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Synchronization of economic activity and business cycles in Central and Eastern European countries – implications for logistics

Synchronizacja aktywności gospodarczej i cykli koniunkturalnych w krajach Europy Środkowo-Wschodniej – implikacje dla logistyki

Abstract. The objective of this paper is to assess the degree of synchronization of economic activity and business cycles in Central and Eastern European countries, with particular emphasis on the role of major economic crises in intensifying this synchronization. The analysis focuses on two key episodes: the global financial crisis of 2008 and the pandemic-related economic crisis as periods during which the co-movement of economic activity across countries strengthened significantly. The study covers the period 2006–2021 and is based on monthly data from the OECD database, including the Business Confidence Indicator (BCI) and the Consumer Confidence Indicator (CCI). The results confirm the existence of coincidence in economic fluctuations among the analyzed CEE countries and demonstrate that cross-country correlations are significantly stronger during crisis periods than during phases of economic expansion. Moreover, successive crises contributed to a unification of the scale, dynamics, and timing of economic activity changes across the region. Beyond their macroeconomic relevance, the findings have important implications for logistics and supply chain management in integrated regional markets, as increased synchronization heightens the likelihood of simultaneous demand and supply fluctuations, directly affecting forecasting accuracy, inventory positioning, transport capacity planning, and cross-border network coordination.

Keywords: economic activity, business cycle, synchronization, economic crises, Central and Eastern Europe, logistics, supply chain

Synopsis. Celem niniejszego artykułu jest ocena stopnia synchronizacji aktywności gospodarczej oraz cykli koniunkturalnych w krajach Europy Środkowo-Wschodniej (EŚW), ze szczególnym uwzględnieniem roli dużych kryzysów gospodarczych w nasilaniu tej synchronizacji. Analiza koncentruje się na dwóch kluczowych wydarzeniach – globalnym kryzysie finansowym z 2008 roku oraz kryzysie gospodarczym związanym z pandemią – jako okresach, w których współwystępowanie zmian aktywności gospodarczej pomiędzy krajami uległo wyraźnemu wzmocnieniu.

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Badanie obejmuje lata 2006–2025 i opiera się na danych miesięcznych pochodzących z bazy OECD, w tym na wskaźniku zaufania przedsiębiorców (Business Confidence Indicator – BCI) oraz wskaźniku zaufania konsumentów (Consumer Confidence Indicator – CCI). Uzyskane wyniki potwierdzają istnienie zbieżności wahań aktywności gospodarczej w analizowanych krajach Europy Środkowo-Wschodniej oraz wskazują, że korelacje pomiędzy krajami są istotnie silniejsze w okresach kryzysowych niż w fazach ożywienia gospodarczego. Ponadto kolejne kryzysy przyczyniły się do ujednolicenia skali, dynamiki oraz momentów występowania zmian aktywności gospodarczej w regionie. Poza znaczeniem makroekonomicznym uzyskane wyniki mają istotne implikacje dla logistyki i zarządzania łańcuchami dostaw na zintegrowanych rynkach regionalnych, gdyż wzrost synchronizacji zwiększa prawdopodobieństwo jednoczesnych zmian popytu i podaży, bezpośrednio wpływając na trafność prognoz, lokalizację zapasów, planowanie zdolności transportowych oraz koordynację transgranicznych sieci logistycznych.

Słowa kluczowe: aktywność gospodarcza, cykl koniunkturalny, synchronizacja, kryzysy gospodarcze, Europa Środkowo-Wschodnia, logistyka, łańcuch dostaw

JEL codes: E32, F44, F15, R15, L91, D12

Introduction

Major economic crises have repeatedly disrupted economic activity across countries, leading to increasingly synchronized fluctuations of the business cycle. The global financial crisis of 2008 and the subsequent pandemic-related crisis represent two key episodes in which economic downturns and recoveries occurred almost simultaneously across a wide range of economies, including those of Central and Eastern Europe. While the COVID-19 pandemic caused an unprecedented contraction of global economic activity in 2020 [Dragos, Tilica 2014; Arshian et al. 2020a, 2020b; Badar 2020; Dayong et al. 2020], it also reinforced a pattern already observed during the 2008 crisis, namely the strengthening of international transmission mechanisms and the growing synchronization of business cycle fluctuations. International crises tend to propagate across economies through a domino mechanism, affecting national economic performance regardless of the scale of direct trade or financial linkages [Bordo, Murshid 2001; Cocozza, Piselli 2011].

It is important to distinguish between two related but conceptually different mechanisms of synchronization: contagion and common shocks. Contagion refers to a domino-type transmission mechanism, where economic disturbances originate in one country and spread sequentially to others through trade, financial, and informational linkages. This mechanism was characteristic of the Global Financial Crisis of 2008, which originated in the United States and gradually propagated to European economies.

In contrast, a common shock occurs when multiple economies are affected simultaneously by the same external disturbance. The COVID-19 pandemic represents a clear example of such a mechanism, as global supply chain disruptions, synchronized lockdown measures, and simultaneous demand contractions affected countries concurrently rather than sequentially.

Both mechanisms lead to increased synchronization of economic activity, but their transmission dynamics and implications for logistics systems differ significantly.

Such transmission processes extend beyond macroeconomic aggregates and are reflected at sectoral and operational levels, where strong domino effects across industries generate imbalances in input-output flows and intensify disruptions in production, distribution, and logistics systems [Abeysinghe 2001]. As a result, successive crises increasingly lead to simultaneous downturns across countries and key sectors, contributing to a cumulative intensification of business cycle synchronization and its economic and operational consequences.

From a logistics and supply chain perspective, the international synchronization of economic activity and consumer demand is of particular importance. Logistics systems are inherently sensitive to concurrent changes in production volumes, order flows, and consumption patterns. When economic activity becomes synchronized across countries, shocks are no longer absorbed locally but propagate rapidly through transport networks, warehousing systems, and cross-border supply chains. This was clearly visible during the global financial crisis of 2008, when a strong coincidence of crisis events across countries translated into abrupt contractions in freight volumes, excess logistics capacity, and disruptions in inventory management [Chiang et al. 2007; Conlon et al. 2018]. A similar, though even more pronounced, pattern emerged during the COVID-19 pandemic, which created conditions for an exceptionally high transmission of crisis phenomena and intensified global economic and logistical disruptions.

The post-COVID period further highlighted the relevance of synchronization for logistics. The rapid and largely simultaneous economic recovery across countries generated sudden surges in demand for transport, warehousing, and distribution services, exposing capacity bottlenecks and coordination problems within logistics networks. In this context, the crisis announced in September 2008 and the COVID-19 pandemic both amplified the importance of a relatively new mechanism of business cycle transmission – business cycle contagion – whose effects extend beyond macroeconomic indicators and directly influence logistics performance and resilience.

The carriers of business cycle impulses include all channels of international economic flows. Traditionally, primary importance has been attributed to trade in goods and services, capital movements – particularly short-term capital – and foreign direct investment. However, none of the classical transmission mechanisms can fully explain the almost immediate adjustment of economic conditions across countries or the near-simultaneous downturns observed during the 2008 subprime crisis and the COVID-19 pandemic. These episodes revealed the limits of explanations based solely on trade intensity or economic similarity [Dornbusch et al. 2000; Forbes, Rigobon 2002; Neal, Weidenmnier 2002]. At the same time, there is broad agreement in the literature that the phenomenon of contagion is real. One approach defines contagion as a situation in which changes in economic activity spread faster and more abruptly than would be expected from standard economic linkages, with fluctuations of greater scope and magnitude than those implied by classical transmission mechanisms [Forbes, Rigobon 2001]. Contagion is identified when economic fundamentals alone are insufficient to explain the sudden and increasing concurrence of economic measures across countries [Maryam et al. 2021].

This study hypothesizes that crisis periods increase the synchronization of changes in economic activity among affected countries. Specifically, correlations in economic activity are expected to be stronger during crises than during periods of economic growth,

with cyclical impulses spreading more rapidly and abruptly than would result from trade-related conditions alone. Moreover, each subsequent crisis is assumed to reinforce similarities in economic activity fluctuations relative to the pre-crisis period, supporting the interpretation of contagion as a mechanism with negative economic and operational consequences [Gaweł 1997; World Bank 2021]. From a logistics perspective, such increasing synchronization implies a higher probability of simultaneous disruptions and recoveries across markets, reducing the effectiveness of spatial diversification in logistics planning.

At the same time, synchronization of business cycles is considered indispensable for the proper development of economic integration processes, particularly within the European Union. Coordination of economic policies among countries facilitates integration, while synchronized cycles influence the stability and efficiency of cross-border logistics systems supporting integrated markets. In this view, synchronization of business cycles is not only a macroeconomic issue but also a key factor for the successful implementation of logistics strategies aimed at supporting economic convergence [World Bank 2021].

The objective of this paper is to assess the degree of synchronization of economic activity and business cycles in Central and Eastern European countries, with particular emphasis on the role of major economic crises in intensifying this synchronization. The analysis focuses on two key episodes: the global financial crisis of 2008 and the pandemic-related economic crisis as periods during which the co-movement of economic activity across countries strengthened significantly. This study analyzes the synchronization of cyclical fluctuations in economic activity rather than its absolute level or long-term trend, which justifies the use of BCI and CCI as appropriate measures for identifying business cycle synchronization.

The results confirm the existence of coincidence in economic fluctuations among Central and Eastern European economies during both crises, indicating that periods of economic turmoil are associated with a higher degree of synchronization than phases of economic expansion. The findings further suggest that successive crises contribute to a unification of the scale, dynamics, and timing of economic activity changes across countries. From a broader perspective, understanding the synchronization of economic activity is essential not only for macroeconomic analysis but also for logistics and supply chain planning, as increased synchronization raises the likelihood of simultaneous demand and supply fluctuations across integrated markets.

Materials and methods

Changes in and synchronization of economic activity in the countries of Central and Eastern Europe were analyzed in the period from January 2006 to November 2025. The adopted time frame is indispensable for the correct evaluation of the impact of the crisis changes on the synchronization of the economic activity fluctuations. Another reason for choosing this period is the need to include the full business cycles, which encompass the full periods of prosperity and depression.

The studies embraced the selected countries of Central and Eastern Europe, such as the Czech Republic, Estonia, Hungary, Poland, the Slovak Republic, and Slovenia. The necessary data to analyze the other countries in the region are unavailable.

The analysis included a monthly time series, namely: the Business Confidence Indicator, the Consumer Confidence Indicator[1], as well as a reference series represented by the GBP index. The studied indexes represent measures of economic activity. Source data was obtained from a public database [OECD 2021]. The Business Confidence Indicator provides information about the evaluation of the companies' current economic activity concerning production growth, orders, and supplies of ready products in the industry sector. This index is used to monitor the changes in production and in predicting turning points in economic activity. Numbers above 100 indicate increased trust in business results in the near future, and numbers below 100 indicate pessimism about future performance. The Business Confidence Indicator is a good measure of the current usage of companies' production capacities.

The Consumer Confidence Indicator shows changes in the level of household consumption and their economic situation. This measure expresses changes in aggregated individual consumption. Indexes over 100 indicate high consumption, while those below 100 indicate a pessimistic attitude towards consumption and reduced household expenditures, which consequently indicate an economic slump.

GDP is a standard measurement of the added value generated by the production of goods and services in the country during a given period. All OECD countries have been supplying their data according to the System of National Accounts (SNA) since 2008. This index is less suitable for comparisons over time because changes are caused not only by real growth but also by changes in prices and PPP; thus, there is additional justification to use the Business Confidence Indicator and the Consumer Confidence Indicator.

In this study, the Business Confidence Indicator (BCI) and Consumer Confidence Indicator (CCI) are not used as direct measures of the level of economic activity but rather as cyclical indicators that enable the identification of changes in the direction of economic activity and the turning points of the business cycle. These indicators are particularly useful in the analysis of business cycle synchronization due to their high publication frequency and sensitivity to changes in economic conditions.

Numerous empirical studies demonstrate that business and consumer confidence indicators exhibit strong correlations with actual changes in industrial production and GDP, and their movements often precede changes in real economic activity. Therefore, these indicators are widely used in business cycle analysis and the study of economic synchronization, particularly in research based on monthly data.

When analyzing the indicators of the business cycle prepared by Biuro Inwestycji i Cykli Ekonomicznych (Bureau of Investments and Business Cycles), Szeplewicz assessed that the Business Confidence Indicator was a suitable current measure of economic activity [Szeplewicz 2011; Ulrichs 2013]. In her studies, Ulrichs proved the diagnostic properties of the Business Confidence Indicator [Gaweł 1997]. However, in his studies, Gaweł demonstrated that the Business Confidence Indicator and the Consumer Confidence Indicator are self-contained indexes for evaluating economic activity [Róg, Strzała 2011].

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[1] Consumer demand constitutes one of the key components of economic activity, reflecting both the level of household consumption and households' expectations regarding future economic conditions. However, it does not fully encompass the entire scope of economic activity, which also includes production, investment, and international trade. In this study, consumer demand is not treated as a separate economic process, but rather as an important indicator and component of economic activity, represented by the Consumer Confidence Indicator (CCI), which enables the identification of cyclical changes and turning points in the economy.

Although the Business Confidence Indicator (BCI) and Consumer Confidence Indicator (CCI) are classified as sentiment-based measures, a substantial body of empirical literature confirms their strong relationship with real economic activity, including industrial production and GDP dynamics. Confidence indicators are widely used in business cycle analysis due to their high frequency and leading or coincident properties, which allow for earlier detection of turning points compared with traditional macroeconomic aggregates.

During crisis periods, sentiment indicators may temporarily amplify economic signals; however, empirical evidence shows that declines in confidence indicators are typically accompanied by corresponding contractions in industrial production and overall economic activity. For example, both the Global Financial Crisis of 2008 and the COVID-19 pandemic were characterized by simultaneous and substantial declines in industrial production across Central and Eastern European countries, confirming that changes observed in confidence indicators reflected real economic disruptions rather than purely psychological reactions.

Therefore, the use of BCI and CCI in this study provides a reliable and high-frequency representation of economic activity fluctuations and enables precise identification of synchronization patterns across countries.

The fundamental problem of the time series analysis of the Business Confidence Indicator and the Consumer Confidence Indicator, as well as PDP, that requires a solution is the character of the time series used in the studies. A starting point in such analyses is to assume that the output series (Y_t) consists of a long-term trend (T_t), cyclical fluctuations, business cycle fluctuations (C_t), seasonal fluctuations (S_t), and random, accidental fluctuations (I_t):

$$Y_t = T_t + C_t + S_t + I_t \tag{1}$$

A common practical approach is to operate only on a cyclic component (C_t), and this approach has been employed in this analysis. The first step of this analysis eliminated seasonal fluctuations using the X-12-ARIMA method [U.S. Census Bureau 2011]. As a result, we arrived at seasonally adjusted series. The next step removed the long-term trend (T_t) using the low-frequency Hodrick-Prescott (HP) filter [Hodrick, Prescott 1997]. The smoothed trend value (τ_t) is a result of minimizing the following problem:

$$y_t = \tau_t + c_t, \ t = 1, 2, ..., T, \tag{2}$$

$$\sum_{1}^{T} (y_t - \tau_t)^2 + \lambda \sum_{2}^{T-1} [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2 \tag{3}$$

where:
y_t – analyzed output time series,
τ_t – trend component (a smoothed value),
c_t – value of a cyclical component (essentially residual in this problem),

T – number of observations,

λ – smoothing parameter.

The first sum of formula (3) minimizes the difference between the time series and its trend component. The second sum minimizes the difference of the second order of the trend component. The higher the value of the λ parameter (positive), the smoother the estimated trend will be.

The advantage of the HP filters versus classic functions of the trend is the possibility to adjust them well regardless of the data character. This method is used in studying the business cycles conducted by OECD, where filters with frequencies of approximately 8–10 years are used for trend extraction. Due to the occurrence of 3–5-year cycles, this paper assumed lower frequencies. The lambda value (14400) adopted in the studies enabled us to better adjust the trend to this type of data and, as a consequence, enabled a more uniform distribution of the amplitudes of the cyclical fluctuations over time.

The analysis of the economic activity synchronization was conducted on a time series that consisted only of the cyclical component (C_t). It was achieved by applying a high-frequency HP filter (lambda = 100). As a result, this action reduced the random fluctuations from the series ($C_t + I_t$); whereas the value smoothed by an HP filter was adopted as a cyclical component (C_t).

The search for time relations among the fluctuations of the general economic activity and individual indexes of the business cycle tests was based on several approaches. Firstly, it was a qualitative evaluation based on a graphic comparison of a series of cyclical components to verify the turning points in the cycle. The GDP time series underwent a standardization procedure for better visualization.

The analyses were conducted both on the basis of the same cyclical components as well as on a series containing the cyclical and random fluctuations. This allowed us to determine the location of the turning points.

To show the changes in the level of synchronization of the business cycle fluctuations over time, we calculated centered moving correlation coefficients. The width of the window was set to 9 months, and the calculated value of the correlation coefficient was attributed to the middle observation. The values of such a correlation coefficient were calculated according to the following formula:

$$r_t = \frac{\sum_{t-4}^{t+4}(x_t - \bar{x})(y_t - \bar{y})}{\sqrt{\sum_{t-4}^{t+4}(x_t - \bar{x})^2 \sum_{t-4}^{t+4}(y_t - \bar{y})^2}} \qquad (4)$$

Additionally, values of the correlation coefficients were calculated for individual phases of the business cycle for all the analyzed countries in order to assess the changes in the level of synchronization of economic activity in each country, depending on the phase of the business cycle. Such an approach allows one to verify the hypothesis that the changes in economic activity blur over time [Rigobon 2001].

Results and discussion

When studying the distribution of the turning points of economic activity within the group of countries of Central and Eastern Europe in the period from January 2006 to September 2021, in the case of the Consumer Confidence Indicator (CCI), GDP, and the Business Confidence Indicator (BCI), three recession phases of the business cycle and three expansion phases were isolated, out of which the last phase was incomplete because the period included in the analysis ended on the last available observation in September 2021 (Figure 1). Defining the correlation between the given business cycles is an important and, at the same time, controversial issue in studying the similarities of the business cycles in order to be able to say that they are synchronized. Assuming the approach of Christodoulakis et al., it is sufficient to run a test to check whether the correlation between the cycle phases is statistically different from zero (most frequently at the level of significance of 5%) [Christodoulakis et al. 1995].
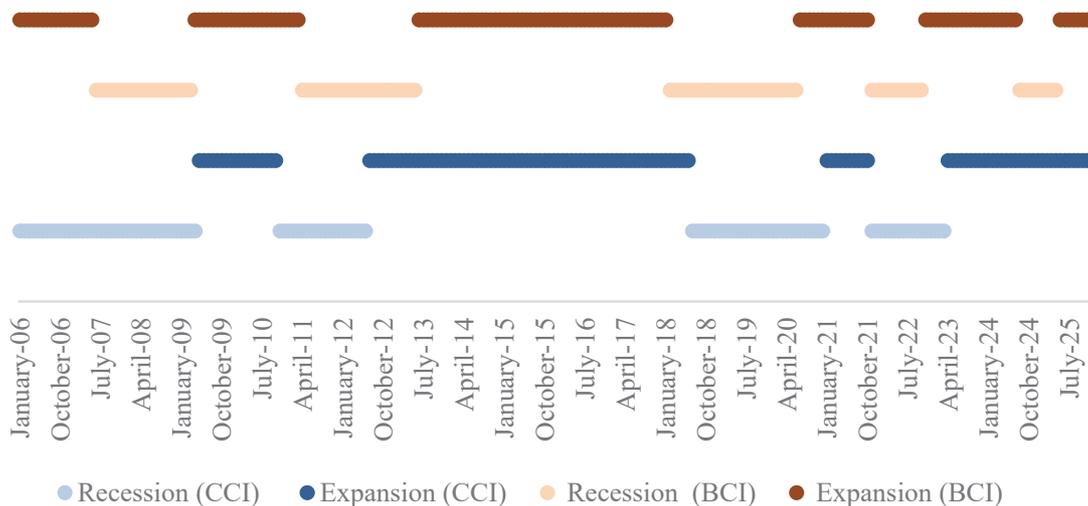

Figure 1. Chronology of the changes in economic activity within the group of countries in Central and Eastern Europe on the basis of the Consumer Confidence Indicator (CCI) and Business Confidence Indicator (BCI)
Rysunek 1. Chronologia zmian aktywności gospodarczej w grupie krajów Europy Środkowo--Wschodniej na podstawie wskaźnika ufności konsumenckiej (CCI) oraz wskaźnika ufności przedsiębiorstw (BCI)
Source: own research
Źródło: badania własne

Synchronization of changes in economic activity based on the Consumer Confidence Indicator

Changes in economic activity expressed through the Consumer Confidence Indicator in the studied countries of Central and Eastern Europe reveal the progressive synchronization of economic activity. The similarities between the directions of the changes as well as the diversification of the levels of assessment of activity have increased (Figure 2). There is a clear drop in the standard deviation values for the correlation coefficients for
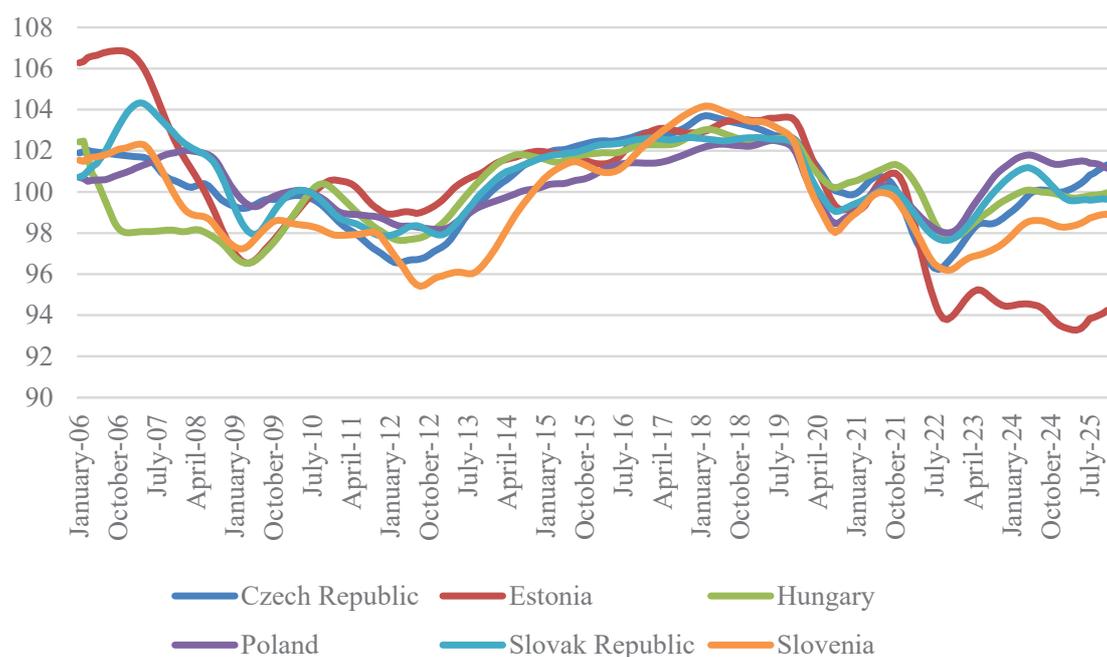
Figure 2. Cyclical component of the Consumer Confidence Indicator in the countries studied
Rysunek 2. Cykliczny komponent wskaźnika ufności konsumenckiej w badanych krajach

Source: own research

Źródło: badania własne

Table 1. Correlation coefficients, their average values and standard deviations for the cycle phase of the Consumer Confidence Indicator (CCI) cycle
Tabela 1. Współczynniki korelacji, ich średnie wartości oraz odchylenia standardowe dla fazy cyklicznej wskaźnika ufności konsumenckiej (CCI)

Correlation coefficients for the phases of the cycle						Dates of turning points		Cycle phase	Average of correlation coefficients for the cycle phases
Czech Republic	Estonia	Hungary	Poland	Slovak Republic	Slovenia				
0.835	0.984	0.758	0.345	0.682	0.963	x	05.2009	downward	0.761
0.453	0.977	0.984	0.566	0.961	0.647	06.2009	11.2010	upward	0.765
0.995	0.990	0.999	0.995	0.954	0.888	12.2010	06.2012	downward	0.970
0.997	0.968	0.975	0.981	0.987	0.970	07.2012	06.2018	upward	0.972
0.994	0.987	0.999	0.998	0.999	0.994	07.2018	12.2020	downward	0.995
0.999	0.996	1.000	0.999	1.000	0.999	01.2021	11.2021	upward	0.999
0.864	0.917	0.853	0.990	0.993	0.966	12.2021	10.2022	downward	0.930
0.880	0.396	0.938	0.982	0.988	0.986	11.2022	06.2024	upward	0.872
0.671	0.745	0.959	0.893	0.883	0.885	07.2024	04.2025	downward	0.839
0.908	0.959	0.770	0.925	0.796	0.911	05.2025	x	upward	0.878

Source: own research

Źródło: badania własne

the individual phases of the cycle, starting with 0.235 for the first analyzed cycle phase to 0.001 in the last analyzed phase (Table 1). During the COVID-19 pandemic, the correlation coefficient for the recession phase of the cycle in the studied countries was 0.005, and during the revival phase, during the pandemic, it dropped to 0.001. For comparison, this index was 0.043 during the recession phase of the previous cycle, and in the revival phase it was 0.011. Moreover, the value of the standard deviation for the average value of the Consumer Confidence Indicator dropped in the case of the individual countries during the pandemic in comparison with the pre-pandemic period and, in comparison, with the pre-subprime period (Table 1).

An increase in the value of correlation coefficients was also revealed for the individual phases of the cycle of economic activity. In the first phase of the business cycle until May 2009, the correlation of economic activity among the individual countries was 0.761, and it increased to 0.97 during the recession phase of the following cycle (Nov 2010–June 2012). It reached 0.995 during the recession phase in the pandemic, and during the revival phase (also during the pandemic) it grew to 0.997. For comparison, the correlation between the activities in the individual countries was 0.972 in the previous revival stage of the business cycle (June 2012–June 2018). Similar relations among the changes in the values of the correlation coefficients can be observed for the individual countries
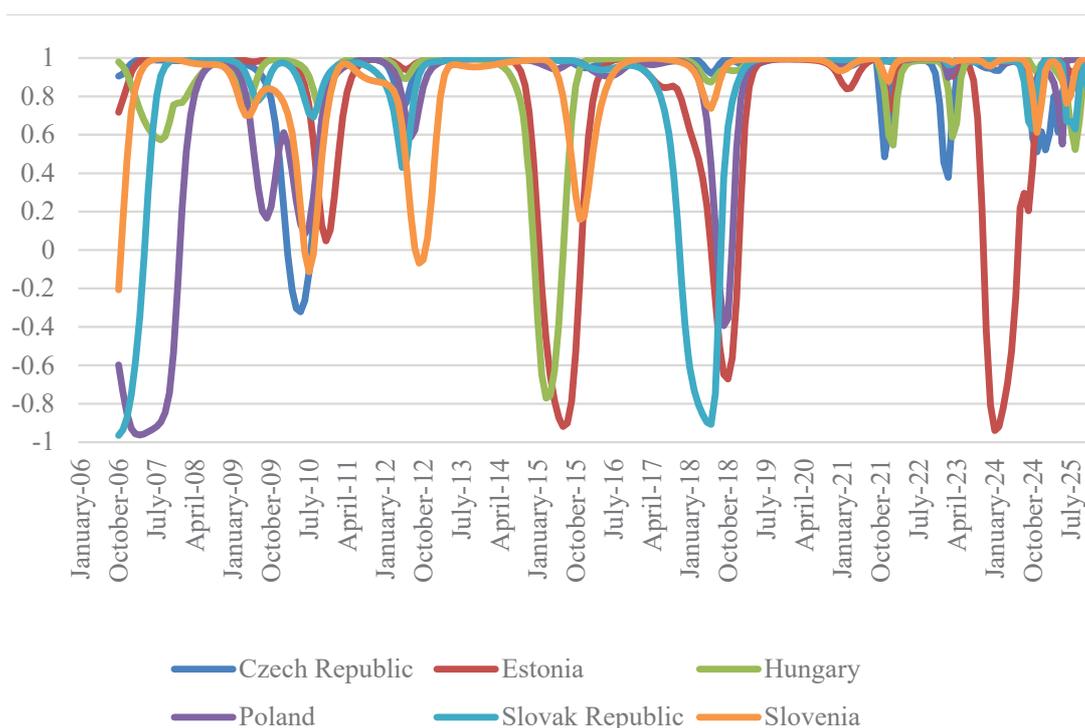

Figure 3. Values of the moving correlation coefficients in a window of 9 months for the Consumer Confidence Indicator

Rysunek 3. Wartości kroczących współczynników korelacji w dziewięciomiesięcznym oknie dla wskaźnika ufności konsumenckiej

Source: own research

Źródło: badania własne

(Table 1). As time passes, we can observe an increase in the synchronization of economic activity in the studied countries. Following the pandemic period, the synchronization of economic fluctuations persists in the analyzed countries, except for Estonia.

A study of the moving correlation coefficients has revealed periods of increased synchronization of changes in economic activity across the countries (Figure 3). Values of the correlation coefficient close to 1 indicate a high level of synchronization of economic activity fluctuations. The period of the COVID-19 pandemic revealed a high synchronization of economic activity measured by the Consumer Confidence Indicator in the countries of Central and Eastern Europe. Close correlation of changes in economic activity was observed during the period from February 2019 to the last period included in the analysis for which data were available.

Synchronization of changes in economic activity based on the Business Confidence Indicator

The analysis of the value of the cyclical component of the Business Confidence Indicator revealed similarities in economic activity in the countries studied. The periods of economic inactivity, during which the synchronization phenomenon increases, also played an important role (Figure 4).
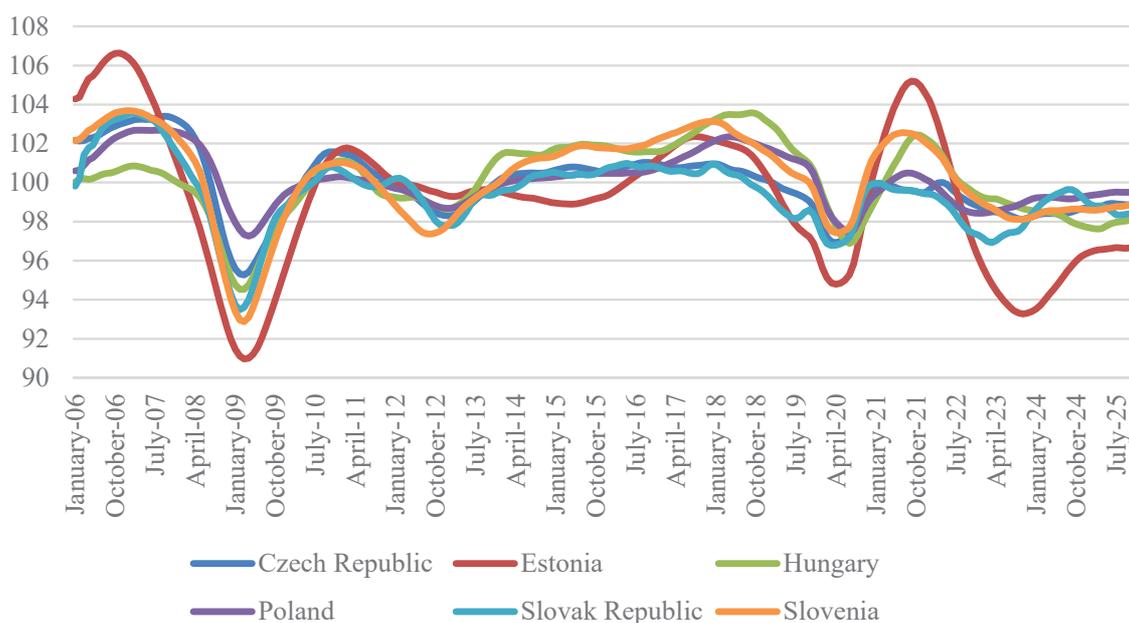

Figure 4. Cyclical component of the Business Confidence Indicator in the studied countries
Rysunek 4. Cykliczny komponent wskaźnika ufności przedsiębiorstw w badanych krajach

Source: own research
Źródło: badania własne

The study of the moving correlation coefficients revealed an increase in the synchronization of changes in economic activity in the individual countries during the crisis and upon entering the following growth phase of the cycle. Such a scenario occurred between June 2007 and June 2012 and from January 2019 to the last analysed period for
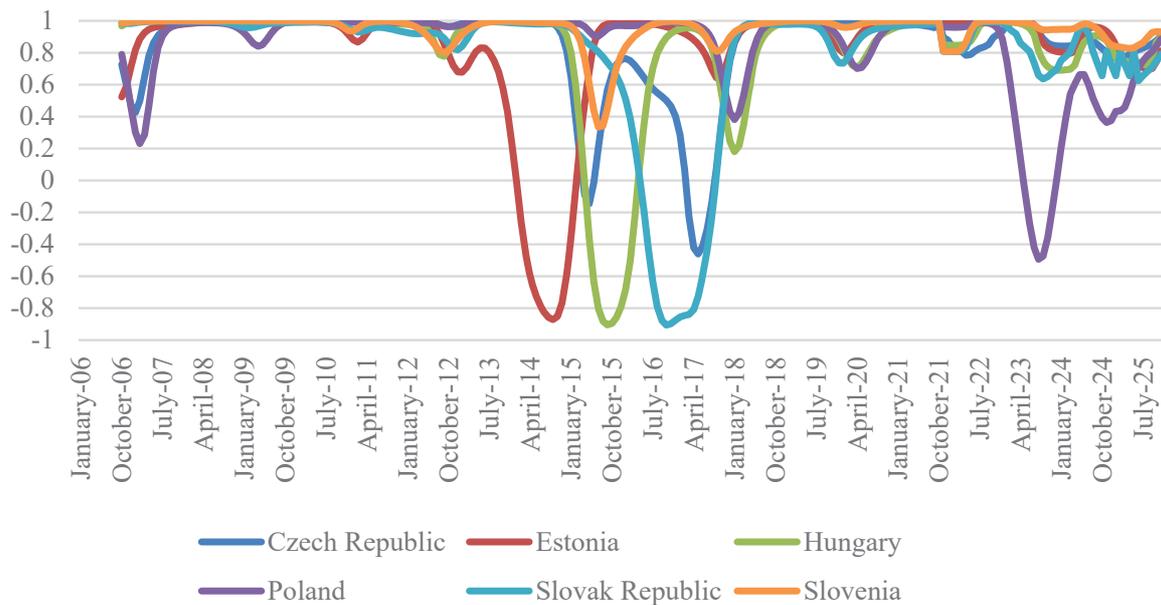
Figure 5. Values of the moving correlation coefficients in a window of 9 months for the Business Confidence Indicator

Rysunek 5. Wartości kroczących współczynników korelacji w dziewięciomiesięcznym oknie dla wskaźnika ufności przedsiębiorstw

Source: own research

Źródło: badania własne

which data were available (Figure 5). After the end of the pandemic period, except for Estonia, the synchronization of economic changes is observed to persist in the analyzed countries.

In all the analyzed periods of the decline of economic activity, the correlation coefficients were higher compared with the periods of the growing cycles (Table 2). An increase in the synchronization value during the recession serves as an argument for the occurrence of business cycle transmission through the so-called contagion. As a result, there is an increase in similarities among the changes in economic activity in the successive periods of the cyclic changes of the activities in the individual countries (Table 2).

The observed increase in synchronization of economic activity in Central and Eastern European countries has direct consequences for logistics systems operating in the region. Higher synchronization implies that downturns and recoveries occur simultaneously across markets, reducing the effectiveness of geographical diversification in logistics operations. During synchronized downturns, transport demand, warehouse utilization, and order volumes decline concurrently, while synchronized recoveries may lead to sudden and simultaneous surges in logistics demand. Such patterns challenge traditional planning approaches based on staggered or weakly correlated national cycles.

The characteristic feature of the contemporary economy is that economic crises are international in nature. Regardless of whether they concern a small or large group of countries, they have serious international effects. Due to the magnitude and intensity of the processes of opening economies, it is not justified to present a picture where a crisis must develop fully in one country for its effects to be felt abroad. Such a mechanical

Table 2. Correlation coefficients, their average values for the cycle phase of the Business Confidence Indicator (BCI)

Tabela 2. Współczynniki korelacji oraz ich średnie wartości dla fazy cyklicznej wskaźnika ufności przedsiębiorstw (BCI)

Correlation coefficients for the phases of the cycle						Dates of turning points		Cycle phase	Average of correlation coefficients for the cycle phases
Czech Republic	Estonia	Hungary	Poland	Slovak Republic	Slovenia				
0.960	0.826	0.970	0.986	0.924	0.996	x	04.2007	upward	0.943
0.891	0.898	0.999	0.989	0.997	0.967	05.2007	03.2009	downward	0.957
0.912	0.996	0.967	0.967	0.976	0.876	04.2009	03.2011	upward	0.949
0.897	0.987	0.974	0.987	0.927	0.965	04.2001	05.2013	downward	0.956
0.885	0.728	0.932	0.974	0.847	0.989	06.2013	01.2018	upward	0.893
0.998	0.988	0.986	0.982	0.973	0.997	02.2018	06.2020	downward	0.987
0.978	0.999	0.981	0.997	0.974	0.999	07.2020	11.2021	upward	0.988
0.874	0.998	0.930	0.891	0.913	0.930	01.2022	11.2022	downward	0.923
0.859	0.846	0.805	0.342	0.705	0.922	12.2022	x	upward	0.746

Source: own research

Źródło: badania własne

approach that separates the domestic aspect from the international sphere is very clear, but it does not allow one to notice that contemporary economic collapses are internationalized at their sources. It is not possible to fully separate the process of recession development in each country from the phenomenon of its international transmission. The sources of a crisis can be foreign themselves, and even if they are domestic in character, interaction with the world economy plays a significant role in their impact on the course and shape of the collapse.

The synchronization of economic activity has direct implications for logistics systems, as changes in production levels, consumption, and trade flows translate into corresponding changes in transport volumes, warehouse utilization, and demand for logistics services. The literature indicates that economic downturns are associated with simultaneous declines in freight volumes and the utilization of logistics infrastructure, while periods of economic recovery lead to increased demand for transport and warehousing capacity. Under conditions of increasing synchronization of economic activity, these changes occur simultaneously across multiple countries, thereby increasing systemic risk and reducing the ability to offset declines in activity in one region with growth in another. Consequently, the synchronization of economic activity represents an important factor influencing both the stability and operational efficiency of logistics systems.

This paper adopted a definition of synchronization of economic activity proposed by the World Bank [World Bank 2021], according to which we encounter contagion when the correlation among economies is stronger during a crisis than during the period of economic growth. Moreover, the increase in the correlation coefficients between economic activities of individual countries occurs in chronological order as a result of the transition through successive periods of slumps and growths of activity and does not have to be identified with crises [Samet 2020; Nardo et al. 2021]. Contagion takes place when,

during a crisis, the correlation between economies is stronger than in the period preceding the economic growth phase. Moreover, every successive crisis tightens the similarity of the course of economic activity among countries.

The approach adopted in this paper is consistent with the approach proposed by Forbes and Rigobon [Forbes, Rigobon 2002]. These authors define contagion as a significant increase in cross-market linkages after a shock to one country. Samet presents a similar view: financial contagion represents "a significant, immediate, and short-term transmission of shocks between financial markets in times of crisis" [Gonzales Minguez 1994].

When analyzing the research results, it was found that there was an increase in the synchronization of economic activity in the countries of Central and Eastern Europe between 2006 and 2021. A particular increase in synchronization occurs in periods of economic slowdown and persists in successive periods of increased activity. The successive periods of slowdown are characterized by a systematic increase in the synchronization of changes in economic activity. The period of the pandemic contributed to an increase in the phenomenon of synchronization of economic activity in the countries of Central and Eastern Europe. A conclusion worth noting is the fact that the economic slowdown had occurred even before the pandemic outbreak in the countries of Central and Eastern Europe. Similarly, a synchronization of the decline in activity was observed in this period regardless of the pandemic, which came approximately eight months later. However, the pandemic contributed to the unprecedented increase in the similarities of the changes in economic activity in the countries studied. The presented results allow us to conclude that there was a unification of the character of the changes in economic activity that corresponded to the phenomenon of contagion in the economic context.

The Central and Eastern European countries have revealed multifaceted similarities in the courses of their business cycles [Dragos, Tilica 2014]. For example, Christodouklakis et al. came to such conclusions already in 1995. Gonzales Minguez noticed similarities during income and consumption. When studying the G-7 countries, Fiorito and Kollintzas arrived at the same conclusions [Kołodko 1982; Fiorito, Kollintzas 1994]. Returning to the countries of Central and Eastern Europe, Kołodko also proved a cyclical character and synchronization of the socialist economies [Kołodko 2001; Flaig et al. 2007]. When analyzing the historical studies, Flaig et al. summed up that the correlations among the business cycles were quite high in Europe already in the 1950s, after which they lost their intensity only to reach their peak after the first oil crisis. Since the 1980s, the correlation of the cycles has gradually risen [Piech 2003]. In subsequent studies, Piech also demonstrated cyclical similarities of economic activity between Poland and the countries in the region [Artis, Zhang 1997]. Bergman also proved that the European business cycles were highly synchronized [Bergman 2007]. Artis and Zhang also came to similar conclusions by demonstrating the synchronization of economic activity in the countries of Central and Eastern Europe [Crespo-Cuaresma, Fernández-Amador 2013].

Artis [Artis 2003; Camacho et al. 2008] intended to identify the European business cycles based on quarterly GDP for 23 countries, including 15 European ones, for the years 1970–2001. This cyclical component was estimated by the Hodrick-Prescott filter. The synchronization of the cycles was measured as a correlation coefficient of the productivity gap. The correlation analysis paper also included different methods of grouping the countries based on the similarities and differences among their cycles. The author

claimed that the core of the European business cycles was comprised of cycles in France, Germany, Austria, Italy, Belgium, and Ireland. These cycles were most correlated with the UE15 cycles.

Camacho, Perez-Quiros, and Saiz [Camacho et al. 2008; Furceri, Karras 2008] analyzed the similarities among the business cycles in 30 countries, including 25 EU countries. They used clusters and distinguished four groups of countries in terms of similarities of the business cycle and one unusual group which included Hungary and Poland. Furceri and Karras [Furceri, Karras 2008] studied the level of synchronization of the business cycles among the members of the EMU before and after the introduction of the euro in the nine countries of the EMU as well as Denmark, Sweden, and Great Britain. The authors measured synchronization as a correlation coefficient of the cyclic component of GDP, which was estimated with the help of the Hodrick-Prescott and Baxter-King filters. They concluded that after the introduction of the euro, the business cycles among the EMU countries became more synchronized. Using the Bayesian Dynamic Factor Model, Lehwald [Allen 2013; Lehwald 2013] analyzed the relations between GDP changes in EA12 countries in two periods: 1991–1998 and 2000–2010. The authors' conclusions were as follows: the introduction of the euro increased the synchronization of the business cycles in the major countries and decreased the synchronization in the peripheral states.

Papadimitriou, Gogas, and Sarantiti [Papadimitriou et al. 2016] studied the convergence of the European business cycles in the years 1986–2011. They used an approach where a Pearson correlation of the GDP growth indexes represented the level of synchronization. Their empirical results showed that despite the countercyclical behavior of several economies, the business cycles of the European countries displayed an overall increase in the level of synchronization: thus the convergence in times of a common currency [Gomez et al. 2017].

Augustyński and Laskoś-Grabowski [Augustyński, Laskoś-Grabowski 2018] used a hierarchical cluster – a method that uses a dissimilarity measure based on compression. The authors compared GDP time series of the EU countries that included three periods: 2000Q1–2007Q4, 2008Q1–2017Q1, and the whole period 2000Q1–2017Q1. Their concluding remarks were that the global financial crisis had intensified the processes of synchronization of economic activity fluctuations. Gomez, Ferrari, Torgler, and Ortega [Gomez et al. 2010] used the correlation matrix of the GDP cyclical component estimated by the Hodrick-Prescott filter and the network analysis method. Their analysis encompassed the years 1995–2015. Their results indicated that the synchronization of the euro zone countries remained stable from 1999 until the global financial crisis, after which the co-movements increased dramatically and the synchronization increased to the highest level in this time sample [Allen, Gale 2007].

Bloom [Bloom 2014] presents a precise summary of his work conducted on this topic and indicates the consequences of economic activity synchronization from the international point of view [Bergman 2007]. The increase in the convergence of economic activity over time from the international point of view was also demonstrated by Bergman [Cepoi 2020].

Cepoi presents other studies concerning the most updated information about COVID-19 [Cepoi 2020]. Cepoi shows that six countries most stricken by the pandemic demonstrated a considerable response to the information about the coronavirus. This

information had a negative impact on the assessment of economic activity in the other countries of the region. Corbet et al. analyzed the markets of gold and cryptocurrency in relation to the Chinese financial markets [Allen, Gale 2007; Cepoi 2020]. They observed signs of "an escape" during the initial stages of the financial crisis caused by COVID-19. Akhtaruzzaman et al. proved a significant influence of COVID-19 between China and the G7 countries and demonstrated a significant increase in their conditional correlations [Fiorito, Kollintzas 1994; Akhtaruzzaman et al. 2021]. It is also possible to find other points of view in the literature, for example, the assessment of the influence of the pandemic on other selected sectors of the economy [Baker et al. 2020].

The COVID-19 pandemic provides a clear example of how synchronized economic shocks amplify logistics risks. The unification of the scale and timing of economic activity changes translated into simultaneous disruptions across transport corridors, warehousing systems, and last-mile delivery networks. In this context, synchronization acts as a multiplier of logistics vulnerability, as firms face concurrent constraints in capacity, labor availability, and infrastructure rather than localized disturbances.

Baker stated that a steep increase in the uncertainty connected with the COVID-19 pandemic revealed an increase in the synchronization of the business cycle in such indexes as the Business Confidence Indicator. This is of key significance for deepening the consequences of economic crises due to their common geographical character.

Consequently, indicators of economic activity synchronization may serve as early warning signals for logistics operators, enabling more proactive adjustments in capacity planning, inventory strategies, and network configuration.

The results suggest that the observed synchronization reflects both contagion-type transmission and common shock effects. The Global Financial Crisis of 2008 exhibited characteristics of contagion, with economic disturbances spreading across countries through financial markets and trade networks. In contrast, the COVID-19 pandemic represented a largely simultaneous global shock, affecting production, consumption, and logistics systems across countries at nearly the same time.

From a logistics perspective, this distinction is particularly important. Contagion-driven synchronization may allow for short-term spatial adjustments in logistics capacity, whereas common shocks create simultaneous disruptions across multiple markets, significantly increasing systemic risk and limiting the effectiveness of geographic diversification strategies.

Conclusions

Beyond its macroeconomic implications, the findings of this study are highly relevant for logistics and supply chain management in integrated regional markets. The increasing synchronization of economic activity and consumer demand observed in Central and Eastern European countries implies that both downturns and recovery phases tend to occur simultaneously across multiple economies. As a result, the traditional buffering role of spatial diversification is weakened, and systemic risks within logistics networks are intensified. For firms operating across the region, synchronized cycles mean that demand shocks, capacity constraints, and recovery pressures are increasingly likely to materialize at the same time in different markets, rather than being offset geographically.

Summarizing the empirical evidence and the findings reported in the literature, this study confirms a long-term increase in the synchronization of economic activity in Central and Eastern Europe. Business cycle impulses are transmitted through multiple channels of international economic flows, including trade, capital movements, and information exchange. However, explanations based solely on trade intensity or economic similarity are insufficient to account for the observed speed, abruptness, and scale of cyclical co-movements. The distinct nature of contagion lies precisely in the rapid and widespread transmission of impulses, which leads to a convergence of economic dynamics across countries and sectors.

The results indicate that major economic crises play a particularly important role in strengthening synchronization. Both the global financial crisis of 2008 and the subsequent pandemic-related crisis were characterized by a simultaneous economic downturn across Central and Eastern European countries. In line with the contagion framework, correlations of economic activity changes across countries were significantly stronger during crisis periods than during phases of economic expansion. Moreover, cyclical impulses were transmitted more rapidly and more abruptly than would be expected based on economic fundamentals alone. Importantly, successive crises did not merely produce temporary synchronization effects but contributed to a cumulative increase in similarity in the scale, dynamics, and timing of economic activity fluctuations across countries.

From a logistics perspective, the growing synchronization of economic activity has far-reaching consequences. When economies enter downturns simultaneously, logistics systems face concurrent reductions in transport volumes, warehouse utilization, and order flows across markets. Conversely, synchronized recoveries generate sudden and simultaneous increases in logistics demand, placing significant pressure on transport capacity, inventory availability, and network coordination. This dual effect increases operational volatility and reduces the effectiveness of staggered planning strategies traditionally used to manage cyclical fluctuations in logistics operations.

The persistence of synchronization beyond crisis periods further reinforces these challenges. After the end of the pandemic period, with the exception of Estonia, synchronization of economic changes was observed to persist in the analyzed countries. This suggests that synchronization is no longer limited to crisis episodes but increasingly characterizes both recessionary and expansionary phases of the business cycle. For logistics systems, this implies that periods of economic growth may also be associated with heightened systemic pressure, as demand expansions occur concurrently across markets rather than sequentially.

In this context, the increasing transmission of business cycles across Central and Eastern Europe should be understood as a structural feature of the regional economic system. For logistics and supply chain management, this underscores the need for higher flexibility, redundancy, and adaptive capacity. Strategic responses may include more dynamic capacity planning, greater emphasis on real-time demand monitoring, diversified transport and warehousing options, and enhanced coordination across cross-border logistics networks.

In this sense, the analysis of economic activity synchronization should be treated as an integral component of strategic logistics planning in integrated regional markets. Understanding the degree and dynamics of synchronization allows logistics operators

and policymakers to better anticipate periods of heightened systemic risk, design more resilient logistics structures, and mitigate the operational consequences of increasingly synchronized economic fluctuations.

The main findings of the study can be summarized as follows:

1. Economic activity in Central and Eastern European countries exhibits a high and increasing level of synchronization over the analyzed period.
2. The synchronization of economic activity increases significantly during crisis periods, such as the Global Financial Crisis of 2008 and the COVID-19 pandemic.
3. Business and consumer confidence indicators constitute reliable tools for identifying business cycle synchronization due to their high frequency and sensitivity to changes in economic conditions.
4. The increasing synchronization of economic activity highlights the growing importance of flexibility and adaptive capacity in logistics systems operating in international markets.

The consistency between confidence indicators and documented contractions in industrial production during both crisis periods confirms that the observed synchronization reflects real economic adjustments rather than purely sentiment-driven reactions. This strengthens the validity of using high-frequency confidence indicators as reliable measures of synchronized economic activity and enhances their practical relevance for logistics planning and early warning systems.

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