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New Evidence on the Effects of EU Regional Policy*

EU Cohesion Policy constitutes an important item in the EU budget. For the Multiannual Financial Framework 2021–2027, EUR 392 billion is reserved for the promotion of economic and social cohesion among the regions of the European Union. However, previous literature has not reached an agreement on the effectiveness of EU cohesion policy in promoting economic development. A key problem for identification is that the effects of EU regional policy can only be analyzed at the level of NUTS-2 and NUTS-3 regions due to a lack of more precise spatial information. However, as funding is targeted at regions with low economic performance, it is often difficult to distinguish the direct effects of regional policy from other local growth trends.

In Bachtrögler-Unger et al. (2023), we develop a novel approach to estimating the effect of EU cohesion policy on economic activity: we combine a new project database that contains detailed information on the distribution of EU funds spent in local administrative units (LAUs), i.e., the municipalities and communes of the European Union, with remote sensing data. Many EU member states lack information on GDP or other (comparable) measures of economic activity at the municipal level. Guided by the hypothesis that increased economic growth is accompanied by changes in spatial-structural parameters, we overcome this data limitation by using changes in aggregated municipality-level total nighttime light emissions to proxy the development of local economic activity.

* This contribution is a short version of Bachtrögler-Unger et al. (2023).

KEY MESSAGES

- **We present a novel approach to assess the effect of EU cohesion policy on economic activity**
- **Project-level data on EU funding is combined with nighttime light emissions data**
- **Higher EU funding is associated with increased economic activity at the municipal level**
- **Remote sensing data can provide an effective way to model local economic development in Europe**
- **Improved access to data on EU-funded projects would enhance transparency of EU regional funding**

We estimate the effect of EU regional funds on economic activity for the municipalities located in the NUTS-2 regions adjacent to the border between the Czech Republic, Germany, and Poland for the programming period 2007–2013. The EU regional policy provides targeted support to NUTS-2 regions with lower economic performance. However, there are no specific rules for the distribution of funds within a NUTS-2 region. Our granular approach therefore makes it possible to break the mechanical link between economic performance and funding levels, which has often complicated the interpretation of previous studies.

Our approach can be illustrated with the help of the following case study. Figure 1 shows the town of Myszków in Poland. There, a bypass was built with EU funds from 2014 onwards. Figures 1 a) and b) show

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Figure 1

EU-Funded Construction of a Bypass in Myszków, Poland

(a) View of Myszków 2014

(b) View of Myszków 2019

(c) Nighttime light emissions 2014

(d) Nighttime light emissions 2019

Note: The photographs show the town of Myszków, Poland, before and after the construction of a local bypass. The photographs were taken in 2014 and 2019, respectively. As a result of the improved infrastructure, a commercial area is developing next to the newly built bypass, which can be seen in the southern part of the 2019 image. In addition, figures c) and d) show the average annual nighttime light emissions. Blue colours indicate low nighttime light emissions, yellow colours indicate high nighttime light emissions. An increase in nighttime light emissions can be seen in the area of the newly developed industrial estate, while emissions in the rest of the city remain relatively stable. Map data © 2021 CNES/Airbus, Google.

the town before and after the construction of the bypass to the west of the town, in 2014 and 2019. As a direct result of the new road, an industrial estate was built along the bypass, with the first businesses settling there already in 2019. In this detailed view, it is clear to see how this project has triggered a landscape change associated with economic development. This development can also be seen in the change in nighttime light emissions. Comparing Figures 1 c) and d), the local development can be directly and clearly linked to the changes in the satellite data. The creation of commercial areas in the south led to an increase in nighttime light emissions, while emissions in the city remained relatively stable.

Sample Region. We collect data for the NUTS-2 regions adjacent to the border between the Czech Republic, Germany, and Poland. Thus, the sample region comprises less-developed NUTS-2 regions (all Polish and Czech regions, and some regions in Germany, such as Chemnitz and Mecklenburg-Vorpommern) and regions with a relatively high GDP per capita compared to the EU average (in Bavaria, Germany). Furthermore, the sample region consists of both urban centers (such as Wrocław, Poland, or Dresden, Germany) and rural areas, which allows us to exploit rich variation in EU funding within and across NUTS-2 regions. Figure 2 depicts the sample region. The investigated region comprises 17 NUTS-2 regions and 102 NUTS-3 regions, and consists of 6,555 municipalities.

Data on EU Funding. As the policy variable of interest, we explore EU support provided via the European Regional Development Fund (ERDF) and the Cohesion Fund (CF). Projects co-financed by the European Social Fund (ESF) are not considered in the baseline results, as information on the exact location of a large share of final beneficiaries (often individuals) is not available. In addition, ESF projects, such as training or labor market measures, are expected to be less visible from space than, for example, infrastructure projects co-financed by the CF or ERDF. We retrieve project-level data on ERDF and CF support from lists of beneficiaries provided by the managing authorities, as well as for INTERREG projects (in cross-border, transnational, and interregional co-operation programs, part of ERDF) from the KEEP database. We enrich this data set with geographic information on the location of each project.

Remote Sensing Data and Economic Activity. At the municipality level, no GDP data or other comparable information on economic development is available in our sample region. Therefore, we use nighttime light emissions as a proxy for changes in local economic activity. Nighttime light emissions have been associated with urban and regional economic development in previous studies (Zhu et al. 2017; Wu and Wang 2019). They provide meaningful features for quantifying human-made local environmental change and are available as consistent time series for the whole sample region. Moreover, there is unrestricted and free data access under an open data license. We use data from the "Defense Meteorological Satellite Program Operational Linescan System" (DMSP-OLS), which is the only sensor that provides uninterrupted coverage of global nighttime light imagery for the period 2007–2013. The

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DMSP data encodes each pixel of 30-arc-seconds resolution with digital numbers (DN), which measure annual brightness on a relative scale ranging from 0 to 63. Our main analysis focuses on the growth in total nighttime light emissions, i.e., the sum of digital numbers, per municipality.

SPATIAL DISTRIBUTION OF EU REGIONAL FUNDS

The dataset of co-funded projects generated for this paper allows for localizing ERDF and CF funding at the municipality level. To the best of our knowledge, we are the first to document and analyze the distribution of regional funds at such a fine geographical level of aggregation for more than one country. Moreover, our dataset allows us to differentiate between thematic categories, and to document which municipalities in our sample region invested how much of EU funding in which area. Figure 3 maps the intensity of EU funding received in the 2007–2013 programming period in terms of the number of projects and the sum of committed EU funding per municipality in current prices. As Panel (b) of Figure 3 shows, there is a large dispersion of funding amounts between and within countries. One factor is that Germany receives no funding from the Cohesion Fund and, by definition, less from the ERDF due to the level of development of its NUTS-2 regions in the sample.

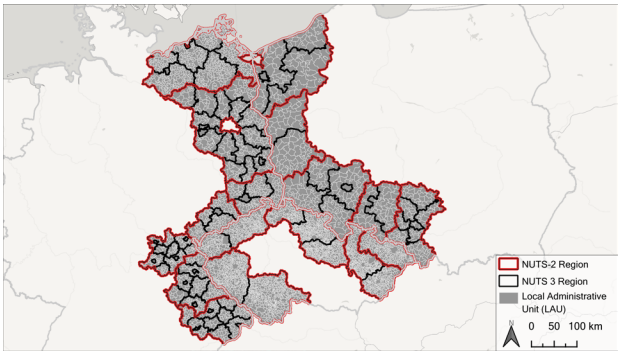
REGIONAL FUNDS AND ECONOMIC PERFORMANCE

To analyze the effects of EU cohesion policy on growth, one would ideally like to allocate funds randomly across municipalities or regions, so that the funding effect is independent of any other factors accounting for growth-rate differentials. In reality, most of the funds are instead explicitly targeted at economically less-developed NUTS-2 regions. The main strength of our research design is the ability to observe variation in EU funding within NUTS-2 and NUTS-3 regions. This allows us to break the mechanical endogeneity of funding and economic growth (proxied by growth in nighttime light emissions) by including fixed effects at the level of NUTS-3 regions. In all our analyses, we compare whether municipalities within a given NUTS-3 region that received comparatively more funding experienced stronger growth.

However, even within a given NUTS-3 region, it is likely that the EU funding amount committed to a municipality depends on observable and unobservable local characteristics, such as the presence of innovative actors who develop projects and successfully apply for funding. As shown in our paper, funding is more likely to flow into municipalities with high initial nighttime light emissions, and also varies with population size and land cover. To account for these factors as well as for a potential convergence effect (municipalities with a higher level of initial nighttime light emissions grow at slower rates), we control for the initial nighttime light emissions in 2007, the share of urban area, the share of cropland, and log population, all at the municipality level. Our results should

Figure 2

Overview of the Sample Region

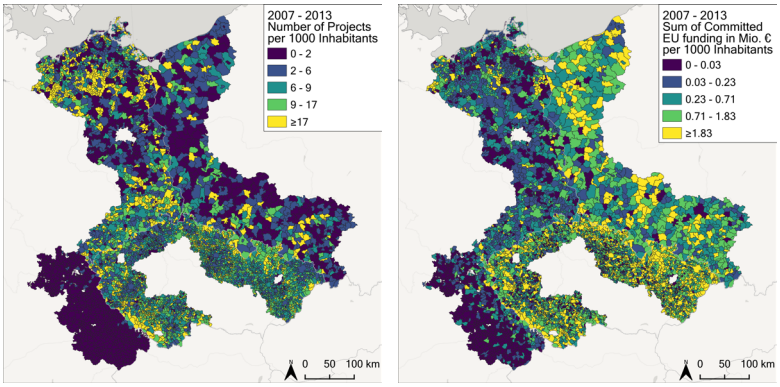


Note: This figure shows NUTS-2 and NUTS-3 regions as well as Local Administrative Units in the border region between the Czech Republic, Germany and Poland. The sample region comprises the municipalities located in the NUTS-2 regions adjacent to the border, which is why the NUTS-2 region of Berlin (corresponding to one NUTS-3 region and one LAU) is not included. We exclude 16 uninhabited military training grounds with own municipal status in Germany and the Czech Republic.
Source: Bachtrögler-Unger et al. (2023).

Figure 3

Number of Projects and Sum of Committed Funding

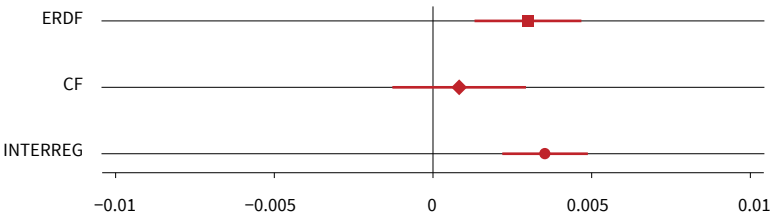
(a) Number of projects **(b) Sum of committed funding**



Note: This figure shows heat maps of the number of projects Panel (a) and the sum of committed funding Panel (b) for all municipalities in the sample for the years 2007-2013. The sample region comprises the municipalities located in the NUTS-2 regions adjacent to the border, which is why the NUTS-2 region of Berlin (corresponding to one NUTS-3 region and one LAU) is not included. 16 LAUs without population are excluded, e.g., military areas or areas without local authority. The colors represent quintiles of the distribution of the respective variable.
Source: Bachtrögler-Unger et al. (2023).

Figure 4

Funding Effect by Type of Fund



Note: This figure shows for the municipalities under investigation the coefficient estimate and the corresponding 95 % confidence interval of a regression of the growth in log night light emission in the period 2007–2013 on the total funding amount received, separately by type of fund. While we cannot reject that the effect of ERDF and INTERREG funding is the same ($p = 0.559$), the effect sizes of both ERDF and INTERREG are significantly larger than the effect size of CF funding ($p = 0.013$, $p = 0.001$).
Source: Bachtrögler-Unger et al. (2023).

be interpreted as correlations. In this sense, our results answer the question of whether municipalities that received more funding grew more strongly – and not necessarily to what extent the funding induced them to grow more strongly. The regression results presented in Bachtrögler-Unger et al. (2023) show that receiving a higher amount of EU funding is associated with increased economic activity at the municipal level. For the average municipality within our sample region, which receives annual funding worth EUR 625,500, we find that total nighttime light emissions increase by 0.05 percent.

Heterogeneity by Type of Fund. Furthermore, we compare the funding effect by the type of fund, keeping in mind that the German municipalities do not receive CF funding by design. Figure 4 shows that funding effects are significant for projects co-funded by the ERDF. The funding effect of INTERREG projects (co-funded by the ERDF) is similar to that of ERDF projects. For the CF, we do not find a significant funding effect. This result holds when excluding Germany as a non-CF beneficiary to avoid a potential sample selection bias, and when distinguishing between predominantly rural and other NUTS-3 regions. The effect of ERDF funding remains positive and statistically significant in all specifications.

IMPLICATIONS AND POLICY CONCLUSIONS

We have presented results from a pilot study (Bachtrögler-Unger et al. 2023) that combines official data on projects co-funded by the ERDF and the CF in the programming period 2007–2013, with remote sensing data on night light emission and land cover to assess the effect of EU funding on economic growth at the municipal level, where regional GDP data are not available. Our approach can also be applied in other contexts, for example to study the impact of investment projects funded by Next Generation EU. However, for an evidence-based evaluation of EU regional policy, it is essential to provide researchers with more comprehensive data on EU-funded projects. The microdata used here at the project level was compiled as part of this project for the pilot region under consideration and geolocalized at the level of municipalities. An EU-wide funding database standardized in this way and covering several funding periods would make it possible to extend the approach developed in this study to all EU member states and to regularly evaluate the effects of EU regional policy. Improved access to data would thus also contribute to greater transparency of EU regional funding.

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