

Tomasz Komornicki  
Piotr Rosik  
Rafał Wiśniewski  
Marcin Mazur  
Patryk Duma

## Border Regions in the European Space of Flows

According to Castells (1998), the space in which we live can no longer be described as a collection of places but rather as a system of multidirectional connections. R. Domański (1996) emphasized that regional growth significantly depends on regions' capacity to interact with their socio-economic and natural environments. He later proposed the concept of central flows as a driving force that enhances cities' significance in the global economy. Flows and various networks of connections bring tangible benefits in terms of the diffusion of innovations, technologies, and knowledge. On the other hand, excessive dependencies can create risks, especially during recessions and crises (see Andersen and Dalgaard, 2011; Martin, 2011; Komornicki et al., 2015).

Between 2020 and 2022, the ESPON IRiE project (Interregional Relations in Europe; [www.espon.eu](http://www.espon.eu); Velasco Echeverria 2022) aimed to comprehensively assess the European space of flows. This project, likely for the first time, simultaneously analyzed several types of interregional connections of various natures. The study covered capital investments, foreign trade, migration, tourism, knowledge transfers, student exchanges, and transport flows. For each type of relationship, a 297x297 matrix was created, corresponding to the number of NUTS2 regions (each roughly the size of Polish voivodeships) across the European Union, including the United Kingdom, Switzerland, Norway, Iceland, and Liechtenstein. Where possible, observed data were used, and where data were unavailable, modeling was applied.

The project's results demonstrated that the "flow-based" map of Europe differs somewhat from the traditional one, which includes the homogeneous "Blue Banana" and vast peripheries. The core of the "European space of flows" is slightly shifted northward compared to the GDP distribution. Scandinavian regions participate more intensively in interregional relations than Southern European regions. However, many flow-based indicators (e.g., flow balance) create a mosaic across Europe, with highly interconnected regions neighboring those still more isolated from external relations. Interestingly, this phenomenon is observed both in the core of Western Europe and in peripheral areas. Therefore, flows rapidly diversify the socio-economic space of Europe, making it much more complex than some policymakers might assume.

Given this data, the position of border areas requires a new perspective, providing new grounds for their delimitation. It becomes possible to compare the intensity of cross-border relations with other international relations. The aim of this study is to highlight the importance of cross-border relations both at the European and local levels (with Poland as a case study). This study extracts relationships between neighboring regions across political borders from matrices of people flows (migration, tourism, ERASMUS). It evaluates their weighted intensity, concentration, and dynamics (2010–2018) compared to the full European matrix, internal relations in selected EU states, and sub-matrices of neighboring countries. The research tests hypotheses that border regions exhibit: a) higher and growing intensity of flows;

and b) higher geographical concentration of flows. Findings will identify functional border regions through spatial mobility and economic cross-border interactions.

Preliminary results obtained during the project concern the level of internationalization of territorial units (NUTS2). The border effect index was applied, indicating the region's dependence on international relations. The obvious conclusion is that small countries are more dependent on foreign flows than large countries. Moreover, border regions typically experience a higher degree of international flow exchange than regions located in central and remote areas. Thus, it is particularly interesting to compare large countries within the ESPON space. An analysis of trade and goods freight flows shows that proximity to the European core is key to regional internationalization. Regions bordering countries closer to the European core are more open to international trade within the ESPON space. This also applies to countries within the European core, where international trade is particularly significant along the Franco-German border. However, this conclusion especially applies to countries such as Poland, Romania, or Hungary (although in Hungary's case, it is mainly due to the specificity of goods freight). Thus, proximity to the European core promotes an increased share of international trade in regional goods exchange.

The situation differs in Scandinavia, where regions such as northern Sweden, Norway, and Finland—despite their distance from the European core—maintain relatively strong international trade ties (mainly with neighboring countries). In the case of goods and services trade, the dominant position of certain capitals and other large cities is evident. These cities are more dependent on international flows than other regions within their countries. Examples include Madrid, Warsaw, Prague, and Vilnius. This pattern is less visible in goods transport, where internal traffic dominance is common, particularly in Poland and Spain.

Some countries within the ESPON space exhibit particularly high shares of internal migration. These include Great Britain, Scandinavian countries, Greece, Hungary, Czechia, and the Netherlands. Conversely, international migrations dominate in Poland, Romania, Bulgaria, Croatia, Slovakia, Portugal, and the Baltic states, as well as in Switzerland, Ireland, and Iceland (although the latter three are primarily recipients rather than senders). Additionally, certain countries show significant internal regional differences. For example, in Spain, Extremadura has a high share of internal migrations, while Catalonia and Valencia are more focused on international migrations. In some countries, internal migration patterns challenge the dominance of foreign migration. This is particularly evident in Poland and Romania, where metropolitan areas like Warsaw and Bucharest serve as alternatives to foreign destinations. In contrast, in Western European countries, metropolitan areas exhibit a higher share of international migration due to the mobility of highly skilled workers. Examples include Paris, Madrid, Berlin, and Stockholm.

The preliminary results indicate that border areas are not, on a European scale, centers of international relations. Such connections are generally generated by units located farther from the border. However, exceptions exist, particularly among lower-level units (NUTS3) forming cross-border functional areas. Identifying these areas is the focus of the second part of this study, which examines Polish border regions. Data on international connections of counties (LAU1) were analyzed, including foreign trade, migration, and tourism. Additionally, mobile phone data on Polish citizens' use of roaming services in other European countries were used, classified territorially by the phone number holder's place of residence.

Several border areas with elevated dependence on neighboring countries (economic, social) were identified. These are primarily located along the Polish-German and Polish-Czech borders. Some counties leveraging their border location were also found on Poland's eastern border. However, the current geopolitical situation has disrupted these relations. The recommendations highlight units that may require additional public intervention due to this disruption. Alternative indicators for delimiting border areas were proposed, based on their actual international connections relative to other interregional relations.

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