

The impact of the Covid-19 pandemic on the resilience of the labour market in the Polish-German borderland

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Abstract

The COVID-19 pandemic quite strongly disrupted the existing trends in the evolution of employment in the Polish-German borderland. The objective of the article is to analyse how resilient Polish and German municipalities are to the COVID-19 pandemic. Border regions, due to their specificities, are characterized by weaker resilience to negative external factors, which meant that the COVID-19 pandemic had a detrimental effect and caused an upturn in unemployment. The empirical part of the study concerns the Polish-German borderland as a clear example of the described tendencies. The research method used in the study is the counterfactual before-after comparison method, which fills the gap in the literature regarding research of cross border regions and develops the existing approaches. This approach is novel in studying the hypothetical rate of unemployment. The results of the survey indicate that the unemployment rate in the Polish-German borderland area has risen (after and due to the pandemic). There are significant differences in how the pandemic has affected the labor market. Utilizing the counterfactual approach, this difference can be described as the impact of the COVID-19 pandemic on the labor market.

Keywords: resilience, labour market, Covid-19, Polish-German borderland

Introduction

This work responds to theoretical and empirical research gaps regarding the specificity of border regions that might explain the resilience of border regions to external factors such as COVID-19¹. Labour markets are at the core of economic and social resilience, alongside the inclusive growth of regions (Borsekova & Korony, 2022). The Covid-19 pandemic has significantly impacted various areas of the economy. There are also different perspectives of analysis to consider. One of them

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¹The authors present the original data collected during the implementation of the project entitled 'Smart energy' and the effects of the pandemic in Polish and German border municipalities financed by FWP in 2021.

is spatial, which shows differences in the impact of the pandemic. The authors have endeavoured to observe the impact of Covid-19 on unemployment in two economies – Poland and Germany – from a regional perspective with particular focus on the Poland-Germany border region. Border regions are specific in that they are linked by numerous and various cross-border flows; however, from the economic perspective of the local communities, these flows are related to local labour markets. In the case of the Polish-German border, the German labour market has traditionally been much more attractive to the residents of Polish border towns, but this is changing, and Germans increasingly work on the Polish side of the border too. For many years after the reunification of Germany, the German side of the border was an outflow area and many downsides related to this fact have affected the situation faced today by German counties (*Landkreise*) (Ulrich, 2020; Ulrich et al., 2020).

In terms of everyday operations, border regions and their labour markets act as ‘connecting vessels’. Borderlands most often face asymmetric flows of people to the neighbouring country for the purpose of earning money, tourism, or in order to purchase various types of goods at lower prices. In this type of flow, a crucial role is played by so-called location rent (Park, 2014) resulting from the proximity of the border. The borderland area studied here is understood as a belt of NUTS-2 administrative units on the Polish side and *Länder* bordering Poland on the German side. Regardless of the impact of barriers on cross-border flows, the crisis provoked by the pandemic also weakened the highly sensitive branches upon which the economy of these regions is based – i.e., tourism (Ascani et al., 2021; Folinias & Metaxas, 2020; Gössling et al., 2021; Gulbrandsen, 2022; Kudelko et al., 2020). The presented problem of asymmetry in the labour market after COVID-19 is related to the ex ante situation regarding unemployment in the previous period. The pandemic served to consolidate negative trends in the existing labour market asymmetry as a result of temporary difficulties in labour flow and other restrictions introduced centrally or, in the case of Germany, regionally. It is worth emphasising that the discussed phenomena are common and generally apply to most border regions in Europe (Novotný, 2021).

This article represents an attempt to make a different contribution to the fast-growing empirical literature on border regions than other authors, who tend to focus on social and political (Opiola & Böhm, 2022) aspects of innovation (Cappellano et al., 2022; Merisalo & Makkonen, 2022), and resilience in the context of the natural environment (Korhonen et al., 2021). Of course, the given examples do not exhaust the entire body of literature on cross-border analyses. During the peak of the pandemic, work was also undertaken to address difficulties faced on the European Union’s internal borders (Novotný, 2022; Ulrich, 2020). Existing empirical work on European border regions and cross-border cooperation focuses primarily on quantifying the scale of border obstacles using recently available data (Bakry & Growe, 2021; Giannakis & Bruggeman, 2019; Pallagst & Caesar, 2014; Ulrich, 2020).

During the COVID-19 pandemic, border regions regressed in terms of development, closing due to restrictions introduced nationwide. On the other hand, they opened up to new solutions in communication, which to some extent closed the deficits, for example, in information exchange. The functioning of territorial networks is currently fundamental for the transformation of all social processes, including those occurring in borderland regions. This 'area of flow' includes the following components: technological IT system infrastructure, nodes and hubs structuring connections and key operations in a given location or locations, social actors operating networks, the electronic environment such as websites, interaction spaces as well as communication spaces (interactive/non-interactive) – information systems (Kumar and Semetko 2018).

The article is divided into the following sections:

- A literature review taking into account the three main terminological areas involved: resilience, labour markets, and cross-border asymmetry;
- The methodology used to study the labour market resilience in the Polish-German borderland;
- Research results in the form of graphics indicating the distinctiveness of the analysed regions in terms of their resilience;
- The background of the results obtained from an analysis of unemployment in the analysed regions, and
- Conclusions for regional policy and inspiration for further regional research.

Cross-border cooperation during the COVID-19 pandemic is mentioned in the literature, but few studies have estimated the impact of the pandemic on the functioning of border regions specifically. Some publications are rich in theoretical or conceptual sophistication but lack a solid empirical basis. Therefore, key research problems have emerged and focused around the following questions: How did the pandemic affect cross-border flows on the Polish-German border? Has the existing pandemic crisis contributed to the increase in unemployment? Would the unemployment rate have stayed the same even without the impact of COVID-19?

The added value of the research is its contribution to existing studies on border regions and their resilience to external factors. We also expand the literature in terms of the methods used to study resilience.

1. Literature review

The article's theoretical considerations lie at the intersection of three literary trends. The article examines how the unemployment rate has changed due to the Covid-19 pandemic. Have the regions coped with the negative factors affecting the labour market? Are there any differences in how this crisis has been handled in the regions on the Polish and German sides of the border? The study also aims to compare the impact of the pandemic on unemployment in terms of similarities in spatial layout. In this work, we assumed that other factors did not have a significant

impact on the regions in the analysed period. The authors' contribution consists, in one sense, in presenting the ATE method in the context of research on spatial socio-economic phenomena. Through research conclusions, we compare the resilience of regions in two countries and formulate conclusions regarding the resilience of these regions and the similarity of responses to the negative impact of external factors. We also aim to focus future research on research niches, especially in context. The first is the most widely studied, focusing on the *resilience of regions* to various external factors. The second concerns the *labour market*, especially in a cross-border context. The third involves *cross-border asymmetry* with a tendency towards regional entrenchment within one country rather than comparable cross-border resilience to external factors.

The concept of resilience, precursors in the literature, refers to the ability of a system to regenerate, reposition and evolve after a shock or disruption (Doran & Fingleton, 2016; Martin 2012). The popularity of research on resilience is linked with the numerous crises that have affected regional economies (such as the financial crisis, climate change, the Covid-19 pandemic, etc.), the constant evolution of regional development factors, and hence the search for formulas for adaptation and survival (Brakman et al., 2015; Bristow & Healy, 2018; Szabó et al., 2018; Ženka et al., 2017). The concept of resilience has a long tradition in the biological and engineering sciences. Over the last decade, it has also gained tremendous traction in urban and regional studies (Borsekova et al., 2018; 2021). In the European Union, research on regional labour markets' resilience and susceptibility to shock reveals that post-socialist regions without a capital city are the most vulnerable EU markets (Vitálišová et al., 2023). Resilience is assessed in terms of regional competitiveness. This postulate is particularly relevant to peripheral regions such as borderlands. A lack of resilience causes an increase in disproportions in socio-economic development – e.g., unemployment rates. Definitions of resilience may also refer to people, society, ecosystems or cities. In their case, resilience means that they quickly return to normal in the face of shock (Pendall et al., 2010). In the social sciences, the concept of regional resilience is associated with regional adaptation and has strong links with evolutionary economic geography as a strand in regional development theory. Resilience in the context of urban and regional planning has sometimes been defined as a goal or desired outcome, or as a process, making the situation in which a city finds itself difficult to grasp or measure (Garrigos-Simon et al., 2018).

Equipped with the aforementioned skills, resilient socio-economic systems can thus be characterized by the capacity of absorbing, adapting, transforming and preparing for the emerging effects of economic, environmental and social crises in order to promote sustainable development, or maintain an acceptable growth pattern for society.

An economically successful region is resilient if over the long term it can adapt to changing circumstances and adapt to external shock (Christofakis et al., 2019; Dubé & Polèse, 2016; Fröhlich & Hassink, 2018; Gazzola et al., 2019; Haggag et al., 2020;

Mutani & Todeschi, 2019; Szabó et al., 2018). However, this begs the question at to development factors might enable a region to adapt. Are these factors multi-regional? Perhaps. However, the relative importance of each factor may vary by region. In general, regional resilience in the past was assisted by the following: workforce, good physical, soft and social infrastructure, a thriving entrepreneurial culture, clusters of technologically innovative companies, an industrial ecosystem of interconnected businesses, good connectivity, as well as effective governance and leadership. During the pandemic, great importance was also attached to culture and institutions.

A different definition of resilience is given by academics who work with this concept in the context of business efficiency: ‘resilience is a fundamental skill for efficiently responding to significant changes disrupting the achievement of plans without falling into long periods of crisis. Economic resilience should include three main components: productivity, security, and agility. Productivity refers to the relationship between the volume of output sold and the amount of resources used to produce that output. In turn, safety concerns sanitary protection and ergonomic working conditions’ (Banaszyk et al., 2021). It is worth emphasising that the concept of resilience is compared from different perspectives – e.g., convergence and resilience (Hippe et al., 2023).

Labour market resilience is significantly influenced by labour market policies, which in border regions often focus on nationwide mechanisms and do not take into account factors that are specific to these regions (Margarian, 2021). Policies and institutions that are helpful in minimising structural unemployment foster labour market resilience (Gertler, 2010; Ortlieb & Knappert, 2023). In a broader sense, social and activation policy is of key importance in limiting the impact of a downturn.

A relevant fact worth highlighting in the context of western Poland regions and their labour market resilience is that Poland has gone through a period of intense growth and labour market development having left the Eastern Bloc in the 1990s. The average income per capita in the country has doubled twice (from 38% to 76% of the EU average) while achieving a relatively low unemployment rate (approx. 3%) and a higher employment rate (74%) compared to the average in the European Union (International Labour Organization, 2023). Due to factors such as geographical proximity, common historical experience, economic cooperation and social contact, in many cases areas located on both sides of the state border present some common features (Krätke, 1999) and are willing to complement each other, as exemplified by cross-border flows on the labour market. On the basis of these similarities, the inhabitants of these regions have initiated local and regional initiatives such as cross-border cooperation, further strengthened by open borders allowing the free movement of labour, capital and foreign investments. Studies on migration show, contrary to expectations, that reinforced borders even lead to an increase in immigration flows (Schon & Leblang, 2021). In the literature, the issue of labour force flows has been analysed across many aspects: the mobility of entrepreneurs, pupils and students, patients and healthcare professionals, as well as

people involved in tourism, including business, shopping, health, religions, etc. Research has also been conducted on interpersonal cross-border relations, which are characteristic, for example, of participants in cross-border projects, clusters and networks (Heinz & Ward-Warmedinger, 2006; Li & Bray, 2007). The development of specific regions or voivodeships affects the level, dynamics and structure of income and expenditure (Kozak et al., 2022). Three voivodeships along Poland's western borderland were classified as having a higher income level compared to households in Poland in 2018, and they may be interpreted as having a good situation on the labour market before the pandemic compared to other regions in Poland.

A lack of resilience to various types of external factors may exacerbate regional disparities and, therefore, *developmental asymmetry in border regions*. This is the second area mentioned in the literature that may be worth considering. Due to constantly growing threats related to natural disasters, large-scale environmental pollution, epidemics of infectious diseases, a high number of traffic accidents and industrial emergencies, resilience is becoming an increasingly important measure of regional competitiveness (Choińska & Szpilko, 2021). This also spurs the need to build the resilience of cities. To do so, action should be taken to boost the resilience of technical infrastructure, support local communities and information transfer processes, encourage the community to participate in city life, support diversity, and create opportunities for self-organisation and cooperation (Kozuch & Sienkiewicz-Malyjurek, 2016). However, the combination of various natural, historical, geopolitical and even civilisational circumstances, as well as varying dynamics and directions of socio-economic and political processes, sometimes leads to significant disproportions in their developmental level, as well as to stark differences on other levels (Jakubowski, 2018). The term 'asymmetry' is a recurring theme in research on borders. Various terms are used in the literature to refer to asymmetry: disproportions in socio-economic development, economic gaps dividing economies (Gorzela, 2003), or imbalance in the level of economic development (measured by GDP per capita, for instance) in adjacent border areas, caused by an asymmetry of potential, capital, resources and institutional solutions (Jakubowski, 2018). Asymmetries in socio-economic development can be shaped by endogenous and exogenous factors. The endogenous dimension has long received extensive discussion in the literature (Jakubowski, 2018; Mischuk & Jakubowski, 2019; Oleński, 2016). The second dimension of asymmetry may stem from external factors such as the 2008 financial crisis or the COVID-19 pandemic. Diverse policies of countries undertaken to prevent the effects of crises damage the functioning of border regions, and such activities definitely lack synchronisation. This is primarily manifested in practice by various restrictions on the movement of people across the border, and therefore restrictions related to the impact on these areas of economic activity. The scope includes areas such as trade, employment on the other side of the border, tourist and educational services, which are attractive to the inhabitants of the borderland due to price differences. However, it should be emphasised that the

resilience of economies to the impact of external factors is very different, as proven on the basis of the conducted research. This article looks at asymmetry in how the unemployment rate changed during the COVID-19 period in border regions.

The crisis caused by the COVID-19 pandemic highlighted and deepened social and regional inequalities that had been growing for at least the previous three decades (Ascani et al., 2021; Capello & Cerisola, 2021; Jakubowski, 2020; Margarian, 2021; Rodríguez-Pose & Petrakos, 2004; Wójcik, 2021). The pandemic accelerated certain socio-economic shifts – transformations that many thought would take decades to occur – and has revealed that the ability of different places to adapt to a ‘new’ world varies greatly (Martin, 2021). The COVID-19 pandemic dramatically changed demand for products and services across sectors and national borders, exposing vulnerabilities in global supply chains across industries (e.g., ICT, automotive supply) and service networks (e.g., financial products). While overcoming the crisis, companies have to deal with uncertainty and need new perspectives, methods and practical steps to stay ahead of the next stage of the current crisis and be better prepared for future crises.

2. Research methodology

The data used in the study comes from four basic sources: The Statistical Office of the European Union (Eurostat)², Local Data Bank Statistics Poland (BDL GUS; Local Data Bank, Central Statistical Office)³, statistics of the German Employment Agency (Bundesagentur für Arbeit)⁴ and from the German Regional Atlas (Regionalatlas Deutschland, Statistisches Bundesamt)⁵. Monthly data presenting the unemployment rate in selected counties along the Polish-German border from the Polish Statistics and the German Employment Agency were used to illustrate the actual state of unemployment in this area, as well as to develop a model based on historical data series from 2010 to 2020, by means of which the potential development of unemployment after Q2 2020 was predicted in a no-COVID situation.

ATE (the Average Treatment Effect)

To examine the possible differences between the observed unemployment rate and the hypothetical rate (without COVID), the Average Treatment Effect (ATE) index was used, which assesses the total average impact of a pandemic expressed as the difference between the mean of the outcome variables in the event of a pandemic and a counterfactual situation (Svabova et al., 2021). In this framework, we use

² The Statistical Office of the European Union (Eurostat), <https://ec.europa.eu/eurostat/web/regions/data/database>.

³ Local Data Bank Statistics Poland, <https://bdl.stat.gov.pl/BDL/start>.

⁴ Bundesagentur für Arbeit, <https://statistik.arbeitsagentur.de/>.

⁵ Regionalatlas Deutschland, Statistisches Bundesamt, <https://www.regionalstatistik.de/>.

binary representation to classify pandemic and non-pandemic scenarios. A 'pandemic' status is encoded as '1' and a 'non-pandemic' status as '0'. We designate X as the binary variable indicating pandemic presence. Thus, $X = 1$ signifies a pandemic condition, whereas $X = 0$ indicates its absence. The objective here is to analyze the differential effects observed in these two scenarios. We focus on evaluating the influence of a pandemic by examining specific outcome variables post-event. Due to the inherent challenges in measuring pandemic effects precisely, we adopt a comparative estimation approach. The estimated discrepancy in the outcomes under pandemic and non-pandemic conditions is represented as follows:

$$ATE = \mathbb{E}(Y|X = 1) - \mathbb{E}(Y|X = 0).$$

Here, ATE denotes the estimated impact, \mathbb{E} represents the expected value calculation, and Y is the outcome variable of interest. This approach aligns with Rubin's (1974) methodology for impact assessment

A key challenge of this methodology lies in addressing the 'non-pandemic' scenario, which is purely conjectural. As a result, direct measurement of outcome variables in such a scenario is not feasible. Instead, we must rely on several methods to approximate the theoretical value of these outcome variables. We decided to use 8 different models to forecast time series.

Time series forecasting models

We tried different models:

- ETS (Error, Trend, Seasonal) model (Hyndman and Athanasopoulos 2018);
- Theta model (Hyndman and Billah 2003);
- BATS and TBATS (Livera *et al.* 2011) models;
- ARIMA (AutoRegressive Integrated Moving Average) and SARIMA models. (Box *et al.* 2008);
- NAÏVE and SNAIVE models.

Quality measures

We tested models using the following popular measures of quality:

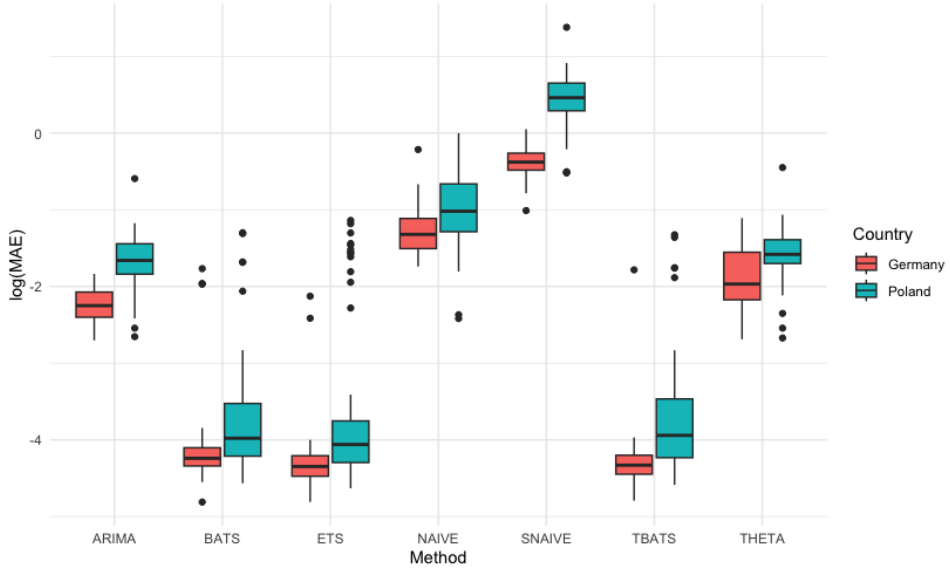
- MAE (mean absolute error);
- MAPE (mean absolute percentage error);
- RMSE (root mean squared error).

All the above measures deal directly with the residuals produced by model. For each of them, we use the magnitude of the metric to decide if the model is performing well. Small error metric values point to good predictive ability, while large values suggest otherwise. Any single metric provides only one projection of the model errors and therefore, only emphasizes a certain aspect of the error characteristics.

The next step is to choose the optimal model for analysis, which will be the simplest but it is powerful. Figures 1–3 show that the BATS, ETS and TBATS models have the best quality ratings among tested models. The models obtained very similar measures of quality in both countries. Using the classic criterion, if several models of similar quality are available, we will decide on the simplest model (with few parameters) or the model that can be calculated by computer in the shortest possible time. Looking at the Figures 1-3 and knowing that ETS is much simpler in calculations than, BATS and TBATS models we decided to use ETS for further analyses.

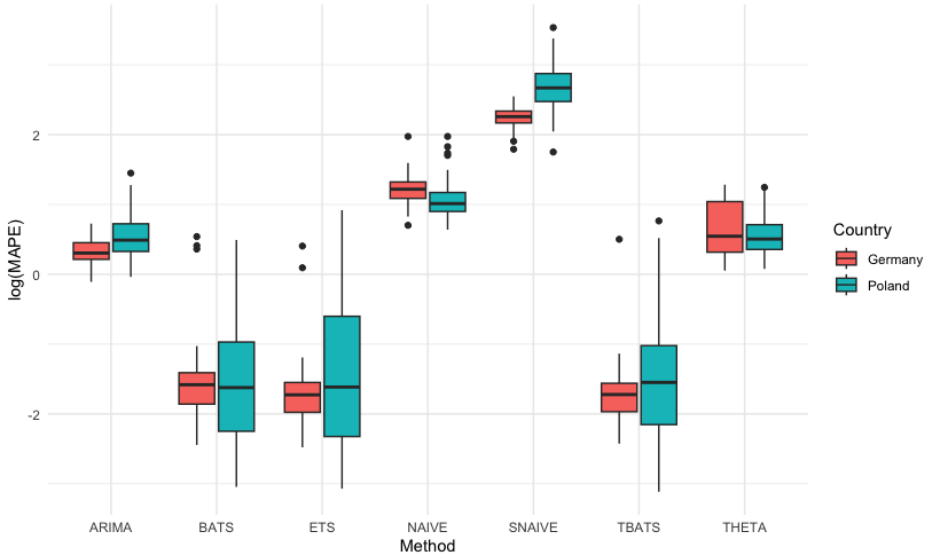
The process of growing asymmetry on the Polish-German border is influenced primarily by the degree to which border municipalities are resilient to external factors, including the COVID-19 pandemic, which caused unprecedented disruptions in global economies, leading to loss of income and high unemployment (Ehlert & Wedemeier, 2021; Boháč, 2021; Kudelko *et al.*, 2020; Novotný, 2021). The COVID-19 pandemic and the aftermath have been compared to the previous global financial crisis of 2008-2009. The impact of the pandemic on labor markets has been studied in the literature, with Rajendra (2021) finding that certain social groups, such as those working in informal sectors of the economy, are at the highest risk of job loss. These groups include small traders, self-employed individuals, young adults, women, migrant workers, and daily wage laborers. The pandemic has particularly affected low-skilled workers and those aged 50-64 who cannot work remotely from home. There are concerns about the potential long-term unemployment after the lockdown and the need to limit the scarring effect of the COVID-crisis. The pandemic has also led to a decline in the quality of human capital due to the erosion of skills and a greater likelihood of exit from the labor market, which is particularly vulnerable in peripheral regions. Unlike the global financial crisis, a large proportion of new hires during the COVID-19 recession were on temporary furlough. The analysis of Central European regions can also be applied to the development sub-path, including its dynamics and resilience related to employment (Drobniak & Plac, 2021). These authors created a classification whereby the regions located on the western border of Poland were included in the group of regions catching up in terms of employment, with job creating dynamics comparable to the leading regions, but whose level of employment per 1,000 inhabitants is still low – i.e., below the average for Central European regions. This group includes: BG31 – Severozapaden, BG32 Severen tsen-tralen, BG33 – Severoiztochen, BG34 – Yugoiztochen, BG42 Yuzhen tsentra-len, HR03, Jadranska Hrvatska, HR04 Kontinentalna Hrvatska, LT02, Vidurio ir vakaru Lietuvos regionas, HU23, Dél -Dunántul, HU31, Észak-Magyarország, HU32, Észak-Alföld, HU33, Dél-Alföld, PL22 – Śląskie, PL42 – Zachodniopomorskie, PL43 – Lubuskie, PL51 – Dolnośląskie, PL63 – Pomorskie, PL84 – Podlaskie, SK04, Eastern Slovenia.

Figure 1. MAE for the examined methods

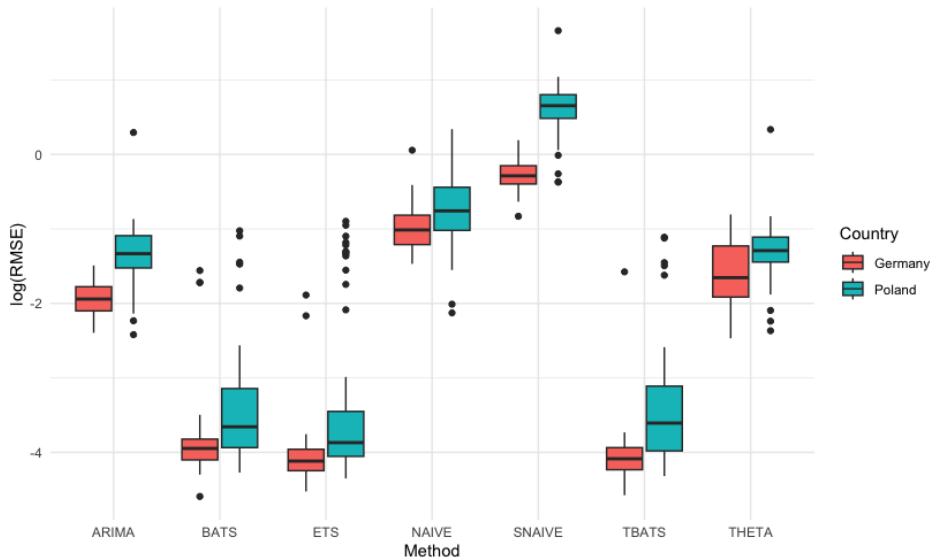


Source: authors' representation

Figure 2. MAPE for the examined methods



Source: authors' representation

Figure 3. RMSE for the examined methods

Source: authors' representation

An article on changes in labour mobility in Germany presents some interesting findings (Ehlert & Wedemeier, 2021). The impact of the COVID-19 crisis on social behaviour may lead to a permanent change, as evidenced by the ability of regions with a high proportion of academics in the labour force to significantly reduce daytime mobility. In Germany, not all regions with heterogeneous socio-economic profiles managed to reduce mobility to the same extent, posing challenges related to spatial policy. Regions with high unemployment in the previous year appear to be in a more difficult situation in this regard. The flexibility required to find a new job and potentially accept a highly mobile job, such as in delivery services, due to the lack of better employment opportunities, may be among the reasons for this asymmetry. Border regions, due to their specificity related to cross-border commuting, are exposed to particular difficulties which may, depending on national regulations, translate to a greater or lesser extent into the possibility to work unimpeded outside the place of residence in another bordering country. Location in the countryside further reduces the chance of limiting mobility. Given that digital technologies are developing at breakneck speed, this barrier is slowly disappearing.

Analysis of unemployment rate trends in Poland and Germany from 2010 on the basis of monthly data indicate differences between the countries. Judging by the trends, unemployment in Germany should have grown during the COVID-19 pandemic, yet it went down, while in Poland the opposite was true (Figure 4). However, this tendency was stronger in Poland (Figure 3). The statistical

significance of the differences was assessed by testing the null hypothesis that the ATE index was equal in Poland and Germany using a permutation t-test. The resulting p-value of 0.001343 led to the rejection of the null hypothesis at a significance level of 5% (or even 1%), indicating that the ATE coefficient was significantly lower in Germany than in Poland.

3. Research results and interpretations

The analysis clearly shows that since the beginning of the pandemic in 2019, its impact on the unemployment rate was significantly diverse. It has significantly widened existing inequalities in many areas such as health, society, culture, and economy (Manemann, 2020). It can be assumed that the effects of the crisis on the labour market may also exacerbate social inequalities, as some people working in lower-income professions – and often with poorly socially and contractually secured employment relationships – are particularly affected or threatened by unemployment (Buch et al., 2021).

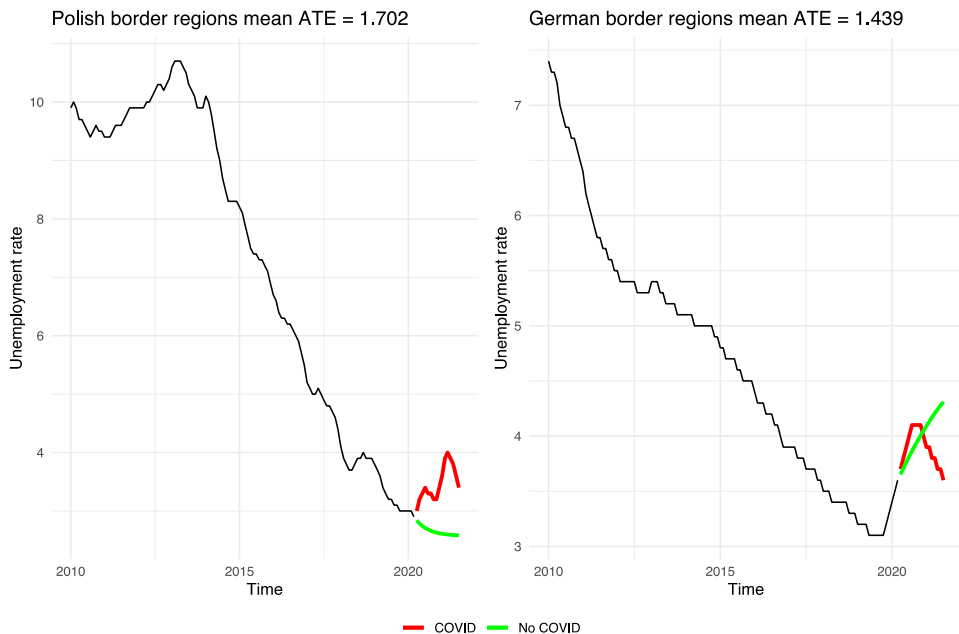
In dual labour markets, one market offers relatively well-paid, secure jobs, while the other provides more precarious employment opportunities. This diversity in production, working conditions, and living standards may result in affluent urban centres being severely affected in the short term and in absolute figures, but the effects on individuals are different compared to weakly structured peripheral regions. Figure 4 shows that the ATE index varies significantly, particularly in the northern region, where tourism plays a significant role, and in the southern region and Berlin, which are characterized by greater urbanization. Strong demand characterizes especially prosperous urban location (Bentolila et al., 2019).

Rural areas exhibit less differentiation than urban areas in terms of labour market recovery from crises. This is because rural labour markets do not benefit significantly from agglomeration effects that could facilitate faster recovery. In the worst-case scenario, long-term structural problems may arise due to the crisis. Rural locations can be described as structurally weak, which is a characteristic of Polish poviats and municipalities in border regions.

It is important to examine the changes in employment during the pandemic, which had multifaceted effects due to its long duration, volatility, and global nature. In the first half of 2020, not only were private, personal, and cultural services, which often have precarious working conditions and low pay, affected, but also part of the export-oriented and high-income manufacturing sector due to the partial collapse of foreign trade. While the structurally weak regions of eastern Germany, including Berlin, were less affected or not affected by short-term increases in unemployment, they also experienced long-term structural effects due to the lack of absorptive capacity of their labour markets. The situation in Polish municipalities was also strongly related to the unemployment situation in German poviats. Rural areas are less differentiated than urban areas because they hardly benefit from agglomeration

effects that could facilitate faster recovery from crises. In the worst-case scenario, long-term structural problems may arise due to the crisis, which is a characteristic picture for Polish poviats and municipalities in the border region. Residents of border towns, especially, used to find employment in German municipalities, while Germans would come to Polish municipalities to provide services. The spatial form of the described results is presented in Figure 6.

Figure 4. ATE for the Polish-German borderland economy from 2010–2020

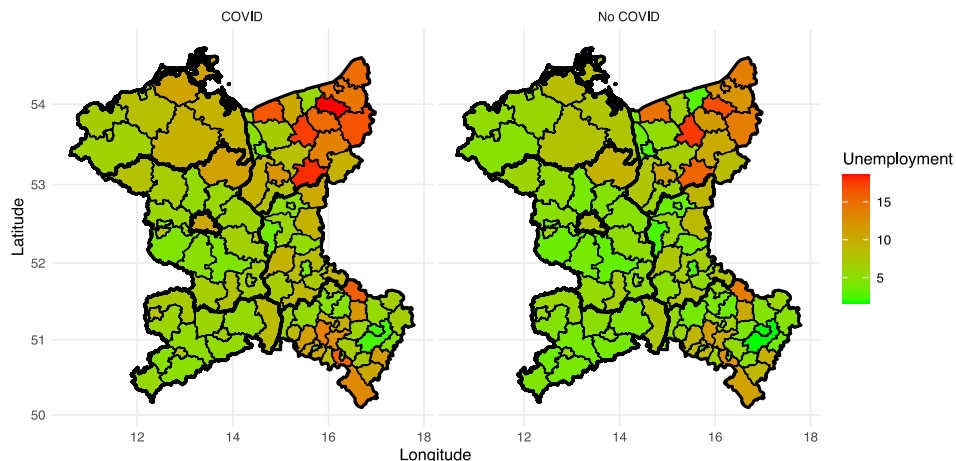


Source: authors' representation

To confirm the noticeable trends in Figure 4, Figure 5 is presented, showing changes in employment in Poland from 2010–2022. This graph shows a clear trend within Polish border regions in the west of Poland related to changes in employment. The chart clearly indicates a negative trend, which proves the weak structure of the regions in Zachodniopomorskie and Lubuskie, which was influenced by many negative external factors, including the COVID-19 pandemic.

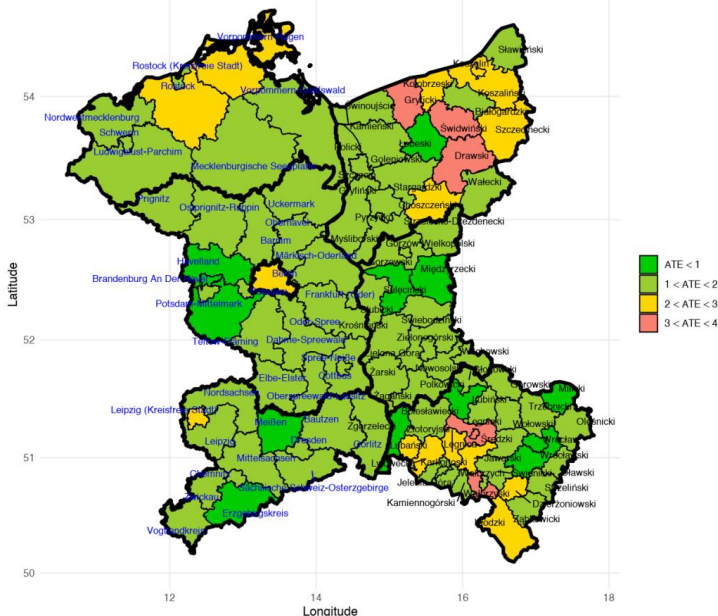
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Figure 5. Unemployment with and without COVID.



Source: authors' representation

Figure 6. ATE for individual communes on the Polish-German border arising from the COVID-19 situation (German communes in blue, and Polish communes in black).



Source: authors' representation

Conclusions

The presented research results indicate numerous effects of the Covid-19 pandemic on regions in terms of rising unemployment compared to long-term trends. The analysis shows that unemployment in Poland for the Polish-German borderland increased slightly during the crisis. However, as the previous trend shows, it should have shown a downward trend. In this way, we confirm the hypothesis posited in our study about the negative impact of the pandemic on peripheral regions. In Germany, based on the same period, we can conclude that unemployment should have increased, yet it decreased slightly. Spatial analysis of the phenomenon shows intra-regional diversity and similarities in responding to external factors such as Covid-19 in regions with similar characteristics. Northern and southern regions, both in Poland and Germany, are more susceptible. This conclusion is supported by the similarity of the regions in terms of dominant economic structures based on tourism. Berlin stands out in the analysis in terms of its high ATE index, which is due to the fact that large cities had to limit service activities during the pandemic.

The rapidly changing economic situation in the world, which is always felt most strongly by economically weaker regions – i.e., those less resistant to negative external phenomena such as border regions – spurs a need for further research. One ought to mention that insufficient regional resilience to external shocks may significantly increase asymmetry on both sides of the border. Border regions, due to their specific location, derive much less benefit from the economic development of their respective countries, as a whole. Their development depends, to a large extent, on good cross-border relations and on building strong economic ties that strengthen various types of cross-border flows. The needs of these regions can be seen both in terms of local and regional initiatives, and often even cross-border ones. The local economy is also influenced by historical circumstances and by the fact that it is mainly based on tourism, which in the face of the pandemic became very vulnerable to economic shock. The postulate of fair transformation (e.g., in relation to Lower Silesia), which is related to changes in the labour market, also fully applies to border regions that have numerous problems related to outdated industry that does not meet environmental standards or climate challenges.

The considered problem of resilience looks at border regions as special cases with specific features resulting, for example, from the historical background (Grillitsch and Hansen, 2019; Makkonen and Rohde, 2016; Makkonen and Weidenfeld, 2016). The main conclusions from the text are as follows:

- The pandemic has significantly widened existing inequalities in various areas such as health, society, culture, and economy, and its impact on the unemployment rate has been significantly diverse;
- The effects of the crisis on the labour market may exacerbate social inequalities, particularly affecting people working in lower-income professions with poorly secured employment relationships;

- Dual labour markets, with relatively well-paid secure jobs alongside more precarious jobs, contribute to diverse production, working, and living conditions, affecting both affluent urban centres and weakly structured peripheral regions differently;
- Rural areas may experience less differentiation than urban areas due to their limited benefit from agglomeration advantages, potentially leading to long-term structural problems;
- The pandemic has multifaceted effects on employment, impacting not only private, personal, and cultural services but also the export-oriented and high-income manufacturing sector;
- Structurally weak regions may experience long-term effects due to the lack of absorptive capacity of their labour markets;
- The unemployment situation in German poviats has a strong relationship with the situation in Polish municipalities, especially in border towns, where residents used to find employment in German municipalities, and Germans would come to Polish municipalities to provide services;
- These conclusions highlight the diverse and multifaceted impact of the pandemic on different regions and labour markets, exacerbating existing inequalities and affecting various sectors of the economy;
- The stronger the asymmetry in border areas, the greater the risk of local disillusionment and political dissatisfaction.

The success of border regions must be supported by the regional policy of each country in order to reduce intraregional and interregional asymmetry. The cross-border model for building the resilience of the Polish-German border regions should consider a set of guidelines at various levels – national, regional, functional, local and cross-border – in terms of being able to adapt and respond proactively to key development challenges facing the country (e.g., transformation and energy security, progressing demographics and migration, food security, counteracting territorial polarisation of development, as well as climate change). The most important premise resulting from the research in terms of formulating normative conclusions is the need to build cross-border initiatives of cooperation and information flow in border areas, alleviating shortages in housing markets (if any), bilingual education, building common municipal infrastructure, cooperation in the field of smart solutions, building strategies for attracting young people to peripheral regions, etc. Such initiatives should also have special strategies for operation and communication during extraordinary situations, such as Covid-19 or war on the Polish-Ukrainian border. From the point of view of obstacles standing in the way of comparative research, there are particularly visible gaps in the area of available, comparable statistical data that could be used in comparative research, and to indicate new areas of cooperation.

It is important for the processes taking place in border regions to foster the inclusion of residents in cross-border action – e.g., through their knowledge of existing

projects, opportunities to develop business cooperation, cultural services, schools, etc. The pandemic has shown that this process can be strengthened by the purposeful use of digital solutions for this purpose. This direction should be further explored. The uniqueness of the conducted research can be distinguished in three areas:

- Research to discover the main areas of cooperation between municipalities on the Polish-German border during the COVID-19 pandemic;
- Theoretical contribution to the concept of regional resilience, and
- Development of methodology for assessing regional resilience.

In the context of the conducted analysis, it is possible to determine a perspective for future research in the sectoral areas of these regions – e.g., related to the energy crisis caused by the war in Ukraine, or to resilience in the face of climate threats.

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