Business Cycles in the Economic and Monetary Union Border Regions: Towards Convergence or Divergence?

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Abstract:

   This study analyzes the problems of business cycles correlation in the Economic and Monetary Union (EMU) border regions. The analyzed subject matter has been overlooked in broadly defined borderlands studies. This study seeks to evaluate the degree of synchronization of business cycles across the EMU border regions. The article is the first in a cycle of studies on the synchronization of business cycles in the EU border regions and the regional aspects of optimum currency areas. Its methodology involves subject literature analysis, descriptive statistics, and selected statistical methods (Hodrick-Prescott filter and Pearson correlation coefficient).

   The study shows that all EMU borderlands are host to both convergent and divergent business cycles. At the same time, the degree of business cycle synchronization among the EMU states does not depend on when (or whether) the single euro currency was adopted. On the other hand, the frequency of business cycle divergence in the EMU borderland regions goes to show that, despite beneficial conditions the economies of these regions are often independent from one another.

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Introduction

   The problem of business cycles has been discussed in a number of theoretical and practical studies, which sought not only to define the notion of business cycle – a daunting task, against all circumstances – but also, and above all, to account for the reasons behind its periodicity. The majority of research on business cycles has addressed the phenomenon on the grounds of economics

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(macroeconomics) (Clark and Van Wincoop, 2001; European Commission, 2003; Montoya and de Haan, 2007; Iossifov, 2014; Montinari and Stracca, 2016; Franks et al., 2018; Gong and Kim, 2018; Cerutti and Osorio-Buitron, 2020; Zouri, 2020; Badarau et al., 2020; Padhan, 2020), with a primary focus on demand and supply-and-demand models, equilibrium business cycle theories, monetarism, and neoclassical economics.

Conversely, the problem of business cycles has not been researched to a comparable extent in regional studies, where most studies have been concerned regions within and outside of the EU (Clark and Van Wincoop, 2001; Martincus and Molinari, 2007; Gong and Kim, 2018; Montinari and Stracca, 2016; Zouri, 2020). Still, the majority of regional scholars concentrate on larger territorial units – in the case of the EU, their lens zooms in on the NUTS1 or NUTS2 regions. The business cycle fluctuations that occur at the NUT3 level or lower units are of no interest to those researchers (Bandrés et al., 2017). As for borderlands studies, the field fails to address business cycle whatsoever (Clark, 1994; Van Houtum, 1998; Perkmann, 2000, 2003, 2007; Clark and Van Wincoop, 2001; Virkkunen, 2002; Montoya and de Haan, 2007; Spierings and Van der Velde, 2008; Sohn et al., 2009; Decoville et al., 2013; Bergs, 2012; Van der Velde, 2012; Sohn and Reitel, 2013; Wróblewski, 2020a, 2020b; Bandrés et al., 2017; Decoville and Durand, 2019). This may come as a surprise, given that border regions show an outstanding potential, both for the development of cross-border cooperation and cross-border ties (which form the primary research subject in borderland studies), and for the optimum allocation of labor and capital as the basic factors of economic convergence and business cycles (European Commission, 2003; Xheneti et al., 2012; Kallioras and Pinna, 2016; Wróblewski, 2018, 2020b). One could go as far as to argue that the broadly defined subject literature has been dominated by studies on economic fluctuations at the level of national economies, including their respective industries, sectors, and branches.

Therefore, it seems legitimate to contemplate the convergence of business cycle fluctuations not only at the level of national economies across the EU and Economic and Monetary Union (EMU) – which have been thoroughly researched – but above all at that of border regions. In this context, the following research questions may be posed:

- Are regional business cycle fluctuations in the EMU border regions synchronized?

- If so, does the process occur to the same extent in all EMU regions?

This study seeks to evaluate the degree of synchronization of business cycles across the border regions of the EMU. Its methodology involves subject

literature analysis, descriptive statistics, and selected statistical methods (Hodrick-Prescott filter and Pearson correlation coefficient).

The notion of regional business cycle

Economically speaking, the notion of business cycle appears to be generally intelligible. In fact, however, its precise definition poses a number of problems, which no doubt follows from the inconsistent premises with regard to its core, the conditions determining its course, and the periods over which it is analyzed. As a result, each theory promulgated in the subject literature adopts slightly different premises, conditions, and determinants of the business cycle.

In the most general of terms, the business cycle is the fluctuation of aggregate social and economic activity indicators (most often the GDP or the GNP) over different periods of time, ranging from one to twelve years. The business cycle comprises a minimum of three phases that ensue in a cyclical fashion, e.g. recession, stagnation, recovery. These fluctuations are determined by different conditions, and their impact on the course of the business cycle can be noticeable immediately or with delay. Regardless of these differences, the said fluctuations occur around a specific trend (a long-term growth or decline tendency), i.e. above or below the trend, albeit in different time series and with different intensity (Burns and Mitchell, 1946; Mintz, 1972; Lucas, 1977; Long and Plosser, 1983; Barnes and Ledebur, 1988; Domański, 1989; Mullineaux et al., 1993; Deitz and Garcia, 2002; European Commission, 2003; Montinari and Stracca, 2016; Padhan, 2020). In principle, the business cycle illustrates the cycle of a dynamically fluctuating economic growth, from the high to the low growth rate, around the trend, in a cyclical, near-sinusoidal fashion (stochastic approach). This entails the interchangeable occurrence of upturns and downturns in the dynamics of the economic growth (turning points), where the duration of the respective phases tends to vary, as each cycle is essentially unique (Domański, 1989; Mullineaux et al., 1993).

And yet, the subject literature differs in terms of the number and names of the business cycle phases. Schumpeter (1939) specifies the phases of prosperity, recession, depression, and revival. In turn, Burns and Mitchell (1946) determine the expansion, recession, contraction, and revival phases. Mendelson (1960) lists those of crisis, depression, recovery, and boom. Regardless of the adopted terminology, each cycle is characterized by a specific duration, and the occurrence of the phases and turning points. The turning points determine the respective phases of the business cycle, enabling one to determine its duration, the distance between its successive phases, and the changes in its growth dynamics. At the same

time, each cycle is marked by amplitudinal fluctuations, i.e. the difference between the extreme upturns and downturns. These fluctuations may occur regularly (e.g. cyclically, seasonally) or irregularly (randomly, e.g. due to a pandemic), and are determined by a range of factors, such as: production, employment, investment, consumption, inflation, labor productivity, aggregate demand, asymmetric shocks (Barnes and Ledebur, 1988; Domański, 1989; Barczyk, 1997; Deitz and Garcia, 2002).

Let us now take a closer look at business fluctuations in regional and local economies. Given that all areas and territorial division units may constitute a subject of analytical studies, it may be assumed by analogy that the regional business cycle (spatial cycle – Klaassen and Van den Berg, 1987) is nothing more than a fluctuation of certain aggregate values around a trend, occurring at the regional or local level. To an extent, such an assumption is correct, although the notion of spatial cycle is slightly more complex. The constituents of regional growth are, in fact, more elaborate. The social and economic growth of regions is not only determined locally and regionally but also depends on the changes occurring in other regions, national economies, and global economy (see the immensely copious subject literature in this regard), albeit their impact on different regions may vary.

Regional business cycles are also characteristically far more idiosyncratic than their national counterparts. They may be both convergent with, and divergent from the national fluctuations, as evidenced in numerous studies (Barnes and Ledebur, 1988; Domański, 1989; Deitz and Garcia, 2002; Musiałkowska, 2005; Montoya and de Haan, 2007; Gong and Kim, 2018; Padhan, 2020). At the same time, regional business cycles do not always fluctuate or their variability may be much more frequent and much deeper than with national business cycles. Similarly, the amplitude of regional fluctuations may not reflect that of the national market. This means that, within a given time series, regional growth may manifest both variability and invariability, regardless of the changes in national economy. Some discrepancies may also occur between the respective regions. In particular, regional economies may be diversified to different extents. A low degree of diversification in a regional economy (specialized regions) may translate into business fluctuations correspondent with the fluctuations of the industry or sector that dominates in a given region. The greater the degree of specialization, the more vulnerable a given region is to the ebbs and flows of the growth rate. Conversely, unspecialized regions with a diverse employment structure and a dominant role of services tend to be more resilient to disruptions in trends. A similar correspondence can be observed between developed and undeveloped regions. The dynamics

of economic growth often strays from trends, resulting in recession in socially and economically undeveloped regions. In contrast, regions with a higher growth rate experience lesser decline during recession and greater expansion during recovery (Domański, 1989; Klaassen and Van den Berg, 1987; Barrios and de Lucia, 2001).

The notion of business cycle is related to that of convergence. The subject literature abounds in theoretical models explicating the course of convergence processes (e.g. Solow's model; Mankiw's, Romer and Weil's model; de la Fuente's model; Heckscher-Ohli-Samuelson model) and divergence (e.g. Perroux's growth pole theory; new growth theory; localization theories). In general, convergence is understood as the process of assimilation of specific objects or phenomena such as growth rate, living standards, public debt and budget deficit, or inflation. Conversely, divergence refers to the process which produces discrepancies.

One can differentiate between absolute and conditional convergence (Sala-i-Martin, 1996). In the simplest terms, absolute convergence refers to the absolute leveling of aggregate social and economic activity indicators observed in different economies or regions, regardless of their initial value. Such a premise, however, is rather improbable to occur in reality. On the other hand, conditional convergence assumes that (local) economies strive towards equilibrium by reducing developmental differences between them, but without assuming that this state of affairs will change over time. A number of factors may be distinguished that determine this process, including migrations, human and capital resources, technology and know-how transfers, demographic potential, transit and transportation infrastructure, quality and density of technological and social infrastructure, degree of economic activity, and comparative advantage. Importantly, these very factors also determine the course and business cycle synchronization.

One key notion from the Vantage point of this study is that of business cycle synchronization. It refers to the conditional convergence of turning points. Its analysis enables one to determine the course and duration of the respective phases of the business cycle (Gong and Kim, 2018; Padhan, 2020). Conditional convergence is a staple subject of analyses of the EU member states' economies, in particular the EMU (European Commission, 2003; Musiałkowska, 2005; Iossifov, 2014; Franks et al., 2018; Badarau et al., 2020; Cerutti and Osorio-Buitron, 2020). According to the now-classical definition of economic integration, proposed by B. Balassa (1961), the paramount goal of integration is to ensure the optimum allocation of labor and capital. The process occurs, above all, between complementary areas, i.e. in a situation in which one area shows a surplus of a specific type of goods or production factor, while another manifests its acute shortness (Wróblewski, 2018, 2020a; 2020b). On the other hand, the optimum allocation

of production factors may lead to the generation and transfer of the so-called asymmetric shocks, which jeopardizes the stability of the entire integration area. It is so because excessive business fluctuations are especially palpable on job markets and transmittable between the respective constituents of the integration area (Wróblewski, 2018; Musiałkowska et al., 2012; Iossifov, 2014). Thus, the EU market and monetary integration strives to reach the fullest convergence of business cycles, since overlapping turning points make facilitate the adoption of anti-cyclical measures.

The above problem has been considered in a number of monetary integration analyses, albeit solely with reference to national economies[2]. In general terms, monetary integration entails fixing currency exchange rates, followed by a discontinuation of national currencies and their replacement with a single currency. This process can be beneficial to national economies solely upon meeting the optimum currency area (OCA) criteria, i.e. mobility of production factors, degree of economic openness, tradable to non-tradable goods ratio, diversification of production, integration of financial markets, wage and price flexibility, economic coherence, overlapping fiscal and monetary policies, convergent goods markets, and convergent business cycles. To ensure the stability of the system, meeting these criteria is more important than meeting the convergence criteria (public debt and budget deficit, inflation, interest rates).

The intersection of the costs and benefits curves depends on the mutual interaction of different factors in different configurations. For instance, despite beneficial circumstances (single market, economic and monetary union), regional labor markets in the EU are relatively inflexible. The problem has deepened along with the subsequent enlargements, which have petrified the discrepancies in the structure of employment and the disproportions in wages across the EU15 (EU's major economies). As a result, the flexibility of the EU labor market decreased, consequently failing to mitigate the negative impact of growing disproportions (McKinnon, 1996; De Grauwe, 2001; Mundell and Zak, 2002; Strüver, 2002; European Communities, 2003; Mundell at al., 2005; Wiktor, 2005; De Groot and Elhorst, 2010; El-Agraa, 2011; Iossifov, 2014; Krugman et al., 2015; Ludwig and Johnson, 2017; Kooiman et al., 2018; Franks et al., 2018; Cerutti and Osorio-Buitron, 2020; Badarau et al., 2020)[3]. In turn, the level of labor market discrepancies

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2   Major studies in this regard concern the optimum monetary area theory (R. Mundell), the cost-benefit analysis of the optimum currency area (R.I. McKinnon, H.G. Grubel, P.R. Krugman and M. Obstfeld), and the endogeneity of the optimum currency area criteria (J.A. Frankiel and A.K. Rose, P. de Grauwe).

3   From the economic standpoint, the expansion of the EMU across the entire EU is unsubstantiated, as the process will only deepen the existing discrepancies.

across the US is approximate to that of the EU15, however these discrepancies are mitigated by a substantially higher flexibility. Therefore, in terms of labor market flexibility, the US may be considered as an optimum currency area, as opposed to the EU15. The outlook changes upon adoption of a different monetary area yardstick, i.e. exports and imports (% of GDP) or correlation of business cycles (Clark and Van Wincoop, 2001; Wiktor, 2005; De Groot and Elhorst, 2010; Franks et al., 2018; Badarau et al., 2020).

As already mentioned, the correlation of business cycles may be a vital variable in determining how integration areas and their regions reach the optimum currency area. This is not to say, however, that all economies and regions of the EMU (or, by extension, the EU) must display a high degree of convergence. Such a state is, naturally, desired, albeit difficult to achieve. The low correlation of business cycles must be mitigated by other criteria of the currency area, e.g. a high degree of commercial exchange. It seems crucial, therefore, to answer the questions posed in this study, i.e. whether the process of business cycle synchronization can be observed across different border regions of the EU, and if so, what is its extent?

It would seem that, in addition to own research, one should seek answers to the above questions in the literature on the subject of regional and borderland studies. However, the majority of regional or borderlands scholars focus their lens on the impact of borders on border regions and their populaces, most notably on the cross-border cooperation of regional governments, interactions between residents, cross-border commute and business cooperation. The subject literature in this regard is immensely rich and intriguing (Clark, 1994; Van Houtum, 1998; Perkmann, 2000, 2003, 2007; Virkkunen, 2002; Spierings and Van der Velde, 2008; Sohn et al., 2009; Decoville et al., 2013; Bergs, 2012; Van der Velde, 2012; Sohn and Reitel, 2013; Wróblewski, 2020a, 2020b; Decoville and Durand, 2019). At the same time, it tends to overlook the phenomenon of business cycle convergence/divergence in border regions. This is not limited to the EMU states only, but rather to business cycles in general. Such a state of affairs is caused by several factors.

Firstly, despite its relatively young age borderlands studies has established itself as a decisively interdisciplinary field. However, differences in research perspectives adopted by various authors should not be held against the usefulness of their studies, as they contribute significant epistemic value. On the other hand, these interdisciplinary approaches my hinder the research process.

Secondly, no theory of cross-border cooperation and not coherent research methodology (often confused with methods) have been adopted, which is somewhat related to the first problem. As a result, the vast majority of studies is based on analyses of case studies (Brenner, 2013; Wróblewski, 2018, 2020a, 2020b).

Thirdly, borderlands studies rarely build on the theoretical and practical publications other than the ones grounded in borderlands and regional studies, in particular with regard to economics (macroeconomics and international economics) (Wróblewski, 2020a). Above all, one is reminded of the ruminations based on market and currency integration theories (economy of market and monetary integration), which would fit in perfectly in explications of social and economic ties between border regions, not only within the EMU but the entire EU, even if those theories are not directly preoccupied with regional or local ties.

Fourthly, borderlands studies often struggle with the limited access to primary data (or the fact that such data is not aggregated whatsoever). The problem is especially noticeable at the local units.

Thus, the studies featured in the subject literature, both those on business cycles and economic fluctuations, as well as those derived from regional and borderland studies, fail to determine the degree of interdependence of the economies of border regions, understood as economic convergence. Bridging this research gap is therefore crucial.

Methodology

To address the research problems formulated in the introduction to this study, we have analyzed the convergence of business cycles among the EMU border countries. In line with the Eurostat classification, six types of NUTS3 border regions can be distinguished within the EU, i.e. those with a land border, maritime border, land and maritime border, land border within 25 km and maritime border within 25 km, land border within 25 km, and maritime border within 25 km (NUTS 2016). In accordance with the above classification, the analysis concerned virtually all internal regions of the EMU. For lack of available statistical data, the border regions of France were excluded from the study On the other hand, the analysis of business cycles in the Benelux countries and the Baltic States accounted for all NUTS3 regions (largely thanks to the modest size of these territories). For the purposes of this study, the gross domestic product (GDP) at current market prices for the years 2009-2017 was adopted as the basic indicator of social accounting, given its predominant choice as the synthetic measure of economic growth.

The temporal scope of the analysis was dictated by the availability of data and the substantive criterion. Contemporary changes in the GDP are closer to the phenomenon of economic fluctuations, manifested by frequent and short-term fluctuations in real output, than to the business cycle in the classical sense offered by (Burns and Mitchell 1946; Mintz 1972). This means that an assessment of the

condition of economies, including regional ones, can be based on shorter time series, more clearly reflecting the real sphere of the economy than classical business cycles. However, it is crucial to clear the course of the observed business cycle from irregular fluctuations, such as those caused by epidemics, natural disasters or crises, since such events affect the condition of economies only temporarily and thus may lead to misleading conclusions. Hence, the analysis conducted for the purpose of this paper does not include the years before the outbreak of the fiscal crisis.

The analytical procedure spanned four stages. The first stage involved the transformation of logarithmic entry data (GDP – annual data) into natural logarithms. The literature indicates that real output is better reflected by the GVA (gross value added). The preparatory investigation conducted for the purpose of this study made it possible to verify this view. Indeed, the course of economic fluctuations in the studied regions measured by the GVA index perfectly reflected the fluctuations in the GDP, with the difference, however, that the time range of GVA was shorter due to limited data availability. Hence, in the course of the analytical proceedings, GDP data was used.

Following the normalization of data, the value of the trend was calculated using the Hodrick-Prescott method (1980). In the third stage, deviations from the trend were determined. The fourth stage saw the determination of the degree of business cycle synchronization. To this end, Pearson correlation coefficient was adopted to distinguish between regions (Table 1).

Table 1. Criteria for classifying the correlation of economic fluctuations

Degree of correlation	Classification criteria	Graphic marking
high correlation	r≥0.75	◄─────────►
moderate correlation	0.75>r≥0.70	◄- - - - - - - -►
low correlation	0.70>r≥0.50	◄·················►
no correlation	r<0.50	no marking

Source: own study

For editorial reasons, the detailed analysis results and charts outlining the course of business cycles, along with the trends and correlation matrices, constitute separate file, published in Mendeley Data (Wróblewski, 2024). Therefore, the main text refers solely to the selected synchronization indicators.

Correlation of business cycles of the EMU border regions

Among the border regions of the twenty European Union member states that are part of the monetary union, it was the Austrian regions that were the most represented. Indeed, qualified for the analysis were regions along Austria's border with Germany, Slovakia, Slovenia and Italy. In turn, the most extensive and, at the same time, the most numerous borderland was the borderland between the Benelux states and Germany. Other regions studied were situated along the Estonian-Finnish, Baltic States, Spanish-Portuguese, Croatian-Slovenian and Slovenian-Italian borders. In total, as many as 223 regions were analyzed, comprising ten border areas, i.e.:

- Austria and Germany (33 regions: 21 German and 12 Austrian),

- Austria and Italy (10 regions: 7 Austrian and 3 Italian),

- Austria and Slovakia (10 regions: 6 Austrian and 4 Slovak),

- Austria and Slovenia (14 regions: 7 Austrian and 7 Slovenian),

- Baltic States (Lithuania, Latvia and Estonia) (20 regions: 9 Lithuanian, 6 Latvian and 5 Estonian),

- Benelux and Germany (78 regions: 19 Belgian, 38 Dutch, 20 German and Luxembourg),

- Croatia and Slovenia (19 regions: 10 Slovenian and 9 Croatian),

- Estonia and Finland (10 regions: 5 Estonian and 5 Estonian),

- Italy and Slovenia (8 regions: 5 Slovenian and 3 Italian),

- Spain and Portugal (21 regions: 8 Spanish and 13 Portuguese).

The analysis excluded regions located in the border areas of the French Republic, due to the fact that the Eurostat database contains no GDP data for French regions of the NUTS3 level.

Austrian-German borderland

Contrary to the appearances, the business cycles of the border regions of Austria and Germany show no vital synchronization. Notable in these regions are the temporal differences in their respective turning points, and a clear difference in the amplitude of fluctuations around the trend in several regions on both sides of the border.

The sharpest economic downturn among all of the analyzed German-Austrian borderland regions was observed in 2010 in the Austrian region of Außerfern. Its GDP fluctuations in the subsequent years were markedly more moderate.

In most regions of the Austrian borderland, the course of the successive business cycles was rather similar, with a slight downturn in 2010, followed by a period of recovery in 2011, succeeded by another decline (of various intensity) in their social and economic activity between 2011 and 2014, and a further growth of divergence starting in 2015. As a result, the majority of the Austrian borderland regions are characterized by a low (if not negative) business cycles correlation ratio.

The course of business cycles in the German regions along the Austrian border is somewhat different. In a number of these regions, business cycles run antithetically to their Austrian counterparts. At the same time, there are clearly noticeable differences in the course of business cycles across the German regions themselves, in particular in terms of their respective turning points and amplitudes of fluctuations around the trend, specifically in the regions of Altötting, Bodenseekreis, Garmisch-Partenkirchen and Passau (Kreisfreie Stadt - KS). Altötting business cycle is characterized by the longest recovery phase (2009-2012), peaking at around mid-2010, and the longest and sharpest decline (2012-2015). In Bodenseekreis, 2011 marked one of the highest GDP growth rates. In turn, despite a clear temporal shift in its initial phase, the business cycle of Garmisch-Partenkirchen saw relatively mild fluctuations, similar to those observed in the other regions. Conversely, in 2010 Passau (KS) saw the highest growth rate among all regions of the Austrian-German borderland.

If the regions of the Austrian-German borderland demonstrate a degree of business cycle synchronization, it is a limited one at best. Most regions demonstrate no correlation or negative correlation (divergence) of business fluctuations.

A limited degree of correlation was observed between 31 region pairs (Figure 1). Despite the relatively high number of correlations, they did not stand out particularly from the other borderlands studied. The highest convergence of business fluctuations in this group of regions was noticeable between the Austrian region of Salzburg und Umgebung [AT323] and two German regions, namely Bodenseekreis [DE147] (0.697303) and Ravensburg [DE148] (0.689204). Next were two more regional pairings, namely Rosenheim (Landkreis) [DE213] - Innviertel [AT311] (0.683899), and Traunstein [DE21M] - Traunviertel [AT315] (0.682315). In turn, the lowest convergence of economic conditions on the German-Austrian border occurred between Rosenheim (KS) [DE213] and the Tiroler Oberland [AT334] region (0.512686). In turn, a moderate degree of correlation was observed

in as few as two region pairs namely Passau (KS) [DE222] - Traunviertel [AT315] (0.719955) and Passau (Landkreis) [DE228] - Linz-Wels [AT312] (0.706985), while the strongest correlation was recorded only in four cases (Figure 1):

- Ravensburg [DE148] - Linz-Wels [AT312] (0.850486),

- Passau (Landkreis) [DE228] - Salzburg und Umgebung [AT323] (0.822252),

- Rosenheim (KS) [DE213] - Pinzgau-Pongau [AT322] (0.810203),

- Passau (KS) [DE222] - Linz-Wels [AT312] (0.790298),

- Altötting [DE214] - Linz-Wels [AT312] (0.766701).

Compared to the other areas studied, especially the Baltic States or Benelux-German borderland, the cross-border convergence of economic fluctuations in the German-Austrian borderland may be surprising for at least two reasons. First, its area is dominated by low-degree correlations. Second, the moderate and high correlations are among the lowest correlations disginguished. This may entail that the course of real output in these regions depends to a greater extent on the condition of national regions or national economies (centripetal ties).
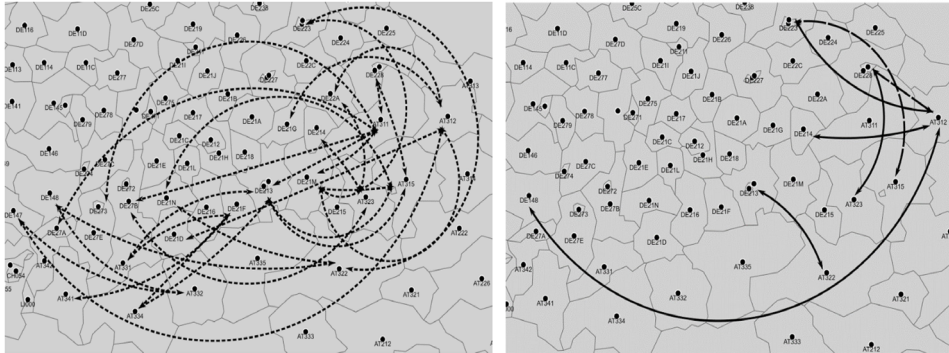

Figure 1. The business cycle synchronization along the German-Austrian border

Source: Own study.

Austrian-Italian borderland

In terms of convergence, the Italian-Austrian borderland sits at the opposite end of the Spanish-Portuguese border, and is dominated by the processes of divergence. Not only do the business cycles in the Italian-Austrian border regions differ in terms of their course but also in terms of their (negative)

correlation. The differences in the course of business cycles are visible in nearly each of their aspects. A desynchronization of turning points is clearly visible, along with amplitudinal business fluctuations, in particular in the Italian regions. In the analyzed group of regions, only a single pair of regions demonstrated a high degree of business cycle synchronization, i.e. the Italian region of Belluno [ITH33] and its Austrian neighbor Klagenfurt-Villach [AT211] (0.858946). Some similarities can also be identified based on the business fluctuations in the Italian region of Bolzano-Bozen and its two Austrian neighbors, i.e. Innsbruck and Klagenfurt-Villach, although the latter showed a visible shift in the cycle phases over the first period of analysis. Conversely, Innsbruck's amplitude of fluctuations was markedly lower. The above observation was corroborated by the degree of correlation of the aforementioned regions. In both cases, a low degree of correlation was observed, i.e. 0.570867 for Bolzano-Bozen [ITH10] – Innsbruck [AT332], and 0.641226 for Bolzano-Bozen [ITH10] - Klagenfurt-Villach [AT211] (Figure 2).
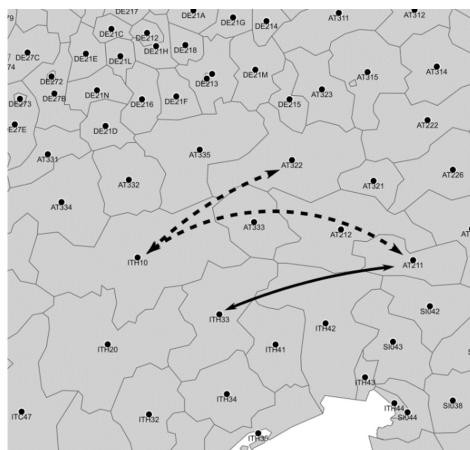

Figure 2. The business cycle synchronization along the Italian-Austrian border

Source: Own study.

Austrian-Slovakian borderland

The Austrian-Slovakian borderland is another example of an area typified by divergent rather than convergent business cycles. Both the Slovak and regions and their Austrian counterparts show considerable discrepancies with regard to the course of their business cycles. In some Slovak regions, e.g. Trnavský kraj, Trenciansky kraj, and Nitriansky kraj, the initial phases of the business cycle were somewhat similar, up until the fourth year of the analysis, which brought about

a noticeable upturn in Tranciansky kraj. Conversely, Bratislavský kraj was only convergent in the very first phase of the cycle, diverting from the rest of the Slovak borderland, as its turning points were antithetical to the other.

In a similar vein, the Austrian border regions are characterized by divergent business cycles, although in some regions (Wien and Niederösterreich-Süd) their course is relatively similar to the Slovak regions. In other regions, the processes of divergence are far more visible. For instance, over the period of analysis, Weinviertel's cycle followed a different trajectory than almost all of the Austrian-Slovakian borderland regions.

A peculiar course of the business cycle was observed in the economy of the Wiener Umland/Nordteil region. Initially, the turning point for this region pointed to an economic slump, however it was followed by a period of recovery, which lasted much longer than in the remaining regions of the Austrian-Slovakian borderland (until 2014). In the subsequent years, however, the economy fell into decline again.

Another curious and atypical business cycle course was observed in Nordburgenland. In this case, business fluctuations around the trend were relatively mild. For the most part, the trend and the cycle manifested a linear convergence, save for 2011-2013, where a higher growth rate was recorded.

The above observations are corroborated by the results of the business cycle synchronization analysis. Among the tested regions, only two region pairs showed a high degree correlation, while four displayed a low convergence ratio. The highest synchronization was recorded for the following region pairs (Figure 3):

- Wiener Umland/Nordteil [AT126] - Nitriansky kraj [SK023] (0.847862),

- Niederösterreich-Süd [AT122] - Trnavský kraj [SK021] (0.774694).

Conversely a low degree of correlation was observed between (Figure 3):

- Wiener Umland/Nordteil [AT126] - Trnavský kraj [SK021] (0.666661),

- Nordburgenland [AT112] - Nitriansky kraj [SK023] (0.689381),

- Niederösterreich-Süd [AT122] - Trenciansky kraj [SK022] (0.608910),

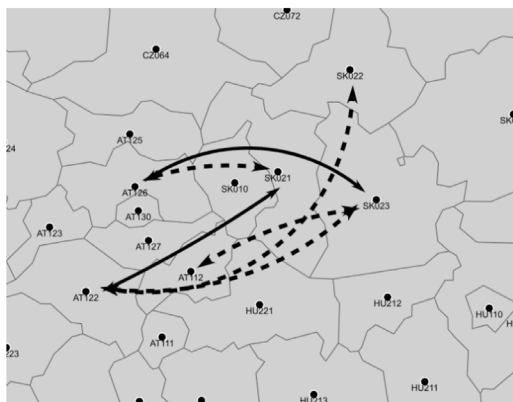- Niederösterreich-Süd [AT122] - Nitriansky kraj [SK023] (0.680242).

Figure 3. The business cycle synchronization along the Austrian-Slovakian border

Source: Own study.

Austrian-Slovenian borderland

The Austrian-Slovenian borderland is dominated by the processes of divergence. Not only do business cycles across the border fail to manifest a significant degree of synchronization but they also reveal clear discrepancies in terms of the duration of their respective phases and the amplitude of fluctuations around the trend. Over the first two years of analysis, the economic decline in most of the Slovenian regions was not nearly as significant as in their Austrian counterparts (some of them even saw economic upturn). Nonetheless, starting in 2011, the majority of the Slovenian border regions saw a slightly sharper decrease in their respective GDPs than on the Austrian side of the border, with the trend continuing through 2014/2015. It should be stressed, however, that the business fluctuations along the Austrian-Slovenian border were generally not as stark as in the other borderlands, e.g. in the Baltic States.

As few as four region pairs were observed in the Austrian-Slovenian borderland that manifested a cross-border synchronization of business cycles. Still, the degree of their synchronization was relatively low (Figure 4):

- Südburgenland [AT113] - Savinjska [SI034] (0.643732),

- Graz [AT221] - Pomurska [SI031] (0.611949),

- Graz [AT221] - Koroska [SI033] (0.608918),
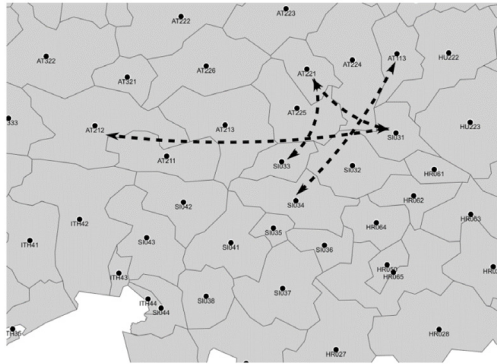
- Oberkärnten [AT212] - Pomurska [SI031] (0.531104).

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Figure 4. The business cycle synchronization along the Austrian-Slovenian border

Source: Own study.

Baltic States borderland

We shall now address the business cycle fluctuations in the borderland regions of the Baltic States: Lithuania, Latvia, and Estonia. In contrast to most borderlands analyzed in this study, the investigation into the business cycles correlations in the Baltic States encompassed all NUTS3 regions (as was the case with the Benelux regions), rather than merely the borderlands identified according to the Eurostat typology.

The business cycles of the analyzed regions are convergent, in particular in Latvia and Estonia. This convergence can be observed over the course of the entire period of analysis, with a noticeable intensification between 2014 and 2017, i.e. following Latvia's and Estonia's accession to the EMU.

On the other hand, the business cycles of some regions in the analyzed territory reveal a clear shift in the turning points and different fluctuations amplitude. Furthermore, fluctuations around the trend in some regions are dissimilar to the remaining regions of the borderland, although the trend was positive across all of those regions. Noteworthy in this regard are the Estonian regions of Kirder-Eesti and Lääne-Eesti, the Latvian regions of Riga, Vidzeme, Latgale, and Kurzme, and the Lithuanian region of Utenos apskritis, whose business cycles show clearly different fluctuations amplitudes and different values and distribution of their respective turning points.

The Lithuanian regions point to both centripetal interdependencies and a rather strong correlation with the Latvian and Estonian regions. At the same time, the Latvian regions frequently show a weak (if not negative) correlation with

the business fluctuations observed in their Estonian counterparts. In turn, the latter are characterized by a divergence of business cycles.

The Baltic borderland distinguishes itself from all the areas studied for the intensity of the phenomenon in question. Between the Lithuanian, Latvian and Estonian border regions, synchronizations of high degree economic fluctuations clearly dominate. These were distinguished for as many as 43 pairs of regions (Figure 5). The highest correlation, not only among the border regions, but among all the distinguished ones occurred between the Lithuanian region of Siauliu apskritis [LT026] and the Estonian region of Kesk-Eesti [EE009] (0.944646). The second highest correlation coefficient value was again identified for the Kesk-Eesti region, this time with the Lithuanian region of Telsiu apskritis [LT028] (0.938126). These were followed by the pair Klaipedos apskritis [LT023] - Põhja-Eesti [EE001] (0.935130). It is worth noting here that the highest correlation in this group of regions was observed between the Estonian and Lithuanian regions. On the other hand, among the Latvian regions, the highest correlation was observed for the Pieriga region [LV007] and Lithuania's Kauno apskritis [LT022] (0.929342). This was the fourth correlation in this group in terms of the intensity of the phenomenon studied. The lowest degree of convergence in this group was characterized by two pairs of regions, namely: Telsiu apskritis [LT028] - Pieriga [LV007] (0.757856) and Panevezio apskritis [LT025] - Zemgale [LV009] (0.755319). The two still ranked among the highest values for all the borderlands under discussion.

Second in terms of number were low degree synchronicities. They were nearly half as numerous as high correlations, amounting to 24 (Figure 5). This time, the correlations between the Lithuanian and Latvian regions stood out. For example, the highest convergence in this group was identified for the Latvian region of Zemgale [LV009] together with two Lithuanian regions, i.e. Kauno apskritis [LT022] (0.694485), Klaipedos apskritis [LT023] (0.692085). In contrast, the weakest ties among all the border regions studied were observed between Telsiu apskritis [LT028] and Latgale [LV005] (0.503110).

A moderate correlation ratio was observed in only four region pairs (Figure 5). Dominant among them were correlations between the Lithuanian and Latvian regions of:

- Marijampoles apskritis [LT024] - Pieriga [LV007] (0.738178),

- Siauliu apskritis [LT026] - Põhja-Eesti [EE001] (0.731891),

- Alytaus apskritis [LT021] - Kurzeme [LV003] (0.728198),

- Siauliu apskritis [LT026] - Kurzeme [LV003] (0.718604).

It is worth noting, however, that compared to the other studied borderlands with moderate correlation of business fluctuations, the Baltic border regions were characterized by a relatively high convergence ratio.

Figure 5. The business cycle synchronization along the Baltic States borders

Source: Own study.

Benelux-German borderland

The course of business cycles along the border between Germany, Belgium, Netherland, and Luxembourg is quite similar. In most regions of this borderland area, the distribution of turning points is typical and overlaps with the sinusoid course of the business cycle. Fluctuations have a cyclical and repeating character, with a relatively limited fluctuation around the trend. However, the analyzed group did reveal eight regions whose cycles are typified by a distinctly different course from that of the remaining Benelux-German borderland regions, mostly due to steeper fluctuations amplitude. These regions include:

- German regions of Wesermarsch and Emden (KS), which showed the highest positive and negative turning points among all the analyzed borderland regions

- Belgian regions of Arr. Bastogne, Arr. Huy, Arr. Arlon and Arr. Dinant, whose turning points in the first phase demonstrate a temporal shift when compared with their German counterparts,

- Dutch region of Overig Groningen, whose cycle is atypical, as it is essentially comprised of two phases. Similar observations can be made with regard to the Belgian regions of Arr. Bastogne and Arr. Arlon.

Generally speaking, the process of business cycle convergence along the border between Germany, Belgium, Netherland, and Luxembourg is not a dominant one, despite a similar course of their respective business cycles. The most numerous group is made up of the regions with a lower degree of business cycle synchronization. Such an image of convergence in real output was undoubtedly influenced by the peculiarities of the area studied. Namely, it consisted of a very large number of small territorial units, often not bordering on one another. Thereby, this group includes as many as 224 region pairs (Figure 6). Nevertheless, the correlations between the Dutch and Belgian regions were particularly noticeable. For example, they were behind the majority of the most intense correlations in this group of regions. At this point, one should also mention the correlation of economic fluctuations between the following regions:

- Arr. Neufchâteau [BE344] - Zuidoost-Friesland [NL126] (0.699202),

- Arr. Bastogne [BE342] - Midden-Limburg [NL422] (0.697237),

- Arr. Bastogne [BE342] - Flevoland [NL230] (0.697214),

- Arr. Neufchâteau [BE344] - Zuidwest-Overijssel [NL212] (0.693532),

- Arr. Thuin [BE32D] - Zuidoost-Noord-Brabant [NL414] (0.692492).

Similarly synchronized was the economic situationof the German Ammerland region [DE946] with the Dutch Noord-Friesland region [NL124] (0.698724) and the Belgian Arr. Huy [BE331] (0.697705). The weakest ties of all the border regions were observed for the Dutch Zuidoost-Drenthe region [NL132] and the German Heinsberg [DEA29] - (0.501098). Slightly higher correlations were determined for two more pairs of regions, namely Wesermarsch [DE94G] and Zuidwest-Gelderland [NL224] (0.501207), and Arr. Thuin [BE32D] - Zuidoost-Drenthe [NL132] (0.501552), respectively.

Also numerous was the group of regions with intensive interdependencies. Thereby, the highest degree of correlation was observed in 130 region pairs (Figure 7). The highest synchronicity of economic fluctuations among the Benelux-German border regions was observed for the province of Liège [BE332], located in the southeastern part of Belgium, and the province of Zuidoost-Friesland [NL126], located in the northern part of the Netherlands (0.973212). As can be seen, these regions were among the most distant administrative units with respect to each other, while also manifesting one of the highest coefficients of convergence of economic fluctuations among all those observed. As for the weakest ties in this group of regions, they were almost identical in as many as seven cases:

- Wesermarsch [DE94G] - Agglomeratie Haarlem [NL324] (0.754111),

- Borken [DEA34] - Zuidoost-Noord-Brabant [NL414] (0.753491),

- Friesland (DE) [DE94A] - Arr. Arlon [BE341] (0.751484),

- Borken [DEA34] - Prov. Liège [BE332] (0.751379),

- Emsland [DE949] - Arr. Huy [BE331] (0.751111),

- Euskirchen [DEA28] - Prov. Liège [BE332] (0.750883),

- Arr. Thuin [BE32D] - Delfzijl en omgeving [NL112] (0.750074).

Over 55 region pairs demonstrated a moderate degree of business cycle synchroniza-tion. These included 49 correlations (Figure 8). The highest convergence of economic situation in this group of regions was observed for the pair Arr. Philippeville [BE353] - Agglomeratie Leiden en Bollenstreek [NL337] (0.749733). The following regions were further distinguished by a moderate degree of interdependence:

- Borken [DEA34] - Arr. Namur [BE352] (0.748112),

- Arr. Bastogne [BE342] - Overig Zeeland [NL342] (0.747736),

- Arr. Neufchâteau [BE344] - Delfzijl en omgeving [NL112] (0.747472),

- Wesermarsch [DE94G] - Arr. Soignies [BE32C] (0.747197).

Nonetheless, the aforementioned correlations were somewhat average when compared to the other studied borderlands. In contrast, the weakest ties of moderate intensity were established for the pairs formed by the Dutch region of Overig Zeeland [NL342], with the German Friesland (DE) [DE94A], on the one hand, and the Belgian Arr. Neufchâteau [BE344], on the other. However, they did not differ significantly in this regard from the following four pairs of regions, namely:

- Borken [DEA34] - Arr. Thuin [BE32D] (0.702891),

- Bezirk Verviers [BE336] - Midden-Limburg [NL422] (0.702604),

- Oldenburg (KS) [DE943] - Midden-Limburg [NL422] (0.702604),

- Arr. Bastogne [BE342] - Zuidwest-Gelderland [NL224] (0.70202).

It should also be emphasized that the business cycle of each of the German-Belgian-Dutch-Luxembourg borderland region was synchronized with that of at least one neighboring region across the border, a rare occurrence in the EMU (granted, most of these regions were correlated to a low degree). Moreover, most of the examined regions that failed to show at least a low degree of synchro-nization were often negatively correlated with the remaining regions of the borderland, e.g. Leer, Viersen, Städteregion Aachen, Trier-Saarburg, Arr. Virton.
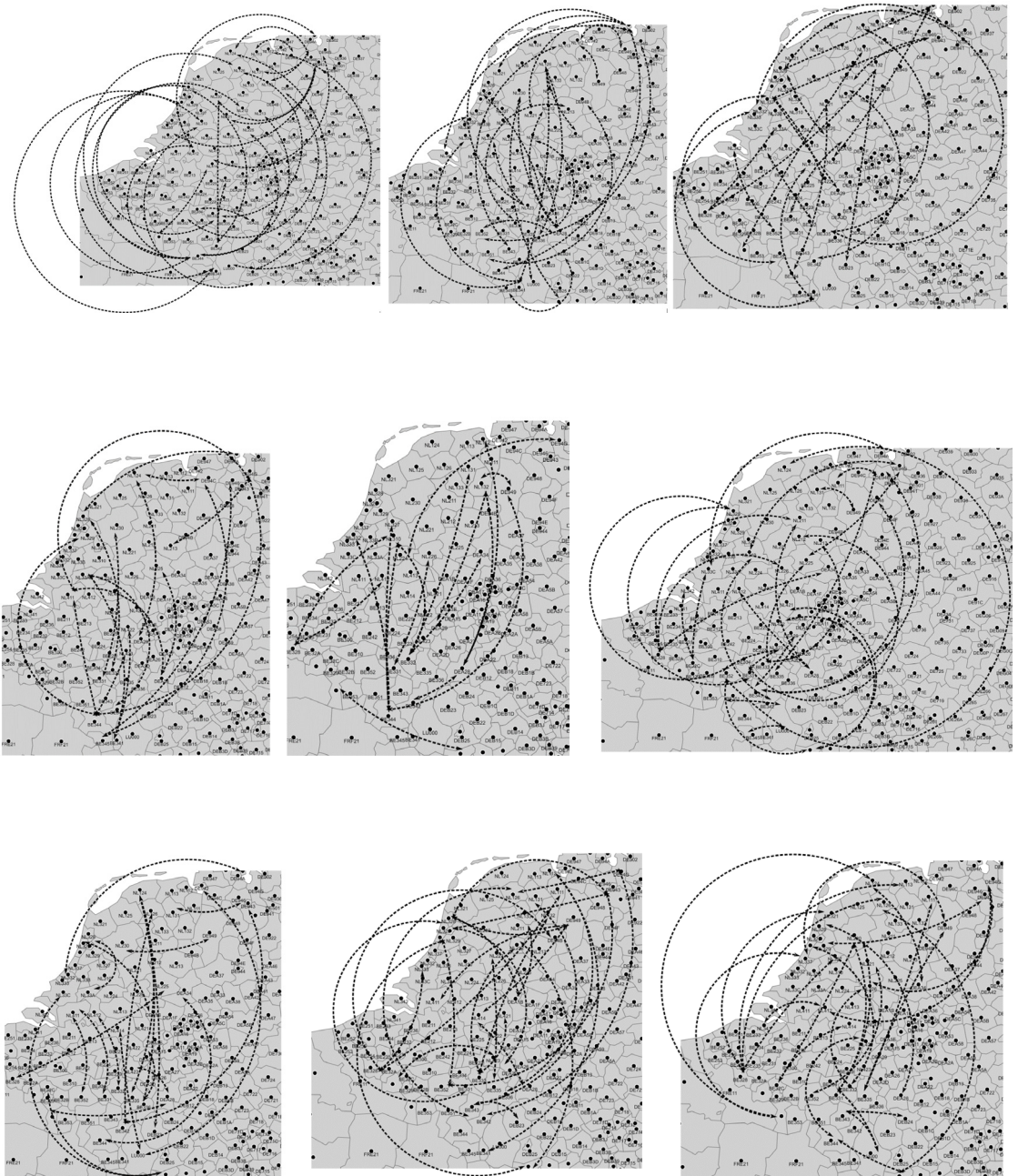
Figure 6. A low degree of the business cycle synchronization along the Benelux-German borders
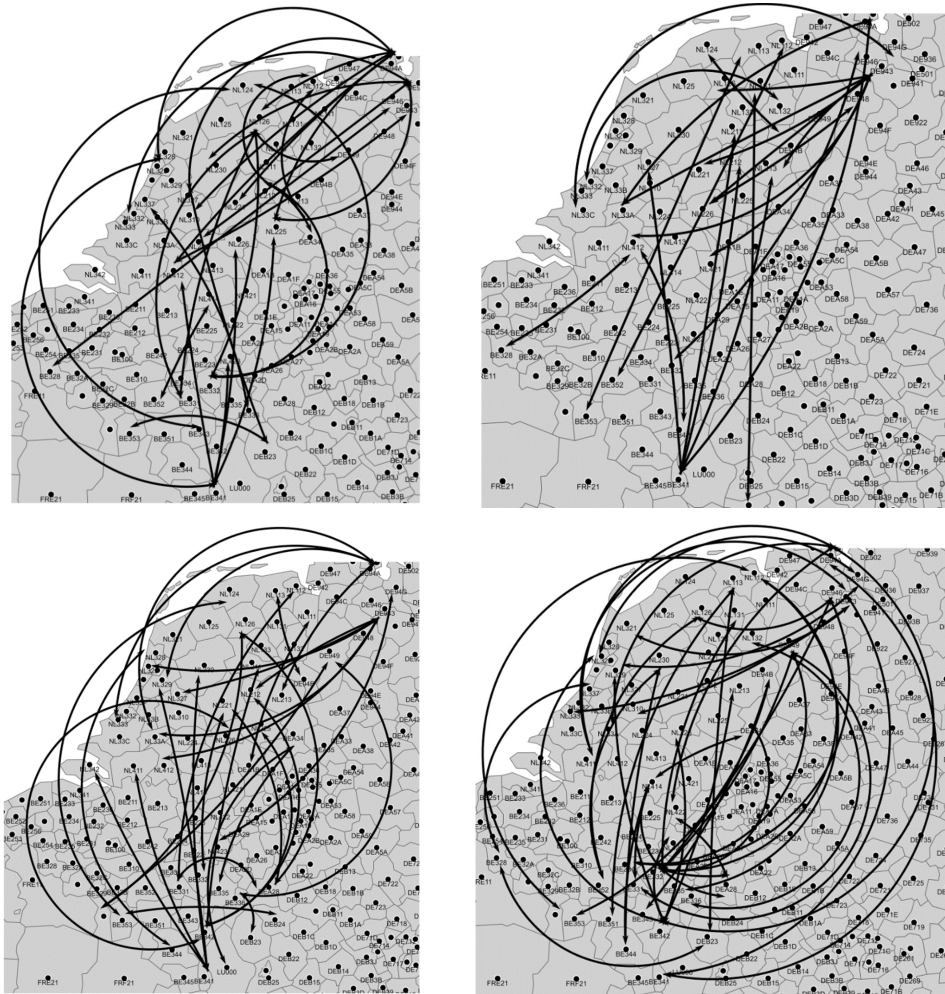
Source: own study

Figure 7. A high degree of the business cycle synchronization along the Benelux-German borders
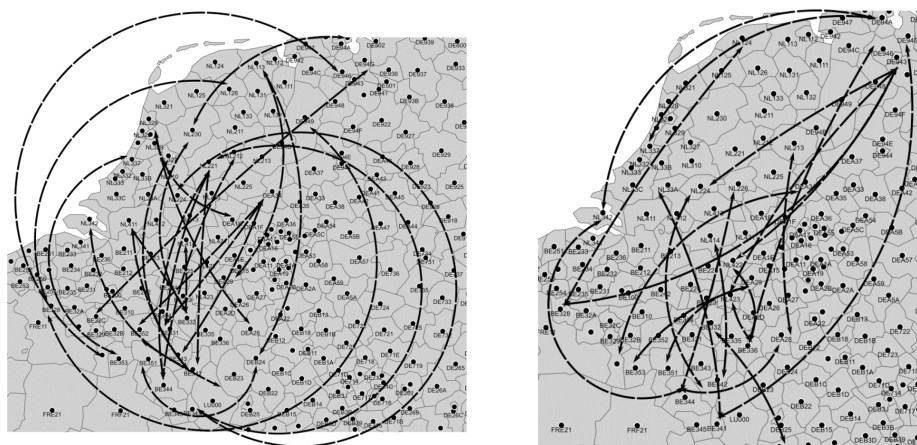
Source: Own study

Figure 8. A moderate degree of the business cycle synchronization along the Benelux-German borders

Source: own study

Croatian-Slovenian borderland

The Croatian-Slovenian border region is one of the few EMU areas where convergence processes are particularly evident, despite the fact that Croatia was the latest of all EU countries to join the Eurozone. The course of economic cycles for almost all border regions between these two states is similar.

In 2009, as in most of the regions studied, the Croatian-Slovenian border embarked on a downturn phase. Its course on the Croatian side of the border varied quite a bit, although the period ended at about the same time (2014/2105). The economy of the Karlovacka županija region was the quickest to react to the economic shock. In contrast, the economy of the Primorskogoranska županija region proved to be the most resilient. This is evidenced by two indications. First, the growth rate in this region was the slowest to decline. Second, the bottom turning point in this phase of the cycle was the highest in this region. In contrast, the economy of the Grad Zagreb region reacted most strongly to the fiscal crisis. It was interesting to note the sudden recovery in 2013 and the equally rapid decline in the Međimurska županija region. No other region on either side of the border saw such an apparent anomaly. This may have been related to Croatia's accession to the European Union in July 2013. Moreover, the region did not show any cross-border correlations in business cycle fluctuations.

The border regions of Slovenia and Croatia very rarely show a convergence of economic fluctuations of less than a moderate degree, most often

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of a high degree. In total, as many as 76 correlations were distinguished (Figure 9). Thus, one can assume that the synchronization of economic fluctuations in the Croatian-Slovenian border region is extremely common, which is not observed particularly often in the EMU area.
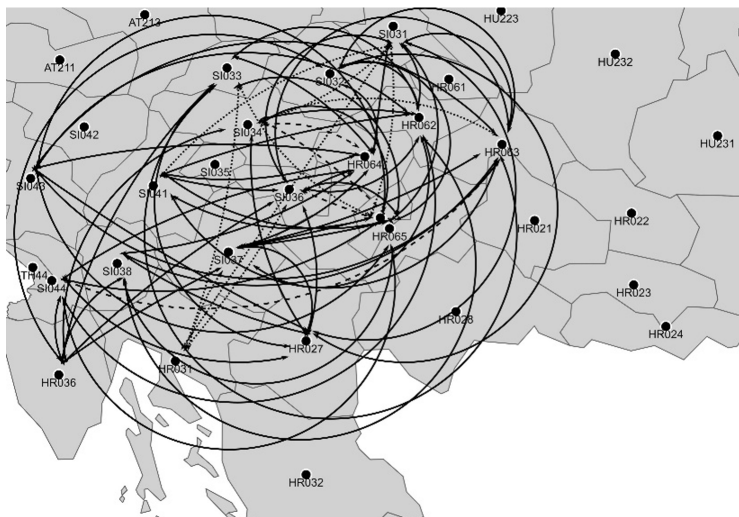

Figure 9. The business cycle synchronization along the Slovenian-Croatian border

Source: Own study.

The highest degree of convergence of economic fluctuations among all border regions was observed between the Croatian Istarska županija [HR036] and three Slovenian regions, i.e. Goriška [SI043] (0.979738), Osrednjeslovenska [SI041] (0.975505), Obalno-kraška [SI044] (0. 965089), respectively. At this point, one should note that the highest degree of convergence among all the regions studied was observed for the regions of Istarska županija and Goriška [SI043]. In addition to the aforementioned, 58 other high degree correlations were distinguished in the Croatian-Slovenian borderland. The lowest convergence in this group was identified for the pair Savinjska [SI034] - Varaždinska županija [HR062] (0.757731).

The Croatian and Slovenian regions showed much more moderate convergence in terms of business cycle fluctuations. Only four such correlations were distinguished. On the other hand, low degree synchronization was observed slightly more often, i.e. in 11 cases. Of all the regions, the weakest correlation was identified between the economic condition of the Croatian Primorsko-goranska

županija HR031] and two Slovenian regions, namely Posavska (0.538080) and Obalno-kraška (0.536185).

Estonian-Finnish borderland

The final examined borderland of the EMU area was that between Finland and Estonia. The territory is host to both convergence and divergence processes, as evidenced in the examined group of regions, which manifested a high degree of business cycle synchronization, and some negative correlations, too.

An analogous course of business fluctuations can be observed in the Finnish region of Varsinais-Suomi and the Estonian region of Lõuna-Eesti. Their business cycles share nearly identical fluctuations around the trend and nearly identical turning points in the initial phase of the cycle, albeit the growth rate was slightly lower in the Finnish Region. In the subsequent phase of the cycle (starting in 2012), the business situation in Lõuna-Eest [EE008] improved, while Varsinais-Suomi [FI1C1] recorded a period of economic downturn. Nonetheless, the cycles of both regions are characterized with a high degree of synchronization (0.877341).

The second region pair with highly convergent business fluctuations is that of Etelä-Karjala [FI1C5] and Kirde-Eesti [EE00A]. Interestingly, despite recording a higher business cycles correlation ratio (0.891447) than in the case of Varsinais-Suomi [FI1C1] and Lõuna-Eesti [EE008], since 2012 Etelä-Karjala [FI1C5] and Põhja-Eesti [EE001] (0,711745) have become increasingly divergent in terms of their business fluctuations. On top of that, Etelä-Karjala [FI1C5] also seems to be strongly correlated with the Estonian region of Kesk-Eesti [EE009] (0.844247), although there has been a marked difference in the course of their respective cycles (2012-2015, and since 2016 to date). Conversely, the business cycle of Kesk-Eesti [EE009] is highly synchronized with the Finnish regions of Päijät-Häme [FI1C3] (0.823761) and Kymenlaakso [FI1C4] (0.806671). The course of Kesk-Eesti's and Päijät-Häme's business cycles is also essentially analogous, although pronounced discrepancies have been observed in the pair after 2015, following a slump in the Estonian region, which was far more noticeable than in the case of Päijät-Häme. In a similar vein, the regional business cycles of Kesk-Eesti and Kymenlaakso share a similar course, albeit with different fluctuations amplitudes. The analyzed group of regions also revealed regions with a low degree of business cycle synchronization, i.e. Helsinki-Uusimaa [FI1B1] - Lääne-Eesti [EE004] (0.617312), and Päijät-Häme [FI1C3] - Kirde-Eesti [EE00A] (0.639617) (Figure 10).
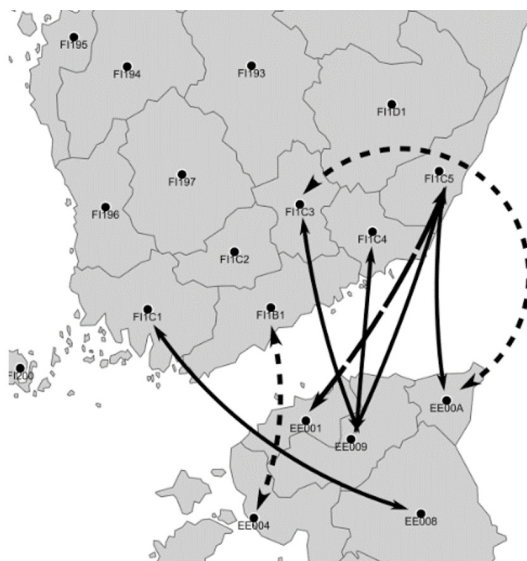
Figure 10. The business cycle synchronization along the Estonian-Finnish border

Source: Own study.

Italian-Slovenian borderland

The situation is slightly different alongside the Italian-Slovenian borderland. The analysis concerned three Italian regions, i.e. Udine, Trieste, and Gorizia, and five Slovenian ones, i.e. Gorenjska, Goriska, Osrednjeslovenska, Primorsko-notranjska, and Obalno-kraska. The first two Italian regions were characterized by an approximate course of business cycles when compared with their Slovenian counterparts throughout almost the entire period of analysis. Conversely, in Gorizia the initial phase of the cycle was distinctly different from those of the remaining regions. Gorizia saw an accelerated growth rate after recession in the first phase of the cycle, whose peak fell at the turn of 2010 and 2011, followed by a downturn in growth and an assimilation of the business cycle to the trend dominant in the remaining regions of the Italian-Slovenian borderland, especially those on the Italian side of the border. Despite this fact, the region failed to demonstrate a significant convergence with the other borderland regions.

In contrast, the Slovenian region that showed the highest business fluctuations was Obalno-kraska, followed by Primorsko-notransjska and Goriska. In general terms, between 2012 and 2015 all of Slovenia's borderland regions saw a social and economic growth slump, resulting from the ailing business situation.

The Italian-Slovenian borderland is host to the processes of high- and low-intensity convergence processes. Moreover, in contrast to the Italian borderland regions, their Slovenian counterparts also manifest significant centripetal inter-dependencies. The highest degree of business cycle synchronization was observed between the Italian region of Udine [ITH42] and, interestingly, all of the Slovenian borderland regions, i.e (Figure 11):

- Primorsko-notranjska [SI038] (0.927745),

- Gorenjska [SI042] (0.886977),

- Goriska [SI043] (0.884519),

- Obalno-kraska [SI044] (0.844454),

- Osrednjeslovenska [SI041] (0.824224),

and between the regions of Trieste [ITH44] and Obalno-kraska [SI044] (0.764367). The business cycle of the Italian region of Trieste [ITH44] further appears to be synchronized with Slovenia's other borderland regions, except for Primorsko-notranjska [SI038], albeit to a lesser degree (Figure 11):

- Osrednjeslovenska [SI041] (0.669396),

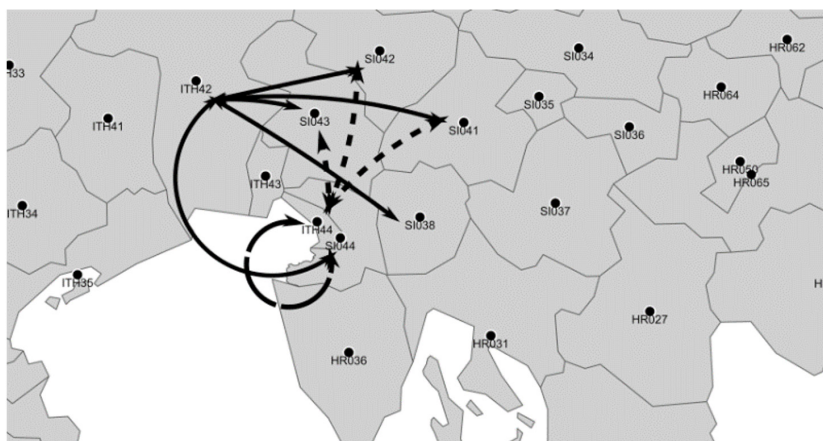- Goriska [SI043] (0.654060),

- Gorenjska [SI042] (0.643245).

Figure 11. The business cycle synchronization along the Italian-Slovenian border

Source: Own study.

Portuguese-Spanish borderland

The course of business cycles along the border between Portugal and Spain is highly correlated. One could even claim that, aside from specific exceptions, the economic conditions on both sides of the border are a mirror image of one another. It ought to be stressed all the more since such a state of affairs is not commonplace in the EMU. Between 2011 and 2014, a stark economic decline was registered across the border, likely due to the crisis in the Eurozone at the time. This suggests that the impact of the crisis on the course of business cycles along the Portuguese-Spanish border occurred with a delay.

On the Spanish side of the border, the highest rate of decline was observed in the Province of Huelva in 2013-2014. The slump was particularly perceptible as in 2011 this very province saw the highest economic growth among all borderland regions. It should also be stressed that there was a notable shift in the business cycle of the Province of Huelva when compared to the remaining regions. A slight shift of the turning point in the first phase of the cycle was also observed in the Province of Zamora. One should further point out that not all border regions (e.g. Zamora, Ourense, Huelva) recorded social and economic growth in the first phase of the cycle. Towards the end of the cycle, the growth rate itself was also lower in some regions than in others.

As signaled above, the course of business cycles in most Portuguese regions is approximately the same as in their Spanish counterparts. In this case, too, some regions divert from the dominant trend in the EMU borderlands. Most notably, such is the case with the Terras de Trás-os-Montes, Beira Baixa, and Alto Tâmega regions. Terras de Trás-os-Montes saw the lowest economic growth decline among the Portuguese regions of the Spanish-Portuguese borderland, second only to the Spanish Province of Huelva. At the same time, the region also shows a characteristic shift in the turning point of the first phase of the business cycle. Conversely, the second phase manifested much more of an economic recovery than in the remaining regions, while the third phase saw a gradual decline. In contrast, the business cycle of the Beira Baixa and Alto Tâmega regions did not fundamentally depart from the remaining borderland regions, although its second phase saw a noticeable (albeit short-lasting) social and economic growth in Beira Baixa (2012) and Alto Tâmega (2013).

The Portuguese-Spanish borderland ranks among the few EMU borderlands dominated by business cycle convergence, which is not often the case for the said area. The highest correlation ratio (r) was observed in 46 region pairs (Figure 1). The highest convergence of economic fluctuations among the border regions was observed between the Spanish region of Pontevedra [ES114] and two

Portuguese regions, namely: Algarve [PT150] (0.986982) and Cávado [PT112] (0.979919). Not much weaker ties were observed for the Médio Tejo [PT16I] and Badajoz [ES431] regions (0.979143). The weakest correlations in this group were determined between the Spanish region of Huelva [ES615] and the Portuguese regions of Médio Tejo [PT16I] (0.756238) and Baixo Alentejo [PT184] (0.751338), and between Alto Alentejo [PT186] and Cáceres [ES432] (0.752676), respectively. Nonetheless, these correlations were among the most intensive ones in the EMU borderlands.
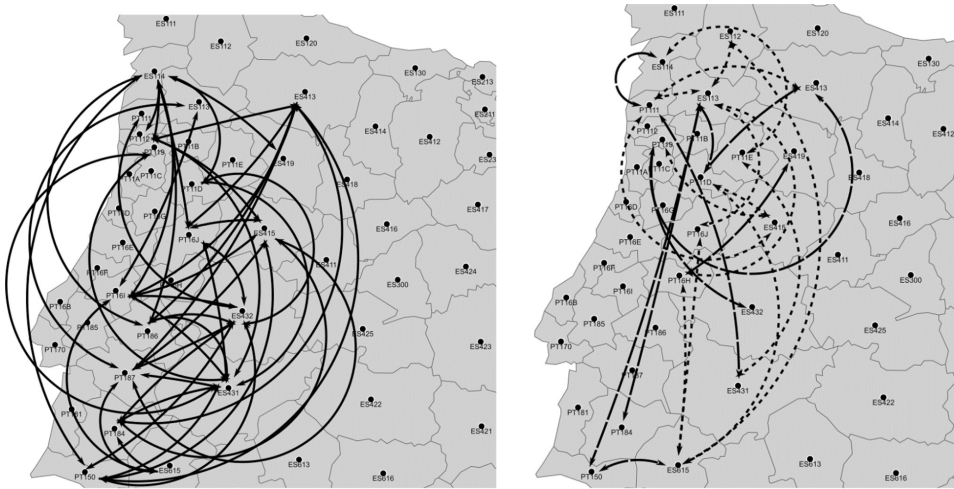

Figure 12. The business cycle synchronization along the Portuguese-Spanish border

Source: Own study

Moderate and low degree correlations were observed less frequently, with as few as 10 of the former identified in total. Low convergence of economic fluctuations, on the other hand, occurred between 15 pairs of regions. Of the moderate correlations, the most pronounced ties, to almost the same degree, were observed between the Portuguese region of Beira Baixa [PT16H] and the Spanish region of Zamora [ES419] (0.746707), as well as between the Alto Minho region [PT111], located in the northwest of Portugal, and two Spanish regions, i.e., Pontevedra [ES114] (0.744952) and Badajoz [ES431] (0.744623). However, they were not significantly different from the lowest correlations in the group of regions with a high degree of synchronization of economic fluctuations. Also, the difference in the correlation coefficient between the lowest moderate correlation, identfied between the Douro [PT11D] and Ourense [ES113] regions (0.700753),

and the highest low-degree correlation, occurring between the Portuguese region of Cávado [PT112] and the Spanish Ourense [ES113] (0.694500), was insignificant, if not marginal. However, the lowest degree of convergence in real output was identified between the regions of Terras de Trás-os-Montes [PT11E] and Pontevedra [ES114] (0.503462) (Figure 12). This was, at the same time, one of the lowest such correlations among all of the observed.

Conclusions

This study comprises the first in a series of papers devoted to the problem of synchronization of economic fluctuations in EU border regions, in this case focused on presenting the intensity of this phenomenon in NUTS3 border regions located along the internal borders of the EMU states. The subject literature in the fields of regional and borderlands studies is not particularly rich, since the vast majority of studies on business cycles tend to be limited to macroeconomics. As a result, most economists analyze the phenomenon from the Vantage point of national economies or larger territorial units (in the case of the EU – NUTS1 or NUTS2 regions). The research conducted for the purpose of this study therefore fills a research gap identified in the literature on the subjects.

The analyses conducted in the course of this study enabled the formulation of the following conclusions:

- All EMU borderlands are host to both convergent and divergent business cycles.

- The degree of business cycle synchronization among the EMU states does not depend on when (or whether) the single euro currency was adopted. In some of the analyzed borderland areas, EMU membership did not result in business cycle convergence, while in other regions, e.g. the Baltic States or Croatian-Slovenian borderland, this impact was noticeable.

- Convergence processes dominate in the Croatian-Slovenian, Portuguese-Spanish and Italian-Slovenian, borderlands, in the Baltic States, and along the Belgium-Dutch-Germany-Luxembourg borderlands. Lower rates of business cycle convergence can be observed along the Austrian borders, e.g. in the Italian-Austrian, Austrian-Slovenian, Austrian-Slovakian, and Austrian-German borderlands. In turn, the Finnish-Estonian borderland both of these processes can be observed.

- The frequency of business cycle divergence in the EMU borderland regions goes to show that, despite beneficial conditions (such as their borderland location, access to the common market, membership in the Schengen Area, the EMU,

cohesion policy, the INTERREG and the EGTC and the oft-intensive cross-border cooperation), the economies of these regions are often independent from one another. Business fluctuations in these regions tend to result from domestic business conditions or align themselves with the business trends in the respective countries rather than with the business situation in the border regions located across the border. As a result, the impact of the EMU on regional cycles seems to be an indirect rather than direct one.

The conducted research casts a new light on borderlands and regional studies. It fills in the research gap by evaluating the interdependencies of the border regions within the EMU. At the same time, it delineates new research areas, directed at:

- Determining the degree of business cycle synchronization among the EMU border regions and the remaining EU borderlands (EMU vs. EMU opt-in borders, e.g. the Polish-German borderland; EMU vs. EMU opt-out, e.g. the German-Danish borderland; EMU opt-in vs. EMU opt-out, e.g. the Swedish-Danish borderland) with the remaining domestic regions, which – along with the body of research borderlands and regional studies – may facilitate the identification of a complex system towards which their respective economies gravitate (i.e. directions in which they develop their economic ties);

- Identifying the degree of impact of the other OCA indicators, i.e. commercial exchange, labor market flexibility, on the economies of the EMU and EU border regions and their business fluctuations;

- Determining the degree to which the EU borderlands fulfill the OCA criteria, which will enable scholars to answer some crucial questions: Do the EU border regions meet the OCA criteria, and if so, does this process take place to an equal extent in and outside of the EMU borderlands? Can one identify a range of smaller optimum integration areas located alongside the internal borders of the EU member states? Answering these questions would be of value not only from the perspectives of borderlands and regional studies but also in the context of the OCA theory and practice.

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