analyzing **spillovers** and **heterogeneity by project types**

Overview of the Sample Region - NUTS-2/3 and LAU



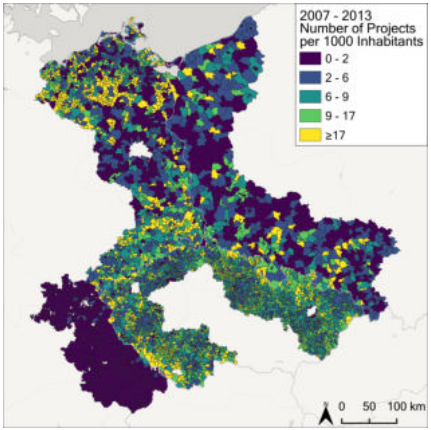
Data on EU Funding

- Dataset of projects co-funded by the European Regional Development Fund (ERDF) and the Cohesion Fund
- Programming period 2007-13
  - Source: lists of beneficiaries published by managing authorities, KEEP database for INTERREG projects
  - Geo-location of projects according to project (or beneficiary) postcode(s) or city name(s)
  - Spatial matching of postcodes and LAU
- Total: 119,000 projects in 6571 municipalities

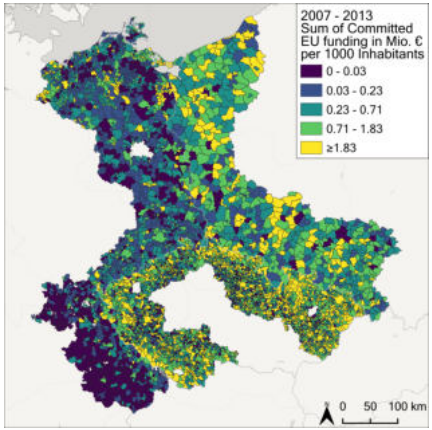
Distribution of EU Funding Across Municipalities

- On average, 17 projects per LAU
- Average funding per project: 260,000 Euro (median: 50,000 Euro)
- Thematic distribution varies across countries

Distribution of Funding: Number of Projects and Sum of Committed EU Funding per 1000 Inhabitants



(a) Number of projects



(b) Sum of committed funding

Night Light Data from Satellite Images

- Growing literature on how remote sensing data can be used to evaluate place-based economic policies (e.g., Davidson and Storeygard 2016) and proxy urban and regional economic development (e.g., Wu and Wang 2019, Zhu et al. 2017, Lessmann and Seidel 2017)
- Calibration and preprocessing of multi-temporal, large scale satellite data
- Aggregation of spatial database of satellite data as a proxy for economic development
- Spatial reference unit LAU: full integration into project database


Myzków, PL
2014
N
0
100
200 m


Myzków, PL
2019


Myzków, PL
2014


Myzków, PL
2019

Estimation Strategy: Regional Funds and Economic Performance

- Target variable: Nighttime light emission (NLE) as proxy for economic activity
- Ideal experiment: Randomly allocate funds to municipalities in t_0 and compare growth rates in t_1
- Here: Compare growth rates of municipalities *i within* a NUTS-3 (or NUTS-2) region *j* which received more or less funds, conditional on observables
  - Controls include initial night light emissions, land cover, population
  - *Funding*: inverse hyperbolic sine transformation, given the highly skewed distribution of funding

$$\Delta NLE_{i,j} = \beta_0 + \beta_1 Funding_{i,j} + \beta_2 X_{i,j} + \phi_j + \varepsilon_{i,j}$$

Positive Association between Funding and Night Light Growth, 2007-2013

	(1) ΔNLE	(2) ΔNLE
Funding Amount	0.00745***	0.00334**
	(4.38)	(3.03)
$\log(NLE_{2007})$	-0.0694***	-0.184***
	(-4.46)	(-5.89)
Share Urban_{2007}		-0.278***
		(-5.49)
Share Cropland_{2007}		-0.136***
		(-5.08)
log(Population)		0.126***
		(5.95)
NUTS-3 FE	✓	✓
Observations	6555	6555

- For an average municipality receiving 625,500 Euro of annual funding, total nightlight emissions increase by 0.05%

Robustness Checks

- **Functional specifications:**
  - Results robust to various functional specifications
  - Significantly positive effects also for funding amount in million Euros, number of projects, ...
- **Intensive vs extensive margin:**
  - Larger estimates when only focusing on municipalities receiving funding
- **Pre-trends and selection effects:**
  - Placebo tests and pre-trends show no significantly higher impact in preceding periods

Distinction between Temporary and Permanent Effects

- Effects may be partly driven by ongoing construction work vs. impact of finished projects
- Solution:
  - Separate estimations for projects ending prior to 2013 vs. projects still ongoing in 2013
  - Analysis for subset of projects receiving funding in first half of MFF
- Results indicate a strong persistent effect of funding after project completion

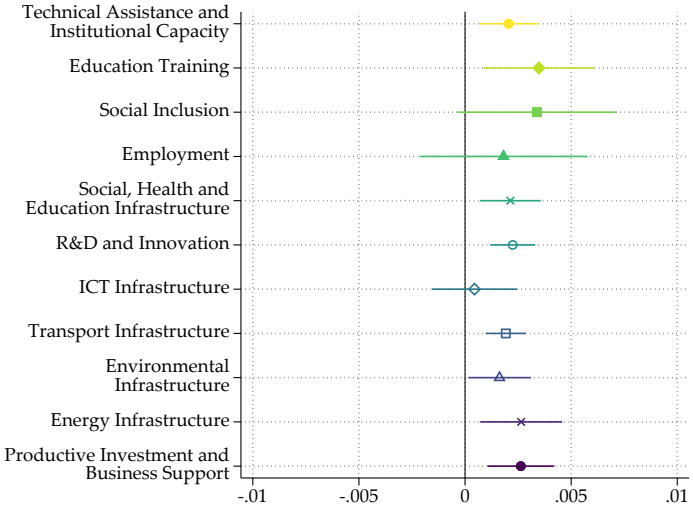
Temporary vs. Permanent Effects

	Finished before 2013		Ongoing in 2013		Funded in 2007-2009	
	(1) ΔNLE	(2) ΔNLE	(3) ΔNLE	(4) ΔNLE	(5) ΔNLE	(6) ΔNLE
Funding Amount	0.00319**	0.00237*	0.00324**	0.00210*	0.00662***	0.00301***
	(2.86)	(2.37)	(3.25)	(2.43)	(4.97)	(3.98)
log(NLE_{2007})	-0.0573***	-0.182***	-0.0568***	-0.182***	-0.0669***	-0.184***
	(-3.96)	(-5.88)	(-3.94)	(-5.87)	(-4.34)	(-5.89)
Share Urban_{2007}		-0.283***		-0.282***		-0.277***
		(-5.55)		(-5.51)		(-5.51)
Share Cropland_{2007}		-0.138***		-0.138***		-0.136***
		(-5.06)		(-5.04)		(-5.03)
log(Population)		0.130***		0.130***		0.126***
		(6.08)		(6.07)		(5.99)
NUTS-3 FE	✓	✓	✓	✓	✓	✓
Observations	6555	6555	6555	6555	6555	6555

Positive Spatial Spillovers to Neighboring Municipalities

	(1) ΔNLE	(2) ΔNLE
Funding Amount	0.00696***	0.00290**
	(4.50)	(2.80)
Funding Amount in Neighbouring Municipalities	0.00371	0.00433*
	(1.68)	(2.37)
Funding Amount Neighbours of Neighbours	0.00575*	0.00368*
	(2.23)	(1.99)
$\log(NLE_{2007})$	-0.0738***	-0.189***
	(-4.49)	(-5.91)
Share Urban_{2007}		-0.279***
		(-5.67)
Share Cropland_{2007}		-0.133***
		(-5.17)
log(Population)		0.126***
		(5.92)
NUTS-3 FE	✓	✓
Observations	6551	6551

Effects are Heterogeneous across Funding Categories



Summary

Contributions of this study

- Novel approach of estimating the local effects of EU cohesion policy by combining project-level data with satellite imagery
- Documentation and analysis of the spatial distribution of EU structural and cohesion funding at the level of municipalities
- Findings confirm positive and significant relationship between EU funding and local economic activity
- Remote-sensing data can be effectively used to capture small-scale effects of place-based policies
- Approach could be applied to other contexts, such as Next Generation EU investment projects

Thank you!

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