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ORIGINAL PAPER

THE IMPORTANCE OF SERVICES IN SHAPING THE VOLATILITY AND SYNCHRONIZATION OF REGIONAL BUSINESS CYCLES: A COMPARATIVE ANALYSIS OF THE POLISH AND PORTUGUESE ECONOMIES

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A b s t r a c t

The aim of this article is to assess the role of services in stabilizing the volatility and the degree of synchronization of regional business cycles. The existing literature points to the relevance of services in smoothing business cycles. However, services can also play a negative role in stabilizing the economy, as the COVID-19 pandemic demonstrated. Among a variety of services, tourism plays a special role; it can act as a stabilizer during a typical business cycle or become a source of strain in the event of an exogenous shock, such as the COVID-19 pandemic.

The study focuses on the regions of two countries – Poland and Portugal – which differ in both the share and the structure of services in their regional GDP, which affects their resistance to changes in the economic environment. To examine this, such parameters of analysed business cycles were calculated, like: cycle length, phase length, coherence ratio, standard deviation ratio, coefficient of variation ratio, mean delay, cross-correlation ratio and average amplitude of upward and downward phases. The conducted analysis has shown that Polish and Portuguese regions exhibit varying degrees of resilience to business cycle fluctuations. Differences are also observed in the level of synchronization of regional cycles in both countries. Overall, the higher share of services in the regional GDP of Portugal translates into greater resilience to cyclical changes compared to the volatility observed in Polish regions. At the same time, Portuguese regions are more synchronized in terms of the phases of the business cycle. This may stem from the relatively higher share of services in GDP, particularly tourism services, in Portugal's economy (11.9% of GDP) compared with Poland (2.2%).

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ROLA USŁUG W KSZTAŁTOWANIU ZMIENNOŚCI I SYNCHRONIZACJI REGIONALNYCH CYKLI KONIUNKTURALNYCH NA PRZYKŁADZIE GOSPODAREK POLSKI I PORTUGALII

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Słowa kluczowe: cykl koniunkturalny, region, zmienność gospodarcza, struktura PKB.

Abstrakt

Celem artykułu jest ocena roli i znaczenia sektora usług w stabilizowaniu zmienności i poziomu synchronizacji regionalnych cykli koniunkturalnych. Aktualne wyniki badań opisane w literaturze wskazują na istotność sektora usług w łagodzeniu wahań koniunkturalnych. Jednakże usługi mogą również odgrywać negatywną rolę w stabilizacji koniunktury, czego przykładem był okres pandemii COVID-19. Spośród zróżnicowanego typu usług, na szczególną uwagę zasługuje turystyka, która jak to wynika z badań – może pełnić rolę stabilizatora koniunktury, ale może również stanowić obciążenie lub też być przyczyną tzw. szoków egzogenicznych, jak podczas pandemii COVID-19.

Przedmiotem badania są regiony dwóch krajów – Polski i Portugalii – które różnią się pod względem udziału usług oraz ich struktury w PKB. Ma to wpływ na stopień odporności regionalnych gospodarek na zmiany w otoczeniu ekonomicznym. Aby zweryfikować powyższe twierdzenia, dokonano pomiaru takich parametrów cykli, jak: długość cyklu, długość fazy, współczynnik koherencji, poziom odchylenia standardowego, współczynnik zmienności, średnie przesunięcie fazowe, współczynnik korelacji krzyżowej oraz średnia amplituda faz wzrostowych i spadkowych. Przeprowadzona analiza wykazała, że polskie i portugalskie regiony wykazują zróżnicowaną odporność na wahania koniunktury. Zróżnicowanie dotyczy również stopnia synchronizacji cykli regionalnych w obu krajach. Ogólnie wyższy udział usług w regionalnym PKB Portugalii przekłada się na wyższą odporność na zmiany koniunkturalne, w porównaniu do zmienności koniunkturalnej polskich regionów. Jednocześnie regiony portugalskie są bardziej zsynchronizowane pod względem faz przebiegu cyklu koniunkturalnego. Może to wynikać z wyższego przeciętnie udziału sektora usług w PKB, a zwłaszcza usług turystycznych w gospodarce Portugalii (11,9% PKB), w porównaniu do gospodarki Polskiej (2,2% PKB).

Introduction

Economies all over the world experience various disturbances caused by endogenous or exogenous shocks. The impact of these shocks depends on many factors, one of the most important being the structure of GDP-specifically, the share of services within it. As existing literature indicates, services are inherently business cycle stabilizers. However, in certain circumstances, such as the COVID-19 pandemic, a high share of services can constitute a significant strain on local or regional economies. This is because many services require face-to-face contact, which may be limited or even prohibited during such crises. Consequently, this leads to higher business cycle volatility at both national and

regional levels. A prime example is the tourism sector, which in many European countries is the most crucial component of the service sector. In a situation where a single service branch holds a dominant position, a demand shock can lead to a sharp crisis in the local or regional economy.

Considering these circumstances, a general question arises regarding the importance of the service sector's share in GDP structure in relation to the volatility and synchronization of business cycles on a regional scale.

The aim of the article is to assess the role of services in stabilizing the volatility and the degree of synchronization of regional business cycles. A secondary objective is to examine differences in the morphological structure of business cycles between regions with a relatively high share of services in GDP – where tourism services play a significant role – and those with a lower share of services in GDP, including a lower share of tourism in the economy. The empirical basis for this assessment is provided by the regional economies of two countries – Portugal and Poland

Although the literature indicates that tourism services are procyclical and may contribute to high business cycle volatility (Kožić *et al.*, 2022, p. 35; Duarte *et al.*, 2024, p. 16), the specific characteristics of tourism in Portugal – reflected in a considerably longer tourist season compared to Poland, and, in island areas as well as in regions hosting the country's major tourist attractions, in year-round tourism activity – suggest that this sector may enhance the resilience of individual regions to cyclical fluctuations.

Business cycles constitute an inherent element of the economic development of both countries and regions. Within the framework of European integration, the synchronization of business cycles is one of the key criteria for monetary integration, as it facilitates a closer alignment of supranational monetary policy with the prevailing phase of the business cycle (Artis & Zhang, 1997, p. 17). In practice, however, this criterion is not always fulfilled (Artis, 2003, p. 23; Warżała, 2016, p. 146). This applies both to countries and to regions, which – under the EU's regional policy – possess a high degree of autonomy. Empirical findings indicate that while some regions display an increasing synchronization of cyclical fluctuations (Marelli, 2007, p. 31; Barrios & Lucio, 2003, p. 14), others exhibit divergence in this respect (Krugman, 1991, p. 32; Krugman, 1993, p. 6; Carlino & Sill, 2001, p. 448; p. 8; Crone, 2003, p. 12). The underlying causes of such heterogeneity may include differences in the level of economic development, reflected in the differentiated structure of regional GDP, the nature and extent of interregional linkages, the degree of openness of a given region to foreign trade, as well as the strength of production chain connections between regions. Furthermore, the geographical location of a region, including its touristic and natural attractiveness, also plays a significant role (Khmeleva *et al.*, 2023).

Poland's economy is dominated by services but retains a comparatively large manufacturing sector (industrial value added remains sizable). According to the Polish Central Statistical Office services are the largest component of GDP

while industry/manufacturing still account for a substantial part of value added, reflecting Poland's continued specialization in tradable manufactured goods. According to the most recent data from the Ministry of Sport and Tourism, the share of tourism in Poland's GDP, calculated in line with the Tourism Satellite Account methodology, amounted to 2.2% of GDP in 2019[1]. This sectoral mix tends to increase cyclical volatility relative to economies where services dominate more fully.

Portugal records a larger services share of GDP than many EU countries, and tourism has become a major contributor to growth. According to recent national estimates of Tourism Satellite Account given by the Turismo de Portugal the total contribution of tourism activity reached €34 billion in 2024, equivalent to 11.9% of national GDP[2]. The Portuguese economy therefore combines a high services share with a non-negligible concentration in tourism services.

Regional Business Cycles: A Literature Review

Most analyses focus on the relationship between regional and nationwide business cycles. Some researchers suggest that the national business cycle reflects an average of cyclical changes across individual regions. However, this aggregated approach to analyzing business cycles overlooks the specific characteristics of different regions and, consequently, obscures information about how regional fluctuations respond to changes in global economic activity (Valencia-Beltran, 2024; Duran & Fratesi, 2023).

Sectoral Composition and Volatility of Business Cycles

A central insight from the literature is that not all sectors of the economy contribute equally to cyclical fluctuations. Consumer durables and investment goods are more volatile than services or nondurable consumption, since expenditures on durable items can be postponed in response to shocks. As a result, economies with a larger share of durables in GDP experience sharper recessions and stronger recoveries (Lubiński, 2004, p. 79; Kahn, 2008, p. 6). Stock and Watson (1999, pp. 6-12) provide early evidence for the U.S., demonstrating that durable goods are markedly more procyclical than nondurables and services.

The structural transformation from manufacturing to services has been a key driver of declining volatility in advanced economies. Moro (2012, p. 28)

[1] Retrieved from https://www.gov.pl/web/sport/rachunek-satelitarny-turystyki-dla-polski-za-lata-2018-i-2019 (1.09.2025). For Poland, these represent the latest available data.

[2] Retrieved from https://www.turismodeportugal.pt/en/Noticias/Pages/turismo-mantem-dinamismo-2024-conta-satelite.aspx. (1.09.2025).

quantifies this effect for the United States, showing that the falling share of manufacturing explains a substantial part of the "Great Moderation" in GDP volatility since the mid-1980s. Relatedly, Jaimovich and Siu (2009, p. 31) argue that demographic changes, which shift labour supply across sectors, interact with structural change to reduce aggregate volatility. These findings suggest that GDP composition, shaped by both secular and demographic forces, systematically influences macroeconomic stability. The conclusions of Török *et al.* (2022), derived from an analysis of Romanian regions, also seem to confirm this statement.

In multi-sector economies, shocks don't stay local: production networks transmit them via intermediate-input trade. Early and subsequent work shows that a few "core" sectors or highly connected nodes can disproportionately move the aggregate cycle; decompositions of industrial production attribute a sizeable share of aggregate variance to common factors consistent with network propagation (Fatás, 1997, p. 15; Horváth, 2000, p. 4; Foerster *et al.*, 2008, p. 19; Masahiro *et al.*, 2025, p. 26). Relatively recent research indicates the role of fiscal policy in stimulating regional economies, both in the consumption and investment areas (Coppola *et al.*, 2024).

GDP Structure and Synchronization of Business Cycles

Another important strand of research concerns the relationship between GDP structure and cross-country or interregional business cycle synchronization. A common finding is that countries with more similar production structures exhibit higher cyclical co-movement. Di Giovanni and Levchenko (2010, p. 58) show that vertical production linkages – captured by input-output relationships across sectors – explain a large part of international synchronization, especially among economies integrated into global value chains. Baxter and Kouparitsas (2005, p. 34) confirm these results using robust regressions across many country pairs, concluding that sectoral similarity is a consistent determinant of comovement, even after controlling for trade intensity and financial linkages.

Trade structure also plays a role. Kose and Yi (2006, p. 11) argue that bilateral trade intensity raises cycle correlation, particularly when countries specialize in similar sectors. Building on this, Imbs (2004, p. 38) emphasizes that both trade and financial integration contribute to synchronization, but that specialization patterns shape whether integration amplifies or reduces co-movement. More recent work by Kalemli-Özcan, Papaioannou, and Peydró (2013, p. 26) suggests that common global shocks transmitted through vertically linked industries are particularly important for small open economies. The significance of the service sector and emerging industrial branches is also emphasized in recent studies (Smolińska-Bryza *et al.*, 2025).

European evidence is especially relevant. Montoya and de Haan (2008, p. 42) examine regional cycles within the euro area and find that, while synchronization has increased overall, important heterogeneity remains: some regions with less diversified industrial structures exhibit lower correlation with the euro-area benchmark. Similarly, Barrios and Lucio (2003, p. 9) find that deeper trade integration between Spain and Portugal increased cycle synchronization, but that sectoral asymmetries continue to generate divergence at the regional level. Analyses of the Chinese and Mexican economies also confirm the conclusion that regional business cycles tend to diverge, due to growing regional autonomy (China) and regional localization (Mexico) (Padilla & Quintero-Otero, 2023).

The convergence of regional (or national) business cycles is also one of the key criteria of the optimum currency area (OCA) theory. Many authors argue that business cycles across countries (or regions) within an optimum currency area should be synchronised (McKinnon, 2002, p. 343). The problem of asymmetric economic shocks following accession to the euro area has been extensively examined by member states. For supranational (as well as national) monetary policy to be effective and appropriate, business cycle fluctuations need to be more synchronised. Moreover, according to OCA theory, if fiscal policy is subject to strict controls and harmonisation at the supranational level, the effects of such instruments should be predictable and similar across the common currency area (Frenkel & Nickel, 2002, p. 169). Recent research shows that among Eurozone member states, the process of regional divergence is also increasing (Jokubaitis & Celov, 2023).

Asymmetries across Sectors and Regions

Differences in sectoral composition not only affect volatility but also create asymmetric responses to shocks. Carlino and Sill (2001, p. 452) show that U.S. regional cycles diverge significantly from the national cycle, partly because of variations in industrial composition. Economies with a larger share of cyclical sectors (e.g., construction, manufacturing, and durable goods) tend to exhibit stronger responses to global shocks. In contrast, regions specialized in less cyclical sectors (e.g., public services, healthcare) are more insulated. In this context, several indicators have been proposed in the literature to examine the rate of convergence of individual regional components (Crone, 2003, p. 41).

Krugman (1993, p. 38) provides a theoretical perspective, arguing that economic integration can foster regional concentration of industry, thereby increasing exposure to sector-specific shocks and generating divergent cycles. By contrast, Frankel and Rose (1998, p. 29) propose that integration fosters trade intensification, which should increase synchronization ex post, even if initial specialization creates divergence. This debate remains central in the literature

on optimum currency areas (OCA), where structural asymmetries are seen as a source of vulnerability to asymmetric shocks. Current research seems to confirm that point of view. However, other factors are cited as evidence of divergence (Beck & Okhrimenko, 2024).

Conversely, evidence from Frankel and Rose (1998, p. 74) and Barrios and Lucio (2003, p. 41) suggests that deepening integration and policy coordination can gradually align business cycles through greater trade intensity and common policy frameworks. In this sense, the long-run relationship between GDP structure and cycle synchronization is endogenous to integration itself. Contrary to this conclusion, Duran and Fratesi (2023), using Italy as an example, argue that although the country has been unified since 1861, the nature of regional business cycles continues to vary, despite the increasing autonomy granted to regions in recent decades. This phenomenon persists regardless of EU and Eurozone membership and must be taken into consideration when conducting fiscal or monetary policy.

Effectiveness of the union's economic policy instruments

The dependence of business cycles on GDP structure has important implications for economic policy. In monetary unions, such as the euro area, heterogeneity in sectoral composition may limit the effectiveness of common monetary policy, since shocks propagate differently across regions. Frenkel and Nickel (2002, p. 58) note that fiscal policy coordination becomes crucial in such contexts, as national instruments may be constrained while cyclical divergences persist. Moreover, if specialization increases with integration – as Krugman (1991, p. 4) warns – the potential for asymmetric shocks rises, raising questions about the resilience of a currency area.

Apart from the occurrence of business shocks, the OCA theory emphasises that no less important than other conditions is the way in which economies react to disturbances, which is determined by the effectiveness of the union's economic policy instruments. If a shock is positive in one country while negative in another, the harmonisation of economic policies would be meaningless (Weimann, 2003, p. 37).

Studies conducted in the EU area demonstrate ambiguous effects of deepening international specialisation. This conclusion also derives from the work of Montoya and de Haan. In their 2007 paper, using the correlation coefficient of regional cycles with the euro area benchmark, they found that synchronisation increased on average over the period considered, with some exceptions. However, the correlation of the business cycle in certain regions with the reference cycle remained low or even declined (Montoya & de Haan, 2007, p. 58). Moreover, as Anagnostou, Panteladis, and Tsiapa (2014, p. 89) conclude, the EU business

cycle benchmark exerts a greater influence on more developed regions, whereas it has little or no effect on less developed ones. Although the transmitted values of euro area shocks are very small overall, their impact tends to be greater in more developed regions than in less developed regions.

There are also studies in the literature demonstrating that a uniform monetary policy, conducted in the absence of business cycle convergence, is inappropriate for all members of a common currency area and, sooner or later, leads to national or regional "asymmetric shocks" (Correia & Gouveia, 2013, p. 48).

Methodology for the identification of regional business cycles

The objectives of the study in Poland concern the morphological features of regional business cycles, represented by 16 administratively separate government units, i.e., provinces[3]. The data for Poland's regions were obtained from the Central Statistical Office of Poland. In the case of Portugal, 7 NUTS II units were analysed, based on data from the Portuguese Statistical Office. The period of analysis covers a dynamic series of regional gross domestic product at quarterly intervals, from the first quarter of 2000 to the fourth quarter of 2022. The choice of this time span was determined by the availability of comparable statistical data. Moreover, the 23-year period makes it possible to identify several complete business cycles and to assess differences in their morphological structure. The business cycle model adopted in this study is the growth cycle. This method enables the identification of business cycles even during long periods of continuous growth, when the analysis of absolute values does not yield clear results (Drozdowicz-Bieć, 2012, p. 15).

The first stage of business cycle analysis involves eliminating seasonal fluctuations from the raw time series. To remove seasonality, the TRAMO/SEATS method was applied, as recommended by Eurostat (Grudkowska & Paśnicka, 2007, p. 8, 9).

To extract the cyclical component from the deseasonalised empirical data obtained using the TRAMO/SEATS method, the Christiano–Fitzgerald asymmetric filter was applied. This econometric tool makes it possible to evaluate cycles at both the beginning and the end of a time series (Christiano & Fitzgerald, 1999, p. 5; Adamowicz *et al*., 2008, p. 12). To identify turning points, the Bry–Boschan method was adopted (Bry & Boschan, 1971, p. 21; Adamowicz *et al*., 2008, p. 13).

The analysis of the morphological features of business cycles also employs measures of variability and dispersion, such as the length of individual phases

[3] According to Eurostat nomenclature both polish provinces and Portuguese regions represent NUTS II administrative areas.

and cycles, standard deviation, variability ratio, amplitude factors, as well as cross-correlation analysis. Based on the obtained results, the morphological features of regional GDP series were examined for 16 voivodships in Poland and, for comparison, 7 regions in Portugal.

The subject of this study was the share of services in GDP and its impact on business cycle volatility from a regional perspective. Particular emphasis was placed on the significance of tourism services in GDP. However, tourism is not directly isolated within standard statistical classifications due to its extensive linkages with other economic sectors. Consequently, the share of tourism services was calculated as the difference between the total share of services in regional GDP and the specific service categories listed in statistics, such as: trade, repair, transportation, storage, accommodation, food service activities, information, and communication. The author is fully aware of the limitations of this method; however, given that only general data on the overall share of tourism in the GDP of both countries was available, and considering the publicly available information on the role of tourism in the economies of Poland and Portugal, the aforementioned approach was the only feasible method to apply.

Empirical Analysis of Regional Business Cycle Convergence in Poland and Portugal

An analysis of the development levels of Polish and Portuguese regions, measured in terms of GDP per capita, indicates that, on average, the two countries are broadly comparable. However, when disaggregated to the regional level, Poland exhibits considerably greater internal disparities. Out of its 16 regions, only three (excluding the capital city, which in 2018 was separated from the Mazowieckie voivodeship) record a per capita income above the national average. The standard deviation of regional GDP in Poland amounts to 3,607 euro, while the coefficient of variation reaches 14.7%. The GDP per capita values for the Polish regions are presented in Table 1.

When assessing the level of regional disparities in terms of development and the structure of regional GDP, several issues stand out. The first concerns the level of development and the GDP structure of the Mazowieckie province after excluding the metropolitan area of the capital. In this configuration, its level of development corresponds to that of the Łódzkie voivodeship, whereas its GDP structure is entirely distinct from that of other regions of Poland. The share of agriculture (including forestry, hunting, and fisheries) exceeds 10%, while the share of industry together with construction is also the highest in Poland, surpassing 45%. The remaining part – around 43% – is accounted for by services, which is the lowest value among all regions in the country. A structure similar to that of Mazowieckie is found in the Warmińsko-Mazurskie and Podlaskie

Table 1

The value and structure of regional GDP in Poland in 2022 (in %)

No.	Country/Voivodeship	GDP per capita (in euro PPS)	Total	Agriculture	Industry and Construction	Services	
						Trade, repair, transportation, storage, accommodation, food activities, information, communication	Total services
POLAND		**28,200**	**100.0**	**3.1**	**33.9**	**28.7**	**63.0**
1.	Dolnośląskie	30,300	100.0	1.3	41.7	24.4	57.0
2.	Kujawsko-Pomorskie	23,400	100.0	5.0	36.1	28.2	58.9
3.	Łódzkie	26,500	100.0	6.5	27.8	26.5	65.7
4.	Lubelskie	19,700	100.0	3.2	40.6	27.4	56.2
5.	Lubuskie	22,900	100.0	4.4	34.6	26.0	61.0
6.	Małopolskie	25,000	100.0	1.2	30.6	30.4	68.2
7.	Mazowieckie	26,500	100.0	10.6	45.5	20.6	43.9
8.	Opolskie	22,900	100.0	3.7	40.8	23.8	55.5
9.	Podkarpackie	20,000	100.0	1.6	38.5	26.5	59.9
10.	Podlaskie	21,800	100.0	8.7	30.1	27.4	61.2
11.	Pomorskie	27,700	100.0	2.3	37.1	29.0	60.6
12.	Śląskie	29,500	100.0	0.8	41.8	26.4	57.4
13.	Świętokrzyskie	20,600	100.0	5.0	35.2	26.5	59.8
14.	Warmińsko-Mazurskie	20,100	100.0	7.1	33.3	24.4	59.6
15.	Wielkopolskie	29,400	100.0	4.4	34.6	30.7	61.0
16.	Zachodniopomorskie	23,100	100.0	4.0	31.3	28.1	64.7

Source: Retrieved from https://ec.europa.eu/eurostat/databrowser/view/nama_10r_2gdp__custom_17992719/default/table; https://stat.gov.pl/obszary-tematyczne/rachunki-narodowe/rachunki-regionalne/produkt-krajowy-brutto-i-wartosc-dodana-brutto-w-przekroju-regionow-w-2022-r-,7,7.html, (7.07.2025).

voivodeships. These last two regions belong to the least developed in terms of GDP per capita, whereas Mazowieckie, without Warsaw, has managed to maintain an average level of development thanks to the high share of industry and construction in GDP. The influence of the Warsaw metropolis on the region is undoubtedly significant.

The lowest share of agriculture in GDP is observed in three regions of southern Poland, namely Śląskie, Małopolskie, and Dolnośląskie. A slightly higher share of the agricultural sector is found in the Pomorskie and Wielkopolskie voivodeships. All five of these regions record the highest levels of GDP per capita.

This is the result of the strong contribution of industry, construction, and broadly defined services to their regional economies. The remaining Polish regions, in which the share of services in GDP exceeds 60%, represent either a medium level of development (Lubuskie, Łódzkie, Zachodniopomorskie) or a low level of development (Podlaskie).

In Portugal, three out of eight regions also exceed the national average in terms of GDP per capita. Overall, Portuguese regions display a higher degree of variation in development levels, as evidenced by a standard deviation of 5,960 euro and a coefficient of variation of 20.8%. However, once the capital region (Lisbon Area) is excluded from the comparison – analogous to the case of Poland – these measures decline significantly. The standard deviation then falls to 2,451 euro, while the coefficient of variation decreases to 9.1%. Both figures are then substantially lower than the corresponding indicators observed in Poland. The GDP per capita values for the Portuguese regions are presented in Table 2.

Table 2

The value and structure of regional GDP in Portugal in 2022 (in %)

No.	Country/Region	GDP per capita (in euro PPS)	Total	Agriculture	Industry and Construction	Services	
						Trade, repair, transportation, storage, accommodation, food activities, information, communication	Total services
PORTUGAL		**27,800**	**100.0**	**2.4**	**20.9**	**28.4**	**76.7**
1.	Continental Area	27,900	100.0	2.4	21.4	28.3	76.2
2.	North	23,900	100.0	1.6	29.5	24.4	68.9
3.	Central	24,400	100.0	3.6	31.6	25.2	64.8
4.	Lisbon Area	43,300	100.0	0.2	9.7	32.4	90.1
5.	Alentejo	26,500	100.0	12.2	26.3	23.1	61.5
6.	Algarve	30,200	100.0	3.6	10.2	42.1	86.2
7.	Azores	24,200	100.0	6.3	12.3	26.9	81.4
8.	Madeira	29,500	100.0	1.6	11.1	35.8	87.3

Source: own calculations based on: Statistics Portugal. Retrieved from https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=cn_quadros&boui=248020715 (08.07.2025).

Regarding the Portuguese regions, a lower degree of developmental disparity is observed, provided that the metropolitan area of Lisbon (Lisbon Area) is excluded from the analysis. Moreover, all Portuguese regions are characterised by a comparatively higher share of services in GDP (76.7%).

To assess the importance of the services sector in GDP and its impact on the course and morphology of business cycle fluctuations, a separate aggregation was

made within this sector, comprising transport, repair, storage, accommodation, food service, as well as information and communication services. The purpose of this procedure was to capture the role and significance of tourism in the economies of individual regions of the country.

When comparing this segment of the services sector, it should be noted that, at the national level, its share in GDP does not differ significantly between the two countries (Poland: 28.7%, Portugal: 28.4%). Slightly greater differences can be observed in certain regions – namely those most frequently visited in both Poland and Portugal. In Poland, the regions of Małopolskie, Pomorskie, and Wielkopolskie recorded shares of the services subsector above the national average, although the difference was relatively small (ranging from 0.3 to 2 pp.). In Portugal, however, the share of this subsector of services was more heterogeneous. The highest shares were recorded in three regions: Lisbon Area, Algarve, and Madeira. These three regions are the most prominent tourist destinations in the entire country. The remaining regions displayed a share of this services subsector below the national average.

An initial examination of the regional GDP structure makes it possible to assess the scale of diversity among regional economies. Provinces with an above-average share of agriculture in GDP include Kujawsko-Pomorskie, Podlaskie, Mazowieckie[4], Warmińsko-Mazurskie, Lubelskie, Lubuskie, Łódzkie, Opolskie, Świętokrzyskie, and Wielkopolskie. By contrast, Podlaskie, Lubelskie, and Zachodniopomorskie also record a significantly smaller share of industry in GDP. The regional GDP structure of Polish provinces is presented in Table 1.

In terms of sectoral specialisation[5], Lubelskie is dominated by mining and the chemical industry, while Podlaskie specialises in agri-food, wood, and machinery production. In Świętokrzyskie, the share of agriculture is close to the national average, but the share of construction is higher than in most other provinces. Podkarpackie, in turn, has the smallest share of agriculture but the largest share of industry among the eastern provinces, with major sectors including aviation, electrical engineering, automotive, chemicals, and food processing.

These structural differences may help explain the varied course of business cycle fluctuations across the regions studied. The analysis of business cycle morphology will allow us to assess the sensitivity of individual Polish provinces to volatility in both the national and supranational economy.

As shown in Table 2, in comparison with the Polish regional GDP structure, the Portuguese regions appear more specialised. This is because in every regional

[4] In accordance with the new NUTS 2016 classification, which has been in force since 1 January 2018 under Commission Regulation (EU) 2016/2066 of 21 November 2016 amending the annexes to Regulation (EC) No 1059/2003 of the European Parliament and of the Council on the establishment of a common classification of territorial units for statistics (NUTS), the Mazowieckie Voivodeship was divided into two separate statistical units at the NUTS 2 level.

[5] The information on the shares of individual sectors in the regional economies was obtained from regional statistical offices.

economy, the services sector accounts for at least 61.5% of total GDP (Alentejo). The highest service shares are recorded in Madeira (87.3%), Algarve (86.2%), and the Lisbon Area (90.1%), all of which are largely driven by tourism[6].

By contrast, the share of agriculture (including hunting and fishing) ranges from 0.2% in the Lisbon area to 6.3% in the Azores and 12.2% in the Alentejo region. A greater reliance on services and a smaller share of agriculture result in a relatively lower share of industry compared with the Polish economy. The Portuguese economy is best known for tourism, fishing, and fruit production. The regional GDP structure of Portuguese provinces is presented in Table 2.

The economic structure of Portuguese regions is dominated by services and the production of non-durable goods, particularly food. Within the service sector, tourism plays a leading role, with seasonality being its main drawback in terms of business cycle stabilisation. While in Poland the tourist season is relatively short (3–4 months), in Portugal it lasts considerably longer (6–8 months). Moreover, in some regions (e.g., Madeira and Lisbon) there is sustained tourist demand throughout the entire year, with only minor and short-lived fluctuations[7].

To describe the degree of comovement between the GDP time series of individual Polish regions and the national business cycle, the coherence coefficient was calculated. Coherence is a frequency-domain function that indicates the correlation coefficient between two stochastic processes as a function of frequency. As shown in Table 3, the GDP time series most coherent with the reference series (Poland) are found in Lubuskie (0.66), Łódzkie (0.65), Zachodniopomorskie (0.52), and Śląskie (0.57). In contrast, the most dissimilar to the reference series are Małopolskie (0.12) and Świętokrzyskie (0.18).

Apart from the coherence ratio, cross-correlation (i.e., correlation with a shift) was also calculated for individual regions. Cross-correlation measures the similarity between two series as a function of the displacement of one relative to the other. It indicates the maximum correlation value with respect to a time shift between the two series.

Some regions tend to lead the business cycle phases relative to the reference series (Kujawsko-Pomorskie, Lubelskie, Mazowieckie, Podkarpackie, Świętokrzyskie, Wielkopolskie), while others tend to lag (Dolnośląskie, Łódzkie, Małopolskie). In six Polish regions, fluctuations are almost coincident with the reference series, namely in Lubuskie, Opolskie, Podlaskie, Pomorskie, Śląskie, and Warmińsko-Mazurskie.

[6] According to the Portuguese Statistical Office, the share of tourism in the country's GDP in 2024 amounted to 11.9%. Regarding the share of tourism services in the economies of individual regions of Portugal, no official data are available. However, information provided by local tourism institutions indicates that in 2024 this share was 29% in the Algarve, 22.7% in Madeira, and 10.6% in the Azores.

[7] Retrieved from https://invest.turismodeportugal.pt/en/portugal-de-relance/analise-regional/ (9.09.2025).

Table 3

Regional bivariate statistics with the Poland GDP reference series

Voivodeship time series	Coherence Ratio	Mean Delay	Cross-correlation		
			r_0	r_{max}	t_{max} [(1)]
Dolnośląskie	0.36	–0.64	0.59	0.65	–1
Kujawsko-Pomorskie	0.47	0.71	0.53	0.70	1
Łódzkie	0.65	–0.42	0.74	0.77	–1
Lubelskie	0.40	0.54	0.59	0.64	1
Lubuskie	0.66	–0.07	0.84	0.84	0
Małopolskie	0.12	–0.58	0.23	0.27	–1
Mazowieckie	0.54	0.42	0.69	0.72	1
Opolskie	0.39	–0.23	0.53	0.53	0
Podkarpackie	0.31	0.56	0.50	0.54	1
Podlaskie	0.28	0.13	0.51	0.51	0
Pomorskie	0.53	–0.38	0.68	0.68	0
Śląskie	0.57	–0.34	0.73	0.73	0
Świętokrzyskie	0.18	0.63	0.35	0.39	1
Warmińsko-Mazurskie	0.41	0.16	0.56	0.58	0
Wielkopolskie	0.48	0.42	0.67	0.71	1
Zachodniopomorskie	0.52	–0.84	0.64	–0.75	4

[(1)] The + (–) sign refers to a lead (lag) in quarters with respect to the reference series.

Source: own elaborations based on: *"Monthly Reports on the socio-economic situation of Dolnośląskie, Kujawsko-Pomorskie, Lubelskie, Lubuskie, Łódzkie, Małopolskie, Mazowieckie, Opolskie, Podkarpackie, Podlaskie, Pomorskie, Śląskie, Świetokrzyskie, Warmińsko-Mazurskie, Wielkopolskie and Zachodniopomorskie Province"*, Local Data Bank, Regional Statistical Office.

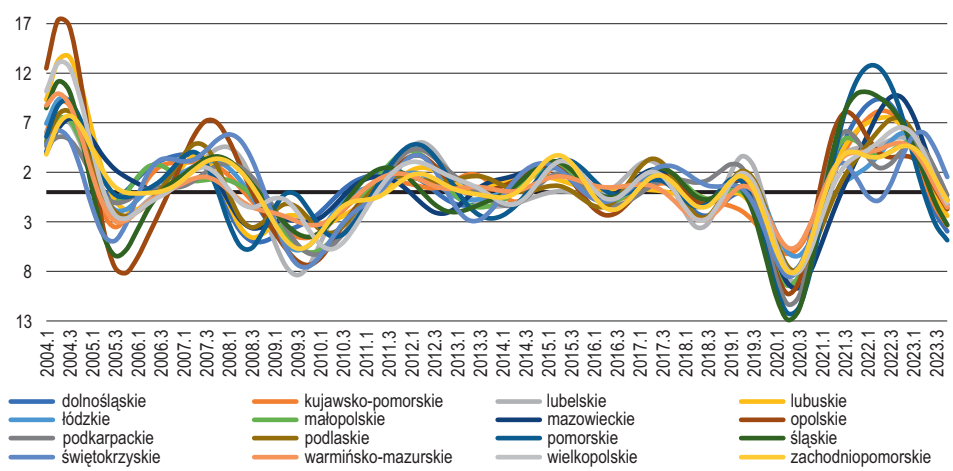

Fig. 1. Business Cycles in Polish Regions, 2004–2024

Source: own calculations based on the data from Statistics Poland (GUS).

The highest levels of cross-correlation were recorded in Lubuskie (0.84), Łódzkie (0.77), Śląskie (0.73), and Mazowieckie (0.72). The Zachodniopomorskie province, however, displayed a four-month lag relative to the average business cycle and a relatively high but negative cross-correlation coefficient (–0.75). This region can therefore be regarded as one of the most dissimilar with respect to national business cycle fluctuations.

In comparison with Polish regions, Portuguese regional business cycles are more synchronised. The lowest coherence ratio was 0.5, observed for Madeira. Only two regions displayed a one-quarter shift relative to the reference series: the Central region, whose business cycle led the reference GDP series by one quarter, and Madeira, whose business fluctuations lagged by one quarter behind Portugal's overall GDP series.

The cross-correlation ratios were generally high, with slightly lower values recorded in the island regions and in the south (Algarve). All bivariate statistics are presented in Table 4.

Table 4

Regional bivariate statistics with the Portugal GDP reference series

Regional time series	Coherence Ratio	Mean Delay	Cross-correlation		
			r_0	r_{max}	t_{max} [(1)]
Continental Area	1.00	0.01	0.98	0.98	0
North	0.93	–0.02	0.95	0.95	0
Central	0.78	0.19	0.86	0.88	1
Lisbon Area	0.91	–0.01	0.94	0.94	0
Alentejo	0.85	0.02	0.91	0.91	0
Algarve	0.66	–0.09	0.79	0.79	0
Azores	0.79	–0.20	0.87	0.87	0
Madeira	0.50	–0.29	0.68	0.71	–1

[(1)] The + (–) sign refers to a lead (lag) in quarters with respect to the reference series.

Source: own calculations based on: Statistics Portugal. Retrieved from https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=cn_quadros&boui=248020715 (08.07.2025).

Most regional business cycles in Poland lasted around ten quarters. The longest average cycles were observed in Małopolskie, Mazowieckie, Opolskie, and Świętokrzyskie, while the shortest were found in Dolnośląskie, Łódzkie, Podkarpackie, Pomorskie, Warmińsko-Mazurskie, and Wielkopolskie. In most regions, the upward phases of the business cycle were longer than the downward ones. The opposite pattern was observed in Kujawsko-Pomorskie, Lubuskie, Opolskie, and Wielkopolskie.

In Portugal, the average duration of regional business cycles was about eleven quarters. The shortest cycles were identified in the Lisbon area and

the Azores (ten quarters), while the longest occurred in the southern region of Algarve (sixteen quarters). In all regions except Alentejo, the upward phase was on average longer than the downward one.

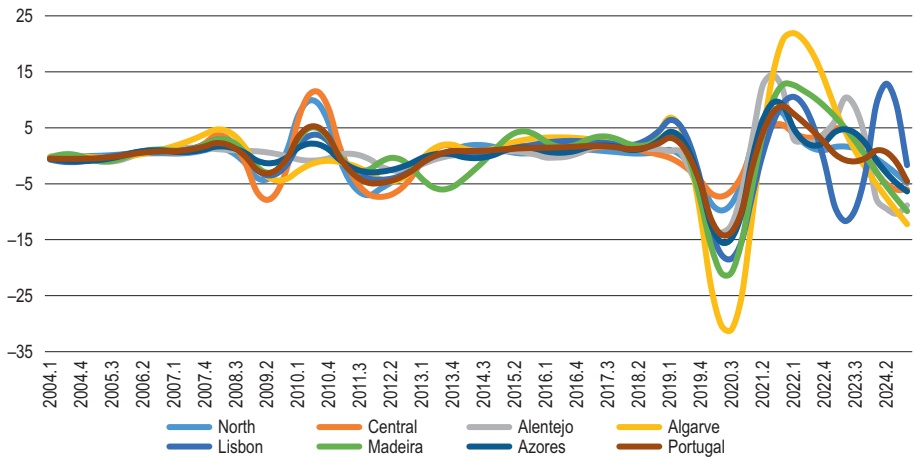

Fig. 2. Business Cycles in Portugal Regions, 2004–2023
Source: own calculations based on the data from Statistics Portugal.

Apart from length and coherence, regional business cycles also differ in terms of volatility and standard deviation. An analysis of the average standard deviation across regions makes it possible to identify provinces characterised by more balanced business cycles, namely Kujawsko-Pomorskie (6.63), Śląskie (6.85), Lubelskie (7.01), Lubuskie (7.06), Opolskie (7.14), and Podkarpackie (7.69). A similar pattern is observed when considering the coefficient of variation.

By contrast, regions with relatively high levels of standard deviation include Mazowieckie (10.20), Wielkopolskie (8.75), Podlaskie (8.47), Małopolskie (8.04), Zachodniopomorskie (8.03), Warmińsko-Mazurskie (7.85), and Świętokrzyskie (7.62). This may result from a relatively higher degree of specialisation. An exception is observed in Małopolskie, Wielkopolskie, and Warmińsko-Mazurskie, where this relationship is less clear.

Differences in volatility are also reflected in the average amplitude of fluctuations. The highest amplitudes of upward and downward deviations are found in regions with relatively high sensitivity to business cycle fluctuations, i.e., regions with a higher degree of specialisation. Such characteristics were observed in Dolnośląskie, Kujawsko-Pomorskie, Lubelskie, Mazowieckie, Małopolskie, Opolskie, Podlaskie, Pomorskie, Wielkopolskie, and Zachodniopomorskie.

Some of these regions (e.g., Lubelskie, Opolskie, Pomorskie) display relatively low standard deviation levels, which can be interpreted as relatively balanced average business cycle fluctuations. In contrast, the remaining regions are characterised by more heterogeneous business cycle patterns.

Table 5

The intensity of the Poland GDP time series and the individual provinces

Country/Voivodeship	Standard Deviation (in p.p.)	Coefficient of Variation (in %)	Average Amplitude (in %)		
			Upward Phases	Downward Phases	Cycles
POLAND	**6.88**	**6.72**	**2.3**	**2.4**	**–0.1**
Dolnośląskie	7.36	6.75	2.9	2.6	0.3
Kujawsko-Pomorskie	6.63	6.04	2.8	2.7	0.1
Łódzkie	7.24	6.58	2.4	2.7	–0.3
Lubelskie	7.01	6.37	2.8	3.1	–0.3
Lubuskie	7.06	6.42	2.7	2.8	–0.1
Małopolskie	8.04	7.18	2.1	2.5	–0.4
Mazowieckie	10.20	9.08	2.9	2.8	0.1
Opolskie	7.14	6.56	2.9	2.4	0.5
Podkarpackie	7.69	7.03	2.0	2.0	0.0
Podlaskie	8.47	7.74	2.9	2.9	0.0
Pomorskie	7.59	6.93	2.9	2.7	0.2
Śląskie	6.85	6.27	2.8	2.7	0.1
Świętokrzyskie	7.62	7.04	2.6	2.4	0.2
Warmińsko-Mazurskie	7.85	7.19	2.3	2.5	–0.2
Wielkopolskie	8.75	7.96	2.7	2.9	–0.2
Zachodniopomorskie	8.03	7.26	2.7	2.8	–0.1

The + (–) sign refers to a lead (lag) in quarters with respect to the reference series.
Source: as in Table 3.

The analysis of the morphological structure of regional business cycles in Portugal reveals a positive impact of services on the variability and dynamics of cyclical fluctuations. The average standard deviation of the national business cycle in Portugal amounts to 1.92 percentage points, which is significantly lower than the corresponding indicator for Poland. Cyclical variability in Portuguese regions ranges from 1.80 in the Central region to 5.26 in Madeira. Similar values were observed for the coefficient of variation across regional economies. Consequently, the amplitudes of both contractionary and expansionary phases were also relatively low. On this basis, it can be concluded that a higher share of services in GDP – both at the national level and in individual regions – contributes to stabilising cyclical fluctuations and thereby enhances resilience to external economic shocks. As is well known, in the case of Portugal, this is primarily associated with the predominance of tourism services, whose contribution to GDP is several times higher than in Poland. The indicators of the morphological structure of regional business cycles in Portugal are presented in Table 6.

Table 6

The intensity of the Portugal GDP time series and the individual regions

Country/Region	Standard Deviation (in p.p.)	Coefficient of Variation (in %)	Average Amplitude (in %)		
			Upward Phases	Downward Phases	Cycles
PORTUGAL	**1.92**	**1.92**	**1.4**	**1.5**	**–0.1**
Continental Area	1.91	1.91	1.4	1.5	–0.1
North	2.18	2.17	1.6	1.5	0.1
Central	1.80	1.80	1.4	1.2	0.2
Lisbon Area	2.00	1.99	1.7	1.8	0.1
Alentejo	2.42	2.43	2.3	2.5	–0.2
Algarve	2.98	2.97	2.4	2.5	–0.1
Azores	2.36	2.34	1.9	1.8	0.1
Madeira	5.26	5.23	2.9	2.4	0.5

Source: own calculations based on: Statistics Portugal. Retrieved from https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=cn_quadros&boui=248020715 (8.07.2025).

The differing morphological structures of regional cycles in the countries under study, and consequently their varying sensitivity to business cycle fluctuations, may also be explained by the relatively low share of industry and construction in GDP, as observed in Portugal's regions. As highlighted earlier and confirmed by previous research (Fatás, 1997; Horváth, 2000; Moro, 2012), industry constitutes the most procyclical component of GDP and is highly sensitive to cyclical fluctuations. Construction, by contrast, responds strongly to changes in economic policy, particularly monetary policy (Warżała, 2016). In Portugal, the combined share of these two sectors averages around 20% of GDP; however, in some of the country's most prominent tourist regions – such as the Algarve, Lisbon Area, Madeira, and the Azores – it does not exceed 12%. This structural characteristic may help to explain the lower amplitude of cyclical fluctuations observed both nationally and, in those regions, where the shares of industry and construction are smallest.

In Poland, by comparison, the average contribution of the two sectors reaches 33.9%, and in certain regions (Lubelskie, Opolskie, Mazowieckie, Śląskie) it exceeds 40%. Coupled with the previously noted regional specialization in specific branches of industry, this structural profile may contribute to larger cyclical amplitudes, driven by so-called asymmetric shocks.

The analysis seems to confirm the conclusion drawn from the literature review: countries with a larger share of services in their GDP appear less sensitive to business cycle fluctuations. This research finds this to be the case for Portugal. Although the total share of services in Portugal is similar to that of Poland,

the structure of these services is substantially different. Portugal's business cycles are smoother and longer and demonstrate a higher level of synchronization.

The analysis highlights substantial regional variation in business cycle dynamics between two economies with broadly comparable levels of development but markedly different GDP structures, namely Poland and Portugal.

Both countries exhibit heterogeneity in terms of GDP composition, both at the aggregate and regional levels. Nationally, Poland is characterised by a lower share of services and a higher contribution of industry and construction, while agriculture also accounts for a relatively larger proportion of output. These structural characteristics shape the morphology of regional cycles.

By contrast, in Portugal the combined share of industry and construction is roughly half that observed in Poland, with services assuming a dominant role in value added. Within the services sector, tourism is the most significant component. As shown in earlier studies, the seasonal nature of tourism tends to amplify cyclical fluctuations rather than dampen them. Nevertheless, in some regions the tourist season is sufficiently extended to provide a stabilising effect on local cycles.

A key limitation for deeper empirical investigation is the absence of regional--level data on the contribution of tourism to GDP in either country (tourism satellite accounts are only available at the national level). Nonetheless, aggregate data on tourism's share in GDP allow for meaningful cross-country comparison. As an imperfect but informative proxy, this study employs the contribution of a subsector of services that includes transport, accommodation, food services, information, and communication.

Overall, Polish regions display a lower degree of synchronisation with the national cycle than Portuguese regions. This finding may have important implications for Poland's prospective accession to the euro area, though it warrants further investigation.

In terms of the morphology of regional cycles, the results show that Polish regions experience greater amplitudes, shorter fluctuation intervals, and more pronounced phase shifts than their Portuguese counterparts. This reflects the relatively larger role of procyclical sectors – industry and construction – in Polish regional economies. Furthermore, Poland's provinces exhibit pronounced sectoral specialisation, as outlined in regional development strategies, which increases their exposure to asymmetric shocks. Tourism, while present in Polish regions, exerts a largely procyclical influence due to its high seasonality. In Portugal, by contrast, the longer duration of tourist demand throughout the year contributes to a more stabilising effect on regional and national cycles.

The above conclusions regarding the degree of synchronization and the morphology of regional cycles at the national level are significant from the perspective of economic policy, i.e. fiscal and monetary policy, which requires adjustment to ongoing cyclical developments. This issue will be the subject of future research.

Conclusions

The findings that emerge from my research lead to several conclusions. First, the structure of GDP has a crucial impact on business cycle morphology. A comparison of two different countries with respect to their GDP structures showed that countries with a higher share of services (and a higher share of tourism) are generally less affected by global economic disturbances. Thus, it can be concluded that the structure of GDP, rather than its level, is more important in influencing business fluctuations. Such economies demonstrate smoother and longer regional business cycles that are more resilient to external economic shocks. These conclusions are universal in nature and do not apply to specific cases, such as the crisis caused by the COVID-19 pandemic. During that period, a high share of services was a strain on the economy, as it was linked to restrictions such as the ban on direct human contact.

The second conclusion is that regions in countries with a higher share of services also demonstrate a higher level of business cycle synchronization at the regional level. This is an important issue when central authorities undertake anticyclical monetary or fiscal policies at the national level. It is also a crucial criterion for conducting adequate monetary policy at the Eurozone level.

For local or regional authorities, the results of my research indicate that to avoid serious demand or supply shocks, regional economies should be diversified in terms of their GDP structure. While services can act as an economic stabilizer, in specific and unfavourable circumstances – like the COVID-19 pandemic – they can also present a real problem for the local labour market. The strong performance of regions with more diversified structures highlights economic diversification as a key source of resilience. Accordingly, policy frameworks should emphasize support for broad-based regional development, including measures that encourage SME activity and the expansion of service clusters, particularly in regions with highly concentrated production structures.

The research needs to be continued, as only tourism services were investigated. In the next stage of the study, financial, digital, and other types of services should also be examined in the context of regional and national resilience to business cycle fluctuations.

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