



# Positive externalities of the EU cohesion policy: Toward more synchronised CEE countries?

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Accepted: 4 July 2023 / Published online: 31 July 2023  
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## Abstract

The aim of this paper is to examine the role of the payments from the European Cohesion Policy (ECP) in the business cycle synchronisation of the EU–28 countries in the time period 2000–2016. The emphasis is especially placed on the Central and Eastern European (CEE) countries, given their status as the biggest ECP recipients; we investigate whether the ECP can serve as an instrument to promote their synchronisation which presents one of the prerequisites for the adoption of common monetary policy in the Economic and Monetary Union (EMU). By applying a panel instrumental variables estimation, our results suggest that the ECP provides a positive externality regarding increased synchronicity in the EMU, suggesting that the ECP should be further strengthened to foster business synchronicity in the Euro Area. Further analysis reveals that the systematically identified driving forces are the European Regional Development Fund (ERDF) and the Cohesion Fund (CF). The current European recovery plan ‘Next Generation EU’ could, therefore, have a promoting effect on the EMU’s monetary policy if it is designed as an additional structural investment fund promoting financial and trade integration.

**Keywords** Business cycle synchronisation · Economic and monetary union · Supranational fiscal transfers · European integration · European Cohesion Policy

**JEL Classification** E32 · F44 · F45 · O47

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## 1 Introduction

The issue of business cycle synchronisation is predominantly discussed in the context of the economic and monetary union (EMU).<sup>1</sup> Given the heterogeneity of the EMU, researchers often identify ‘the core’ (some initial member states) and ‘the periphery’ (mostly of later member states).<sup>2</sup> While most Western European countries (EU-15) are identified as the core countries (Bayoumi and Eichengreen 1992; Artis and Zhang 2001; Darvas and Szapary 2008; Aguiar-Conraria and Soares 2011; Belke et al. 2017), the research on the Central and Eastern European (CEE) countries remains still scarce and limited and treats them as a part of the periphery (Ferroni and Klaus 2006; Darvas and Szapary 2008; Aguiar-Conraria and Soares 2011; Stiblarova and Sinicakova 2020).<sup>3</sup>

The reason for this may lie in the fact that these economies have experienced two remarkable transitions in the last two decades. Transformation in the true sense of the word happened, first, during the switch from planned to market economies and second, during the period of entry and integration within the EU, accompanied by the latter’s outstanding trade openness, financial integration, and capital account liberalisation (European Commission 2006; Fabrizio et al. 2009). In this paper, we focus on the latter type of transition, because, aside from the last step of adopting the common currency, the Euro, the transition is still ongoing for most CEE countries. Although several reforms have been implemented to improve the institutional establishment of the EMU and strengthen cooperation between the member states, the future shape of the EMU remains uncertain, as does the potential for enlargements (Blesse et al. 2021).<sup>4</sup>

One may note that those countries classified as belonging to the periphery regarding business cycle synchronisation are still the poorest in the EU (see Fig. 1), but most of the CEE economies have experienced substantial economic catching up relative to the EMU. However, the Great Recession of 2008–2009 created temporary economic divergence. Notably, the Baltics experienced a fall in their relative GDP per capita to the EMU during the late 2000s. To a lesser extent, Croatia and Hungary plateaued at around 30% of the EMU’s GDP per capita in the early 2010s (50%

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<sup>1</sup> For the purpose of this paper, we use the term ‘Economic and Monetary Union’ (EMU) or ‘Euro Area’ to refer to the third stage of the EMU represented by the member countries that have already adopted the euro. A term ‘European Union (EU)’, refers to the second stage of the EMU—that is, it also includes the member states that have not adopted the euro yet.

<sup>2</sup> Germany, Austria, France, Belgium, and the Netherlands are unanimously identified as the core countries, whereas Greece, Italy, Portugal, and Spain (so-called, GIPS countries) are often considered the periphery (see, e.g., König and Ohr 2013). These findings are illustrated in Annex, Table A1; Austria can be considered the EMU economy with the highest average level of business cycle synchronisation with Germany (one of the EMU’s core main economies, considered as a reference EMU business cycle) during 2000–2014. Conversely, Greece exhibits the lowest average value.

<sup>3</sup> We follow the OECD term ‘CEE countries’, comprising the Visegrad countries (Hungary, Poland, Slovakia, and the Czech Republic), the Baltic countries (Estonia, Latvia, and Lithuania), and the Southeastern countries (Bulgaria, Croatia, Romania, and Slovenia).

<sup>4</sup> For instance, Blesse et al. (2021) mention the reinforcement of the rules of the stability and growth pact and the establishment of the European Stability Mechanism.

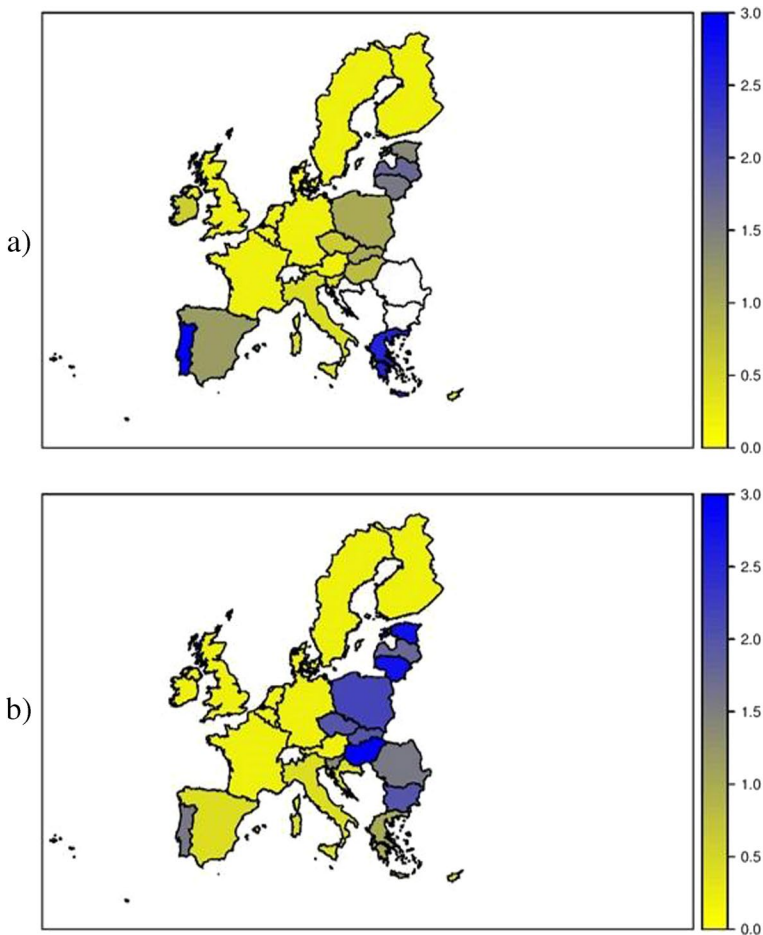


**Fig. 1** Real GDP per capita of the CEE countries, 2000–22 (EA = 100). Note: real GDP per capita is expressed in base-year 2015 prices using a price index (implicit deflator). Source: authors' elaboration based on data from Eurostat

in the case of the Czech Republic). On the opposite, the COVID-19 recession did not hurt the economic catching up of most CEE countries, but according to World Bank (2022), the war between the Federation of Russia and Ukraine has delivered a major blow to the recovery following adverse spillovers from the war, including fractures in critical trade and transit routes, sharp falls in remittances, and higher commodity prices and inflation. It can, therefore, be expected that CEE economies might experience simultaneous economic divergence with the EU-27 and business desynchronisation with the EMU.

To support economic development and convergence between the EU member states in terms of GDP per capita, five main EU funds (officially, *the European Structural and Investment Funds*), have been established: the European Regional Development Fund (ERDF), the European Social Fund (ESF), the Cohesion Fund (CF), the European Agricultural Fund for Rural Development (EAFRD), and the European Maritime and Fisheries Fund (EMFF). These EU funds constituted the second-largest budget line after the EU's agricultural expenses for the programming period 2014–20.<sup>5</sup> The EU funds provide financing for various projects and programmes in different areas (such as regional or agricultural development, transport

<sup>5</sup> For more information concerning the legislation of the EU funds, see regulation (EU) No. 1303/2013 of the European Parliament and of the Council and repealing Council Regulation (EC) No. 1083/2006 or particular Fund-specific regulations – the ERDF Regulation No. 1301/2013; the ESF Regulation No. 1304/2013; the CF Regulation No. 1300/2013; the EAFRD Regulation No 1305/2013; the EMFF Regulation No. 508/2014.



**Fig. 2** Commitments of the EU funds. Note: We depict the total committed amount of resources (ERDF, ESF, CF) as a share of country's GDP: **a** in the programming period 2000–06; **b** in the programming period 2007–13. Source: authors' elaboration based on data from European Commission. © EuroGeographics for the administrative boundaries

infrastructure, and research) to promote economic growth, mostly in the EU's lagging countries. As Fig. 2 indicates, the CEE countries are in the spotlight of the European Cohesion Policy, as they are the recipients of the bulk of the EU funds.<sup>6</sup>

Through the promotion of the economic integration of the recipient countries, we expect that the EU funds could provide a positive externality, bringing the EMU

<sup>6</sup> Several EU policy tools have complimented the support of economic convergence in CEE economies as part of the European Neighbourhood Policy (EPN) before their accession to the EU. For instance, the Instrument for Pre-accession Assistance (IPA) has supported reforms in the enlargement region with financial and technical assistance. Also, the Technical Assistance and Information Exchange instrument (TAIEX) supported public administrations in enforcing EU legislation and facilitated sharing of EU best practises.

closer to the OCA. Our study tries to fill the gap in the empirical literature, which to the best of our knowledge has not focused on the role of supranational fiscal transfers such as the EU funds as a possible driving force of business cycle synchronisation. However, it should be mentioned that this paper builds on substantial work by Darvas et al. (2005), who provide empirical evidence of the helping role of both fiscal convergence and fiscal discipline on the closeness of business cycle fluctuations. A common fiscal policy instrument in the form of the EU funds could possibly reduce idiosyncratic shocks among economies as well, by increasing trade and financial linkages between the recipients.

The aim of this paper is, therefore, to study the potential role of the EU funds on business cycle synchronisation. We examine this issue not only in the context of the EMU, but also from the perspective of future enlargements to other CEE countries, which are the biggest recipients of the EU funds. Our results suggest that the EU funds have improved business cycle synchronicity in the EU. The effects are even stronger when considering the EMU membership, which would suggest that the less synchronised non-euro CEE member states should become a part of the EMU. The policy implications of our results might, therefore, be very valuable not only for the implementation and regulation of the recent European Cohesion Policy but also when considering the potential future enlargement of the EMU. The systematically identified driving forces are the ERDF and the CF, through which most projects financing transport infrastructure and technological development are supported. These estimates are robust to different estimators and different business cycle filtering techniques.

The remainder of this paper is organised as follows: the second section provides a related literature review. The third section deals with the methodology and data used to conduct our analysis: we apply a panel instrumental variables approach to account for the possible endogeneity problem of the business cycle synchronisation driving forces. The fourth section provides the estimation results for the full sample, as well as for the sub-samples with particular country pairs and EU funds. We conclude our findings in the last section, about EU cooperation in the areas of supranational fiscal transfers and common economic governance. We also give perspectives for future research.

## 2 Literature review

The discussion surrounding the future of the EMU involves, among other things, a thoughtful examination of the synchronisation of the business cycle (see, e.g., Campos et al. 2019). However, existing empirical research shows mixed results regarding this matter. Whereas some authors find evidence of increasing synchronisation in time (Fatas 1997; Artis and Zhang 1999; Darvas and Szapary 2008), others claim that converging and diverging periods of synchronisation tend to alternate (Massmann and Mitchell 2004; De Haan et al. 2008) or raise doubts as to whether a common monetary policy would be suitable to implement in more recently joined members, as the differences in the business cycles may not be alleviated (Inklaar and De Haan 2001).

The synchronisation aspect in the monetary unions has been mostly highlighted in the optimum currency areas (OCA) theory pioneered by Mundell (1961), according to which the optimality of the common monetary policy depends not on the fulfilment of the formally determined, Maastricht criteria, which might not prevent imbalances among the member states after the adoption of a common currency (Angelini and Farina 2012; Lukmanova and Tondl 2017), but instead on the extent to which economies willing to adopt the common currency share specific common characteristics, the so-called ‘OCA properties’ (Frankel and Rose 1998; Campos and Macchiarelli 2016). Synchronisation of business cycles (that is, the extent to which output gaps among the member states are correlated), is often assumed to be the crucial criterion within the OCA framework (Darvas and Szapary 2008).

At the same time, the EMU countries benefit from the ECP aimed to stimulate cohesion and convergence in per capita income. The previous research about the EU funds has, therefore, attempted to determine whether these expenditures can be considered as an important policy instrument promoting economic growth (Becker et al. 2010; Mohl and Hagen 2010; Pellegrini et al. 2013), employment (Bondonio and Greenbaum 2006; Mohl and Hagen 2010), and the level of convergence of the member states (Cappelen et al. 2003; Becker et al. 2013).

The latter is based on the  $\beta$ -convergence models by Barro and Sala-i-Martin (1992) stemming from the neoclassical growth theory. For instance, Merler (2016) investigates economic convergence in the EU and states that EU funds played a crucial role in mitigating the impact of the Great Recession. Cappelen et al. (2003) examine the effect of the EU Cohesion Policy on convergence in the 1980–1990s and find a significant and positive contribution of EU funds to productivity and income convergence in Europe. Becker et al. (2013) validate such results for the EU funds under Objective 1 in the time period 1989–2006 but also claim that a positive effect in terms of per capita income growth is observed in regions with adequate human capital and quality institutions.

In a similar way, the literature acknowledges that the impact of the EU funds on GDP is conditional on certain factors. Some commonly identified determinants of this conditional impact are the quality of institutions and government (Ederveen et al. 2006; Becker et al. 2012; Rodriguez-Pose and Garcilazo 2015), absorption capacity (Tatulescu and Patruți 2014; Huliaras and Petropoulos 2016), socio-economic conditions (Crescenzi and Giua 2016), and quality of macroeconomic management (Tomova et al. 2013; Dicharry et al. 2019). However, to our knowledge, no systematic empirical research directly addresses the question of potential linkage between the EU funds and business cycle synchronicity.

Can these payments promote business cycle synchronisation in the EMU to make it closer to an OCA? The very few existing studies mostly focus on the examination of a cyclical component of the EU funds in the years following the Great Recession of 2008–2009 to underline a counter-cyclical component of the European Cohesion Policy. Smail (2010) highlights the reactivity of the European authorities to this economic downturn in the form of a series of amending regulations aimed at increasing the level of advances to member states to use the EU funds as a tool for macroeconomic stabilisation. These advances accounted for more than eight percent of all funds in the programming period 2007–2013. Such a strategy has also been pursued

in the programming period 2014–2020, as, for instance, when an additional €1.375 billion was allocated for Greece, or €1 billion for Portugal.<sup>7</sup>

Another key measure has been to simplify the EU funds regulations to make the implementation of projects easier and speed up recipient countries' absorption. According to Kondor-Tabun and Staehr (2015), this measure led to faster execution of programmes in the Baltic countries after the global financial crisis. Besides that, this study points out that in Poland (the biggest EU funds recipient country), a similar pattern can be observed.

On the other hand, some studies such as that by Tatulescu and Patruti (2014) describe the EU funds as procyclical, owing to the reduced ability to draw allocated funds during economic downturns. Indeed, during recessions, the available resources for national co-financing are reduced as a result of increased national expenditure and a reduction on the revenue side of public budgets. Covering the period 2004–2015 for the Czech Republic, Chmelova (2018) examines and concludes that EU funds are procyclical, as a 1 percent increase in the Czech economy's output gap is associated with an increase in European transfers by CZK 8.4 billion.

However, the Chmelova study concludes that this procyclicality must be considered a purely random effect resulting from the restricted time frame of the programming periods. The ability to prepare projects and implement them in the context of the national and EU legal framework is identified as the main determinants of this procyclicality. Indeed, the first years of a programming period are characterised by few payments, as a large amount of investment projects are just being constituted and await the approval of the European Commission. Given that all of the EU's economies are recipients of the EU funds, their pro-cyclicality or counter-cyclicality might promote business synchronisation, as payments are implemented simultaneously.

To the best of our knowledge, empirical literature lacks a study exploring the potential role of the Cohesion Policy on business cycle synchronisation among its recipient countries, a gap that we will try to fill. In the context of the EU, three drivers of business synchronisation have already been widely identified in the literature. First, trade intensity has been the most examined potential driver (Frankel and Rose 1998; Baxter and Kouparitsas 2005; Silvestre and Mendonca 2007), leading to more synchronised business cycles by boosting demand shocks among countries. Frankel and Rose (1998) find a positive relationship between trade and synchronisation based on the dataset of industrialised countries. Many other empirical studies of industrialised countries confirm their findings (see, for instance, Fatas 1997; Clark and Van Wincoop 2001). For the EU, Antonakakis and Tondl (2014) provide evidence of a substantial positive effect of trade on business cycle synchronisation, which seems to be crucial, especially between the incumbent EU-15 members and the new EU-12 member states of the EU-27.<sup>8</sup> Beck (2013a) find a lack of trade

<sup>7</sup> See Annex VII of the EU Regulation No. 1303/2013 for more details.

<sup>8</sup> For this paper, Antonakakis and Tondl (2014) consider the following 'new EU-12 member states': Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, and Slovenia.



barriers as a factor easing synchronisation in the EU, while the author in his later study (Beck 2019) through the Bayesian model averaging (BMA) method adds that the structure of trade plays an important role in the EU, stressing the intra-industry trade and structural similarity.

In this vein, a second driving force is the similarity of economic structures, as when, in the presence of sector-specific shocks, two economies producing the same types of goods are likely to face similar economic conditions (Imbs 2004; Calderon et al. 2007; Beck 2013b). This evidence has also been supported when studying the economic integration of eight CEE countries which joined the EU in 2004; the similarity of economic structures in these countries had a direct positive and significant effect on business cycle synchronisation with the euro area members over the period 1990–2003 (Siedschlag 2010).

Siedschlag (2010) also draws attention to the endogeneity of business cycle correlations, the similarity of economic structures, and the trade intensity resulting from membership in the EMU. Indeed, this study concludes that the new EU countries will better qualify for the monetary union after the adoption of the euro, and that, therefore, they should not postpone joining the euro area. The promoting role of the euro on CEE countries' economic integration has also been supported by researchers such as Jimenez-Rodriguez et al. (2010) and Nguyen and Rondeau (2019).

The pioneering work of Darvas et al. (2005) invokes the fiscal rules inherited from the Maastricht (nominal convergence) criteria as a factor fostering fiscal convergence and making member states' business cycles fluctuate more closely with one another. By promoting economic integration of their recipient economies, the EU funds may act as an additional driver of business cycle synchronisation in the Common Market, especially for the countries that share the euro.

The extensive body of research on business cycle synchronisation in the EU also suggests other, non-traditional determinants, such as migration, total factor productivity shocks, risk sharing, or exchange rate variability which, however, are beyond the scope of the presented paper (for more, see, e.g., Beck 2013a, 2019).

Our analysis contributes to the existing empirical literature in two ways. Firstly, we investigate whether the EU funds have a positive externality in terms of an increased level of synchronisation in the EU, but also, especially in the EMU which is characterised by a common monetary policy. Secondly, we tackle the issue of the economic integration of the CEE countries within the EU, by studying the role of the EU funds in promoting business synchronisation between the CEE and the EU-15 countries.

### 3 Methodology and data

#### 3.1 Panel instrumental variables estimation

Our instrumental variable strategy builds on studies of Frankel and Rose (1998), Imbs (2004), and Darvas et al. (2005), considering the possible endogeneity problem of the business cycle synchronisation driving forces. We estimate the following regression model:



$$\begin{aligned} SyncFisher_{i,j,\tau} = & \beta_1 ActualEU_{i,j,\tau} + \beta_2 Trade_{i,j,\tau} + \beta_3 Specialization_{i,j,\tau} \\ & + \sum_{c=1}^C \delta_c X_{c,i,j,\tau} + u_{ij} + \varepsilon_{i,j,\tau} \end{aligned} \quad (1)$$

where  $SyncFisher_{i,j,\tau}$  represents a level of the business cycle synchronisation between country  $i$  and country  $j$  within time span  $\tau$ . The variable of our interest,  $ActualEU_{i,j,\tau}$ , denotes a total amount of actual expenditure from the EU funds (as a share of GDP) in countries  $i$  and  $j$  within time span  $\tau$ .<sup>9</sup> The model specification also covers the key determinants of the business cycle co-movement, mostly highlighted in the previous empirical literature:  $Trade_{i,j,\tau}$  which denotes trade intensity between countries  $i$  and  $j$  within time span  $\tau$ , and  $Specialization_{i,j,\tau}$  which stands for the similarity in industry specialisation between countries  $i$  and  $j$  within time span  $\tau$ . We include a set of control variables ( $X_{c,i,j,\tau}$ ), country-pair fixed effects ( $\mu_{ij}$ ), time fixed effects ( $\gamma_\tau$ ) to account for country-pair/time heterogeneity, and  $\varepsilon_{i,j,\tau}$  to present the error term.

We consider the following set of control variables. Firstly, we consider a variable related to human capital, which presents an education proxy measuring the labour enrolments in high school and tertiary education. Dellas and Sakellaris (2003) and Ductor and Leiva-Leon (2016) find that countries with different levels of schooling are more likely to be in different business cycle phases, as during periods of expansion, individuals tend to substitute human capital investment with other economic activities because of the higher opportunity costs of schooling. Secondly, we consider the urbanisation rate as an exogenous control for level of economic development (Bloom et al. 2008); urban areas induce economies of scale and consequently, a higher level of income. Examination of country pairs shows that deep income differences should lead to synchronised business cycles (Antonakakis and Tondl 2014). Thirdly, we consider a proxy for institutional setting (namely, control of corruption), as previous studies find significant linkages to business cycle synchronisation (Altug and Canova 2014; Antonakakis and Tondl 2014). For instance, Altug and Canova (2014) conclude that for a full sample of the European and Mediterranean countries, differences in the quality of governance and in civil liberties reduce business cycle synchronisation. Finally, following Darvas et al. (2005), we consider fiscal convergence as a potential driver of business cycle synchronisation. According to the authors, more similar fiscal positions should be associated with more synchronised business cycles. As net lending/borrowing of the general government is heavily affected by the business cycle, i.e., endogenous, we follow Degiannakis et al. (2016) and use the cyclically adjusted net lending/borrowing of the general government to address the endogeneity issue.

<sup>9</sup> As the EC declares, 'Data collected on annual real expenditure from the EU funds [...] may negatively bias evaluation of the policy implications while performing analyses. To prevent from that, the EC develops more realistic estimate of the annual expenditure, which presents the mean of 100 000 simulations on the historic annual EU payments.' Hence, we consider this simulated annual expenditure to be our actual EU funds expenditure variable. Information regarding the robustness and sensitivity of assumptions are available in Lo Piano et al. (2017).

In this regard, one should be careful when using simple OLS estimation of the relationship between business cycle synchronisation and its determinants. Trade intensity and industry specialisation are proven to be the endogenous determinants of business cycle synchronisation (see Frankel and Rose 1998; Imbs 2004; Antonakakis and Tondl 2014, and many others).<sup>10</sup> Similarly, the final allocation of the EU funds, which can be considered a fiscal instrument, is plausibly driven by contemporaneous economic conditions. For instance, countries in deteriorated economic condition may be likely to receive a greater share of the EU payments than others, confirming counter-cyclical character and a greater business cycle synchronisation, which would likely bias our estimates.

On the other hand, there might exist an upward bias, which would occur if the expansionary periods were positively correlated with an increase in aggregate demand, a growing number of co-financed projects, and the final allocation of the EU funds payments. This would imply a cyclical character of the EU payments, reducing the level of the business cycle synchronisation, which can be also associated with the paradox of decreased ability to draw the EU's resources in the recessionary periods. Taking these facts into account, we also cannot consider actual expenditure from the EU funds as an exogenous variable with respect to business cycle fluctuations, due to expenditure's demand-driven nature (counter-cyclical or cyclical).

Without correcting for possible endogeneity, our estimates would be biased, invalidating the basic assumption of uncorrelated error term with the independent variable. To address this issue, we employ a panel instrumental variable strategy using two-stage least squares (2SLS) estimation, where the first stage estimation has the following form:

$$\begin{aligned} ActualEU_{i,j,\tau} = & \sum_{n=1}^N \theta_{1,n} Z_{n,i,j,\tau} + \alpha_1 Trade_{i,j,\tau} + \alpha_2 Specialization_{i,j,\tau} \\ & + \sum_{c=1}^C \pi_{c,i,j,\tau} + \lambda_{1,i,j} + \nu_{1,\tau} + \zeta_{1,i,j,\tau} \end{aligned} \quad (2)$$

$$\begin{aligned} Trade_{i,j,\tau} = & \sum_{n=1}^N \theta_{2,n} Z_{n,i,j,\tau} + \alpha_3 ActualEU_{i,j,\tau} + \alpha_4 Specialization_{i,j,\tau} \\ & + \sum_{c=1}^C \pi_{2,c} X_{c,i,j,\tau} + \lambda_{2,i,j} + \nu_{2,\tau} + \zeta_{2,i,j,\tau} \end{aligned} \quad (3)$$

$$\begin{aligned} Specialization_{i,j,\tau} = & \sum_{n=1}^N \theta_{3,n} Z_{n,i,j,\tau} + \alpha_5 ActualEU_{i,j,\tau} + \alpha_6 Trade_{i,j,\tau} \\ & + \sum_{c=1}^C \pi_{3,c} X_{c,i,j,\tau} + \lambda_{3,i,j} + \nu_{3,\tau} + \zeta_{3,i,j,\tau} \end{aligned} \quad (4)$$

<sup>10</sup> Since the impact of trade intensity and industry specialisation on business cycle co-movement has already been investigated by numerous authors, it is not central to this paper. We rather recommend to the reader the vast empirical literature on this matter.

where  $Z_{n,i,j,\tau}$  denotes  $n$ -th instrumental variable (instrument) used to estimate endogenous determinants of the synchronisation: actual payments from the EU funds/trade intensity/specialisation, varying over both time span  $\tau$  and country pairs  $i, j$ . Estimated dependent variables from Eqs. (2–4) are consequently used in Eq. (1), which presents the second stage estimation.

Empirical research of trade intensity and industry specialisation offers many options regarding possible instruments. Trade instruments include known gravity variables, such as geographical distance, and dummy variables denoting common borders or language (Frankel and Rose 1998). However, because of their time-invariant nature, we must follow Imbs (2004), Bravo-Ortega and Di Giovanni (2005) and use time-variant measures: the non-tariff barriers and the remoteness index, which defines the propensity to trade between countries  $i$  and  $j$ .<sup>11</sup> For specialisation, we apply the GDP gap and GDP product of both economies, showing two stages of specialisation: initial diversification, followed by re-specialisation at a relatively high level of income (Imbs and Wacziarg 2003), alongside the capital account restrictions/liberalisation, which serve as the instruments for specialisation arising from access to financial markets (Imbs 2004).

The literature is not so extensive to account for the endogeneity in the actual payments from the EU funds. We need to find an instrument  $Z_{i,j,\tau}$ , uncorrelated with contemporaneous economic conditions (and the error term), but strongly linked to the actual EU funds expenditure. In this paper, we decide to use planned EU payments (commitments) as an instrument to the actual payments from the EU funds; this constitutes our innovation in business cycle synchronisation research.<sup>12</sup> The argument behind using the commitments as a source of exogenous variation in the actual EU payments is that their allocation rule, provided in Annex, Table A2, is based on past values of variables such as one NUTS-2 region's relative GDP per capita, unemployment rate, and demographic and geographic characteristics.<sup>13</sup> Consequently, the commitment allocation is determined at the regional NUTS-2 level at the beginning of each programming period, independently of contemporaneous business cycle conditions. It is driven by supranational political factors—negotiations and the final approval by the European Council and the European Parliament based on the proposal by the European Commission, which occurs several years before considered programming periods—rather than by endogenous business cycle conditions. At the same time, it goes without saying that commitment allocation is closely connected to the actual allocation (see Annex, Fig. A1). However, many member states do not draw all committed resources from the EU funds, due to their low absorptive capacity (Becker et al. 2013).

<sup>11</sup> Imbs (2004) also suggests other instruments, such as local trade agreements and import duties. Unfortunately, these do not seem relevant for the current EU institutional framework and the European single market.

<sup>12</sup> However, we follow recent empirical contributions regarding estimation of the impact of government spending on the (local) economy, in which authors use planned funds resources as instruments (see, for instance, Coelho (2019) and Dupor and Guerrero (2017)).

<sup>13</sup> See the EU Council Regulations 502/1999, 595/2006, and 189/2007 for further details. For the CF, allocation criteria are first established at the member state's level with the 90 percent threshold rule.

The instrument relevance (strength) is tested using  $F$ -test of the first-stage regression for weak instruments and the consistency of the 2SLS estimation by the Wu-Hausman test for endogeneity. Throughout the paper, we report heteroscedasticity and serial correlation consistent standard errors for within-group estimators (Arelano 1987).

### 3.2 Variables definition and data

In line with previous studies (see, for instance, Imbs 2004; Darvas et al. 2005; Siedschlag and Tondl 2011; Antonakakis and Tondl 2014), we choose the Pearson correlation coefficient of real GDP time series as the indicator measuring the level of the business cycle synchronisation. We calculate bilateral correlation coefficients between each country  $i$  and country  $j$  within time span  $\tau$  using input data  $v$  (real GDP) by de-trending technique (s):

$$Sync_{i,j,\tau} = Cor(v, s)_{i,j,\tau} \quad (5)$$

To retrieve cyclical component from real GDP time series, we apply the high-pass Hodrick-Prescott (HP) filter (Hodrick and Prescott 1997). In spite of the fact that the HP filter has been subject to some criticism—it is said to suffer from the so-called ‘end-point bias problem’—we rely on this filter because it has become a standard tool for filtering business cycles (Ravn and Uhlig 2002), predominating in recent empirical studies.<sup>14</sup> In addition, we check the robustness of our results with the use of another filtering technique, the band-pass Christiano-Fitzgerald filter (Christiano and Fitzgerald 2003), which avoids the aforementioned problem.

As the Pearson correlation coefficient is bounded at  $[-1, 1]$ , the error term in our model specification would likely not be normally distributed, which could lead to unreliable inference (Inklaar et al. 2008). To avoid this problem, we decide to apply Fisher’s  $z$ -transformation of the Pearson correlation coefficient:

$$SyncFisher_{i,j,\tau} = \frac{1}{2} \log \frac{(1 + Sync_{i,j,\tau})}{(1 - Sync_{i,j,\tau})} \quad (6)$$

Such transformation should ensure normality in the distribution of the correlation coefficients (David 1949).

For the EU funds variable, we select only CF, ERDF, and ESF, since together, these funds provide most of the financial resources to the member states. Another reason for considering only these particular funds is that each programming period

<sup>14</sup> Canova (1998) claims that the choice of de-trending method might affect estimated cyclical properties. On the other hand, De Haan et al. (2008) conclude that the authors of empirical studies often reach qualitatively similar results in spite of different filtering techniques used to estimate the business cycles.

**Table 1** Panel IV estimation results—total EU funds

	(I)	(II)	(III)	(IV)	(V)	(VI)
Actual EU pay- ments	0.0966*** (0.0327)			0.2218*** (0.0535)		0.1279** (0.0620)
Trade intensity		0.3429*** (0.0927)			0.2676*** (0.0886)	0.1863 (0.1339)
Specialisation			1.2617** (0.5147)	2.2976*** (0.6744)	2.2357*** (0.6345)	1.8587*** (0.5349)
Education	0.4733** (0.1984)	1.2635*** (0.2741)	0.9251*** (0.2589)	1.1232*** (0.2866)	1.3180*** (0.3048)	1.2643*** (0.3055)
Urbanisation	-0.0793*** (0.0156)	-0.0581*** (0.0209)	-0.0317* (0.0187)	-0.0185 (0.0205)	-0.0079 (0.0242)	-0.0175 (0.0233)
Corruption	0.2454 (0.3722)	0.3923 (0.4745)	1.3921*** (0.5206)	2.5431*** (0.7022)	1.9518*** (0.6370)	2.1815*** (0.6313)
Fiscal policy	0.0088* (0.0048)	0.0008 (0.0054)	0.0066 (0.0051)	0.0154*** (0.0056)	0.0035 (0.0054)	0.0094 (0.0065)
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.8316	0.7885	0.8267	0.8219	0.7902	0.8183
N	2 441	2 277	2 066	2 004	2 057	1 995
Weak instru- ments	3317.7620 <0.0001***	60.9220 <0.0001***	64.3580 <0.0001***	959.1450 <0.0001***	39.72000 <0.0001***	690.1930 <0.0001***
Wu-Hausman	1.4450 0.2290	34.8150 <0.0001***	4.9670 0.0260**	5.0020 <0.0001***	14.2300 <0.0001***	5.8230 <0.0001***

This table reports results from the two-stage least square (panel IV) estimation, where dependent variable presents Fisher's z-transformation of the Pearson correlation coefficient. We control for country-pair and year-fixed effects. Robust standard errors (Arellano 1987) are reported in parentheses

\*  $p < 0.1$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$

Source: authors' calculations based on data from European Commission, Eurostat, and World Bank

implies specific objectives and instruments, which slightly differ among periods (and among the member countries to which these payments are allocated).<sup>15</sup> The payments from these funds remain consistent, allowing us to cover more programming periods. We also provide more alternatives of this variable regarding particular

<sup>15</sup> For instance, European Agricultural Guidance and Guarantee Fund (EAGGF) was replaced by the European Agricultural Guarantee Fund (EAGF) and the European Agricultural Fund for Rural Development (EAFRD) in 2007.

**Table 2** Panel IV estimation results—country-pairs analysis and robustness check

	CF		HP	
	(1)	(2)	(3)	(4)
Total funds				
EMU pairs	0.1929*** (0.0526)	0.2016*** (0.0610)	0.2510*** (0.0460)	0.2751*** (0.0820)
EU-15-CEE pairs	0.1216 (0.0899)	0.3560 (0.2744)	0.9007*** (0.1310)	0.7246** (0.3263)
EU-15 pairs	0.1909*** (0.0717)	0.2339*** (0.0703)	0.1732* (0.0929)	0.1433* (0.0836)
CEE pairs	0.5737* (0.3246)	-0.5673 (1.8760)	1.2297*** (0.4361)	1.5542 (2.8287)
Control variables	NO	YES	NO	YES
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

This table reports the second stage from the two-stage least square (panel IV) estimation, where dependent variable presents Fisher's z-transformation of the Pearson correlation coefficient from Christiano-Fitzgerald (CF) real GDP filtered data, Hodrick-Prescott (HP) real GDP filtered data. Other endogenous variables (trade intensity, similarity in industrial specialisation index) are also included in the model. We control for country-pair and year-fixed effects. Robust standard errors (Arellano 1987) are reported in parentheses

\*  $p < 0.1$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$

Source: authors' calculations based on data from European Commission, Eurostat, and World Bank

funds and country pairs, to capture the differing intensity of the EU funds impact' in the sub-groups. Another way to deal with this measure could be by classifying the payments according to thematic objectives. However, the European Commission does not provide data on annual (actual) EU funds expenditure per country and objective.<sup>16</sup>

We create a dataset of annual committed and actual EU funds expenditure covering three programming periods (2000–2006, 2007–2013, and 2014–2020) from multiple documents and databases published by the European Commission.<sup>17</sup> In the programming period 2000–2006, data on annual committed payments from the CF

<sup>16</sup> This is because no harmonised system or information was available regarding the classification of the payments per objective across different funds and programming periods. Only annual commitments per country and objective are available.

<sup>17</sup> For the programming period 2014–2020, complete data are available only until 2016.

**Table 3** Panel IV estimation results—funds analysis and robustness check

	CF		HP	
	(1)	(2)	(3)	(4)
Total pairs (EU-28)				
All funds	0.1368*** (0.0283)	0.1196** (0.0504)	0.2510*** (0.0460)	0.1279** (0.0620)
CF	0.2414 (0.1568)	0.9077*** (0.3372)	0.8662*** (0.1948)	0.7635* (0.2924)
ERDF	0.3002*** (0.0300)	0.2842*** (0.0654)	0.4425*** (0.0515)	0.2340*** (0.0766)
ESF	-0.3132* (0.1712)	-0.0430 (0.0590)	-0.1353*** (0.0487)	-0.0690 (0.0725)
Control variables	NO	YES	NO	YES
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

This table reports the second stage from the two-stage least square (panel IV) estimation, where dependent variable presents Fisher's z-transformation of the Pearson correlation coefficient from Christiano-Fitzgerald (CF) real GDP filtered data, Hodrick-Prescott (HP) real GDP filtered data. Other endogenous variables (trade intensity, similarity in industrial specialisation index) are also included in the model. We control for country-pair and year-fixed effects. Robust standard errors (Arellano 1987) are reported in parentheses

\*  $p < 0.1$

\*\*  $p < 0.05$

\*\*\*  $p < 0.01$

Source: authors' calculations based on data from European Commission, Eurostat, and World Bank

are unavailable; here, we follow an amended proposal from 2003 for a Council Regulation establishing a Cohesion Fund and calculate missing data.<sup>18</sup>

Trade intensity is calculated in the standard way as bilateral trade over the country  $i$ 's and country  $j$ 's nominal GDP (Imbs 2004). Trade instrument, the remoteness index presents the standard remoteness index of Bravo-Ortega and Di Giovanni (2005) at the EU level:

$$Remoteness_{ij} = \sum_j j \frac{D_{ij}}{T_j/T} \quad (7)$$

<sup>18</sup> In the programming period 2000–2006, the financial resources from the CF should be allocated to 14 EU member states (from 1 January 1, 2000: Greece, Spain, Portugal, and Ireland; from date of accession to the EU: the Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia, and Slovakia). Commitment appropriations for the latter should be: €2.6168 billion in 2004, €2.1517 billion in 2005, and €2.8220 billion in 2006. We calculate annual commitments for each country by multiplying total annual commitment appropriations by mean indicative allocation coefficient per country. Total resources available for commitments for Greece, Spain, Portugal, and Ireland are only available for the whole period 2000–06; here, we calculate annual committed payments per country based on annual committed payments from remaining funds under Objective 1 (Convergence).



where  $D_{ij}$  denotes the population-weighted distance from country  $i$  to country  $j$  and  $T_j$  stands for the bilateral trade flows (imports and exports) between  $i$  and  $j$ , whereas  $T$  represents the total intra-European trade. This variable captures an expected increase in trade for bilateral trading partners that are remote from the rest of the EU. For example, it would be expected that Ireland and the UK would trade more with each other not only because of their geographic closeness but also because of their remote geographic positions in the EU.

For the specialisation, we compute the Krugman (1991) specialisation index (KSI) based on 18 industrial categories, which ranges between 0 and 2; whereas a value of 2 indicates total specialisation (concerning the EU-average, in our case), a value 0 represents perfect similarity.<sup>19</sup> As we work with the country pairs, we compute the ratio of KSI between countries  $i$  and  $j$  to obtain a similarity in industry specialisation that takes values between 0 and 1. The higher the value, the more similar the relative industrial structure in the country-pair.

All variables used in the model estimation undergo several transformations. Firstly, the variables are expressed as an annual percentage change or percentage of population/GDP to account for the country's size and population. Consequently, we calculate the bilateral values of each variable (such as correlation coefficients, a sum of actual/committed payments) between each country-pair. The last step of transformation presents a log-transformation of the smoothed data; we apply a five-year rolling window transformation (time span  $\tau$ ), by which we lose a few observations, but eliminate redundant fluctuations/noise in time series and consider possible persistent effects by using a lag term of the EU funds expenditure on business cycle synchronisation.<sup>20</sup>

Our sample covers a panel dataset of the EU-28 countries in the time period 2000–2016. We construct bilateral measures, which means that in total the model can be estimated as using a maximum of 4,914 observations. We provide all the variable definitions and sources in Annex, Table A3.

## 4 Results and discussion

In this section, we present the main results from performed analysis regarding the potential linkage between the supranational fiscal transfers from the EU funds and business cycle synchronisation, which are available in Tables 1, 2, and 3.

In general, our results support the view that the EU funds enhance business cycle synchronisation. A more detailed picture is that this relationship holds between CEE and the EU-15 economies, but also between economies in the EMU. Both the weak instruments test and the Wu-Hausman test for the endogeneity of the instrument

<sup>19</sup> NACE Rev. 2 1-digit industry classification.

<sup>20</sup> Deciding on the length of rolling window might be problematic especially when using correlation coefficients (due to the trade-off between statistical confidence and ability to isolate significant changes in time). Here, we follow the studies of Antonakakis and Tondl (2014) and Lukmanova and Tondl (2017), who use 5-year rolling windows while investigating potential business cycle synchronisation driving forces.

are satisfied while using control variables in our model's specifications. Estimation results for the impact of total EU funds in the EU-28 are provided in Table 1.<sup>21</sup>

First, the impact of the EU funds on business synchronisation remains positive and significant in all specifications (columns (I), (IV), and (VI)). As expected, an increased bilateral trade intensity leads to more economic synchronisation (columns (II), (V), and (VI)) resulting from more economic interdependencies (Frankel and Rose 1998; Baxter and Kouparitsas 2005; Silvestre and Mendonca 2007). Moreover, similarity in economic specialisation has a promoting role in business synchronisation (columns (III)–(VI)), as both countries are more likely to face analogous economic shocks (Imbs 2004). Regarding control variables, a significant positive relationship between the actual EU payments and business cycle synchronisation can be observed while controlling for education, urbanisation rate, corruption, and fiscal policy. Our results, like those of Ductor and Leiva-Leon (2016), indicate that education promotes business cycle synchronisation, while urbanisation has an adverse effect. An increase in the quality of institutions represented by the corruption index is found to foster business cycle synchronisation in line with Altug and Canova (2014). The increased differences in fiscal policies are positively associated with business cycle synchronisation, as, while being not statistically significant in most of the specifications, the fiscal policy variable exhibits a positive coefficient. Although this result is not in line with Darvas et al. (2005) who observe a helping role of converging fiscal positions in synchronisation, such evidence corresponds to the findings of Antonakakis and Tondl (2014) for a similar EU sample. The authors suggest that diverging fiscal policies could lessen the effects of the crisis which the member countries experienced in different intensities and, hence, reduce idiosyncratic shocks among economies.

As a next step in our analysis, we divide the dataset into several parts, considering particular funds and country pairs to provide additional findings. We also incorporate a robustness check for performed analysis (while also considering particular funds and country pairs), using different filtering techniques to retrieve the business cycles: the Christiano-Fitzgerald (CF) filter and the Hodrick-Prescott (HP) filter. The related estimations are displayed in Tables 2 and 3.

To tackle the issue of the economic integration of CEE countries, we examine the EU-15–CEE pairs, the EU-15 pairs, and the CEE pairs, due to the prevailing claims about two-speed or multi-speed Europe, which can also be reflected by differences in the level of business cycle synchronisation among these groups of countries. We should recall that most of the CEE countries are major recipients of the European Cohesion Policy, such as the Czech Republic, Hungary, Poland, Romania, Bulgaria, and Croatia. The enhancing role of the EU funds on business cycle synchronisation holds for the EU-15 pairs but is not robust to the CF filter between the EU-15 and the CEE countries. Moreover, we do not find any statistically significant relationship between the EU funds and business cycle synchronisation among the CEE pairs while considering control variables, which is in line with Stanisis (2013), who rejects the hypothesis of a common business cycle

<sup>21</sup> For the sake of brevity, the OLS estimation results suggesting limited bias are not reported (available upon request).

between the CEE countries. Such a result suggests that the degree of economic integration underwent more significant increases for the CEE countries that have adopted the euro than it did for the other CEE countries. (Jimenez-Rodriguez et al. 2010; Siedschlag 2010; Nguyen and Rondeau 2019). The Baltic states present a perfect example; these economies strengthened their trade and investment links with Western countries and now show a large degree of convergence (for more, see, e.g., Diaz del Hoyo et al. 2017).

We also consider business synchronisation between economies belonging to the EMU. The advantage of considering only EMU country pairs is that it allows us to consider the effects of fiscal discipline associated with membership in this area. We find that the EU funds can promote business cycle synchronisation in the EMU. This finding has important policy implications, as it reveals that the European Cohesion Policy has a positive externality on the EMU's common monetary policy. Indeed, even if their initial aim is the promotion of economic convergence, the EU funds are beneficial for business cycle synchronisation as well. Thus, in order to make less aligned non-EMU CEE countries more synchronised, it would be beneficial to become a part of the EMU.

Besides our main results, we examine the effects of particular funds (CF, ERDF, and ESF) on business cycle synchronisation to understand which EU fund drives business cycle synchronisation the most. The estimation results are available in Table 3. We find that both the CF (row (1)) and the ERDF (row (2)) have promoted business cycle synchronisation, although the same could not be said for the ESF (row (3)). To interpret our estimation results and understand why the ERDF and the CF are the only funds promoting business cycle synchronisation in the EU, we rely on the extensive empirical literature which has acknowledged these funds' role in promoting trade integration and, consequently, business cycle synchronicity (see Basile et al. 2008; Breuss et al. 2010; Grigoras and Stanciu 2016).

To illustrate this point, we could mention that about €59.1 billion from the ERDF and the CF was spent on transport infrastructure for the programming period 2014–2020. Moreover, about €86.9 billion was spent by the ERDF on technological development. Also, during the period 2015–17, the ERDF and the CF accounted for more than 50 percent of gross fixed capital formation by the general government in Portugal, Lithuania, Latvia, and the Slovak Republic (European Commission 2019). While comparing the CEE countries and other Western European countries, we must mention that according to the EU Council Regulations, only member states whose gross national income (GNI) per inhabitant is below 90% are eligible for payments under the CF.<sup>22</sup> For this reason, the CF recipients are mainly CEE countries.<sup>23</sup>

<sup>22</sup> See the EU Council Regulations 1264/1999, 1084/2006, and 1303/2013 for considered programming periods.

<sup>23</sup> The only exceptions are the following countries: Cyprus (2000–2020), Greece (2000–2020), Malta (2000–2020), Portugal, and Spain (2000–2006).

The ERDF and the CF are the only EU funds financing transport infrastructure and projects supporting technological development, and it should be mentioned that both these EU funds represent a large portion of public investment expenditures in the EMU countries belonging to the periphery. Although the previous research points out that the overall entrepreneurial performance in the CEE countries lags behind the Southern, Northern, and Western European countries (see, e.g., Szerb et al 2017), a strong entrepreneurial aspiration in this region may give a rationale for such support.

However, the ESF is usually targeted at disadvantaged groups of people that are not included in the labour market. For instance, for the period 2014–2017, projects with the theme ‘Employment, social inclusion, and education’, to which the ESF devotes a majority of its resources, covered 15.3 million people, of which 7.9 million were unemployed and 4.9 million inactive.<sup>24</sup> Hence, our results suggest that the ESF payments of a non-investment nature do not seem to boost synchronisation as the CF or the ERDF do with technological, more long-term-growth generating programmes.

## 5 Conclusions

The aim of this study was to investigate the potential role of EU payments in business cycle synchronisation, a topic rarely addressed in the previous empirical literature. Our sample covered a panel dataset of the EU-28 countries for the period 2000–2016. We considered several variants of the country pairs and of particular EU funds to confirm the robustness of our results.

Overall, our estimation results suggest the enhancing role of the EU funds on business cycle synchronisation. Our findings are qualitatively similar and robust to the use of different estimators (OLS, panel IV) and different business cycle filtering techniques (the Hodrick-Prescott filter, the Christiano-Fitzgerald filter). More detailed findings suggest that the EU funds promoted business synchronisation, especially in the EMU, which constitutes a positive externality of the European Cohesion Policy. Even if its main aim is to increase member states’ competitiveness and convergence, the goal of alleviating asymmetries of the members’ business cycles by means of the EU funds might present an additional motive to support lagging EU economies. Although each EU member state is obliged to join the EMU after meeting Maastricht criteria, some CEE candidate countries are not currently considering the adoption of the euro; our results, however, suggest that the degree of economic integration was greater for the CEE countries that have adopted the euro than for the other CEE countries; to increase their synchronization, it is, therefore, appropriate for the CEE countries outside the EMU to become part of the EMU.

In this vein, the convergence performance of the Baltic states has been among the strongest among CEE countries, and they exhibit, with the Czech Republic,

<sup>24</sup> See European Commission (2019) 816 final/2 of 01.04.2019.

the highest standard of living in this group of countries. As indicated by Diaz del Hoyo et al. (2017), at the beginning of the transition process, these countries had very limited economic links with Western Europe and were moderately open in economic terms. Integration with Europe via trade and FDI helped the Baltic countries by providing them with the necessary capital, know-how, and foreign technology, ensuring high potential growth.

Moreover, we find that both the ERDF and the CF have fostered business cycle synchronisation, which can be explained by the fact that both of these EU funds represent a large part of public investment expenditures in the EMU countries belonging to the periphery. This result confirms previous empirical evidence that the EU funds have increased financial and trade integration in the recipient countries. Following the European Council of July 17–21, 2020, the European recovery plan ‘Next Generation EU’ could, therefore, have a promoting effect on the EMU’s monetary policy if it is designed as an additional structural investment fund promoting financial and trade integration, as are both the CF and the ERDF.

With this paper, we enlarged the list of potential driving forces of business cycle synchronisation. Besides previously examined fiscal variables—fiscal convergence and fiscal discipline, which are encouraged by the Maastricht (nominal convergence) criteria and systematically associated with more synchronised business cycles (Darvas et al. 2005)—we find that another instrument, namely, fiscal transfers within the EMU seems to be effective in boosting synchronisation of the member states’ business cycles, and these transfers could possibly help the EMU to become an OCA. These findings, thus, call for strengthening the cooperation of the EMU countries in supranational fiscal transfers and common economic governance and might support the idea of creating a fiscal union within the EMU.

Following the inflation shock generated by the conflict between Russia and Ukraine, calibrating policy levers to get ahead of inflation without stifling the recovery will be key. Besides the Baltics, CEE economies outside the EMU have been the most exposed to inflation. Communicating monetary policy decisions clearly, leveraging credible monetary frameworks, and safeguarding central bank independence will be critical for these economies to manage the cycle to reinforce the anchor of low inflation expectations (Coibion et al. 2022), which constitutes an opportunity to prepare the integration to the EMU. With the substantial support of the ECP, such monetary adjustments could even generate additional business synchronisation through limited output losses.

Finally, this paper, which confirmed our initial assumptions, opens the door for future research on variables conditioning the relationship between EU funds and business cycle synchronisation (that is, possible direct and indirect effects).

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s10368-023-00566-9>.

**Acknowledgements** We would like to thank Phu Nguyen-Van, Thi Kim Cuong Pham, and Marianna Sinicakova; participants of the internal ERMEES seminar in Strasbourg; participants of the 3rd ERMEES Macroeconomic Workshop 2019 in Strasbourg; and conference participants at the Czech Economic Society and Slovak Economic Association Meeting in Brno for their helpful comments and suggestions on previous versions of this paper.

**Funding** Open access funding provided by The Ministry of Education, Science, Research and Sport of the Slovak Republic in cooperation with Centre for Scientific and Technical Information of the Slovak Republic. This work was supported by the Scientific Grant Agency VEGA under Grant No. 1/0394/21 and by the Technical University of Kosice under Grant No. 03/TUKE/2020.

**Data availability** The data that support the findings of this study are available from the corresponding author upon request.

**Code availability** Not applicable.

## Declarations

**Competing interests** The authors declare no competing interests.

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