



The Effect of Fiscal Policy Asymmetries on Business Cycle Correlation in the EU

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Abstract

This paper reviews the role of bilateral fiscal differences, fiscal indiscipline and their joint effects in particular in determining business cycle synchronicity in the European Union (EU). Panel data comprising 28 EU members from 1999–2019 are used in the analysis. The two-step Instrumental Variable–Generalized Method of Moments (IV–GMM) is employed to estimate the effects of examined fiscal measures on business cycle correlations. The study finds that fiscal indiscipline doubles the negative effect of increasing fiscal differences on business cycle correlation compared to fiscally disciplined country-pairs. The findings suggest reopening the debate on fiscal policy coordination across Europe.

Keywords: business cycle synchronicity; fiscal indiscipline; fiscal differences; fiscal policy.

JEL classification: E62; F44.

1. INTRODUCTION

The progress of fiscal and monetary policy harmonization has been remarkably different in the EU. While the European Central Bank conducts a common monetary policy for Euro member countries and acceding countries are expected to adjust their policies in line with the Maastricht convergence criteria, fiscal policy is still under the control of national authorities. Apart from the augmentation of the Stability and Growth Pact (SGP) by the Fiscal Compact rules introduced in the Treaty on Stability, Coordination, and Governance (2011), there has hardly been any progress in government spending and tax policy harmonization or coordination in Europe. Poor fiscal convergence in the EU is confirmed by several authors, suggesting that economic integration and monetary unification in Europe does not necessarily lead to fiscal convergence for member states (Kočenda *et al.*, 2008; Schalck, 2012; Bertarelli

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et al., 2014; Kouba *et al.*, 2016; Blanco *et al.*, 2020). Fiscal policy conduct remains significantly heterogeneous in the contemporary EU.

Regarding persistent fiscal policy heterogeneity in Europe, the question arises whether different fiscal policy conducts might be a source of economic disturbance that reduces business cycle synchronicity in the presence of strong symmetric shocks, as in the case of the global financial crisis in 2007 or the current COVID-19 pandemic situation. Baldi and Staehr (2016) describe divergent fiscal performance across EU countries before and after the outbreak of the global financial crisis between 2000 and 2014. Comparable to the dissimilar fiscal reactions by sovereign governments of EU countries in mitigating the macroeconomic damages of the global financial crisis, the COVID-19 pandemic has forced governments to dampen the negative effects of locked-down economies.

A vast amount of literature deals with business cycle correlation factors, especially since the development of the new optimum currency area (OCA) theory that focuses on an endogenous convergence hypothesis as noted by Wagner (2014). Fiscal policy similarity has become a standard control variable in business cycle literature, focusing on European integration processes since seminal work by Frankel and Rose (1998).

Despite several papers finding no relationship between fiscal policy similarity and business cycle correlation, mainstream business cycle literature concludes that similar fiscal policies matter in terms of business cycle convergence (Shin & Wang, 2003; Böwer & Guillemineau, 2006; Nguyen, 2007). As Beck (2019) summarizes, current theory suggests higher business cycle synchronization in the presence of symmetric shocks due to similar fiscal and monetary policy and lower synchronization when asymmetric shocks occur. In line with numerous authors, Beck (2019) established a relationship between fiscal policy similarity and business cycle synchronization (Rana, 2008; Crespo-Cuaresma *et al.*, 2011; Pentecôte *et al.*, 2012; Schleer & Sachs, 2013; Duval *et al.*, 2014; Ductor & Leiva-Leon, 2016). Kappler and Sachs (2013) suggest that business cycle synchronization is determined by the similarity of macroeconomic shocks, transmission channels, institutional factors, including fiscal policy, and the degree of economic integration between countries. Dissimilar fiscal policies can be a source of asymmetric shocks as their higher similarity positively affects business cycle synchronization.

One might still ask whether fiscal discipline plays similar role as fiscal similarity. In case countries are fiscally indisciplined but similar, does it also positively affect their business cycle synchronicity? The importance of fiscal discipline framed by strict numerical rules is stressed e.g. by Holm-Hadulla *et al.* (2012) or Kouba *et al.* (2016). To the best of our knowledge, the impact of fiscal indiscipline on business cycle synchronicity is not sufficiently examined in the literature compared to fiscal similarity, especially the effects of interaction between the extent of the bilateral fiscal similarity and fiscal indiscipline of countries in business cycle correlation. In other words, the novelty of our paper lies in the focus on the role of fiscal discipline and indiscipline of the pair of countries on the synchronicity of their business cycles. Whereas contemporary literature deals mainly with the fiscal similarity (or fiscal differences) measures, we employ fiscal indiscipline measure as another explanatory variable in the model. The measure is based on the size of the structural budget deficit as explained in the methodology section. In line with contemporary literature, we also employ modified measure of fiscal difference. In addition, we examine their joint effects on business cycle synchronicity, which is another original contribution of the paper. The business cycle synchronicity is approximated by the Artis–Okubo index which appear as alternative measures to correlation indices in the literature. All measures are described in details below.

The question of the relationship between the development of structural budget deficits of countries, the similarity of cyclical deficits, and business cycle synchronicity has become relevant when countries use fiscal policy to stifle the negative economic impact of the current COVID-19 pandemic in Europe. Despite the efforts of the European Commission to restructure the EU's budget and create funds to dampen the economic damage of the COVID-19 pandemic, such as the 750 billion EUR NextGeneration EU recovery budget, a superior coordinating mechanism is still missing, and autonomous national fiscal policies have become the main tool for national governments in the EU. The current situation offers a historical parallel to governments' mixed fiscal reactions to the global financial crisis hitting Europe in 2007/8 and its aftermath. Similarly, in the current situation, one might see a rather non-coordinated heterogeneous effort by national governments to use fiscal measures to stabilize their locked-down economies. Consequently, the asymmetric fiscal shocks in Europe can reduce business cycle synchronization in the forthcoming future.

In light of the historical parallels of shocking heterogeneous fiscal policy use from 2007/8 and 2020, this paper examines the impact of rising fiscal differences together with fiscal indiscipline on business cycle synchronicity among EU countries from 2000–2019. To estimate the effect of bilateral fiscal similarity, fiscal indiscipline, and their interactions on business cycle synchronicity, we used the IV–GMM estimator, which addresses possible endogeneity, heterogeneity, and autocorrelation issues. The bilateral differences between cyclically adjusted deficits of countries were used to proxy fiscal similarity and fiscal indiscipline. Hence, we follow the approach followed in contemporary studies dealing with the link between business cycle synchronicity and fiscal heterogeneity such as [Gächter and Riedl \(2014\)](#) and [Hildebrandt and Moder \(2015\)](#). Similarly, [Beck \(2019\)](#) uses a proxy for fiscal similarity of two countries as the absolute value of the differences in their budget balances (as shares of GDP). The Cerqueira–Martins cross-correlation index ([Cerqueira & Martins, 2009](#)) and its transformation introduced by [Artis and Okubo \(2011\)](#) measured business cycle similarity. The ability of the Pearson correlation index to be used in the panel regression analysis as a measure of business cycle synchronicity is limited since the need to use sufficiently long time series. The original cross correlation index proposed by [Cerqueira and Martins \(2009\)](#) is the reaction to the weakness of Pearson correlation coefficients. The index was then augmented and modified by [Artis and Okubo \(2011\)](#) with the use of Fisher's transformation. Introduction of those indices allowed to augment the number of observations of business cycle synchronicity measures and augment their ability to be used in various panel data models. The popularity of those indices slowly raised over the past decade in the literature. Similarly with [Christodoulopoulou \(2014\)](#); [Gächter and Riedl \(2014\)](#); [Hildebrandt and Moder \(2015\)](#); [Bierbaumer-Polly et al. \(2016\)](#); [Cheng et al. \(2020\)](#), we employ both before mentioned indices to approximate the development of business cycle synchronicity of analysed countries. Still, the traditional correlation measures remain standardly used in literature as well, as applied e.g. by [Schleer and Sachs \(2013\)](#); [Degiannakis et al. \(2016\)](#); [Agnello et al. \(2017\)](#); [Gianelle et al. \(2017\)](#).

In summary, the paper asks three questions. First, it examines the effect of changes in fiscal differentials on business cycle synchronicity across EU countries. The second question analyses the impact of countries' bilateral fiscal indiscipline on business cycle correlation, i.e., investigating whether pairwise fiscal indiscipline worsens business cycle correlation. Third, the research sheds some light on interactions between fiscal differentials and pairwise fiscal indiscipline in business cycle synchronicity development across EU countries. Accordingly, we ask whether fiscal indiscipline complemented by rising fiscal differential reinforces negative effects on business cycle synchronicity.

2. BUSINESS CYCLE SYNCHRONIZATION

To determine the effect of fiscal policy conduct and business cycle similarity in the EU, we examined bilateral measures between each pair of countries. For our analysis, we used data comprising all 28 EU members from 2000–2020 (including pre-accession periods of countries that became members during the examined period).

The dependent variable used in this research was a measure of business cycle correlation based on a Fisher-transformed Cerqueira–Martins cross-correlation of countries' growth value added (GVA) as proposed by (Artis & Okubo, 2011). The Cerqueira–Martins index (cm) takes the form:

$$cm_{ij,t} = 1 - \frac{1}{2} \left[\frac{d_{j,t} - \bar{d}_j}{\sqrt{\frac{1}{T} \sum_{t=1}^T (d_{j,t} - \bar{d}_j)^2}} - \frac{d_{i,t} - \bar{d}_i}{\sqrt{\frac{1}{T} \sum_{t=1}^T (d_{i,t} - \bar{d}_i)^2}} \right]^2; \quad (1)$$

where $cm_{ij,t}$ denotes the cross-correlation index of country i with country j in time t , $d_{j,t}$ and $d_{i,t}$ represent yearly GVA growth rates in time t , \bar{d}_i and \bar{d}_j are the average growth rates of country i and j in the time t (Cerqueira & Martins, 2009). The index is bound by ranges $(-\infty; 1)$, which results in asymmetric distribution, which is thoroughly discussed by Artis and Okubo (2011) and depicted on our data sample in Figure 1a). Due to an asymmetric range, the Cerqueira–Martins index is skewed and may result in biased estimation results. To deal with this issue, we used the Fisher-transformed Cerqueira–Martins index introduced by Artis and Okubo (2011), hereafter Artis–Okubo index (ao), which binds the resulting similarity measure $cm_{ij,t}$ by symmetric range $(-\infty; \infty)$.

$$ao_{ij,t} = \frac{1}{2} \log \left(\frac{1}{1 - cm_{ij,t}} \right); \quad (2)$$

As depicted in Figure 1b), the transformed correlation coefficient is very close to being normally distributed.

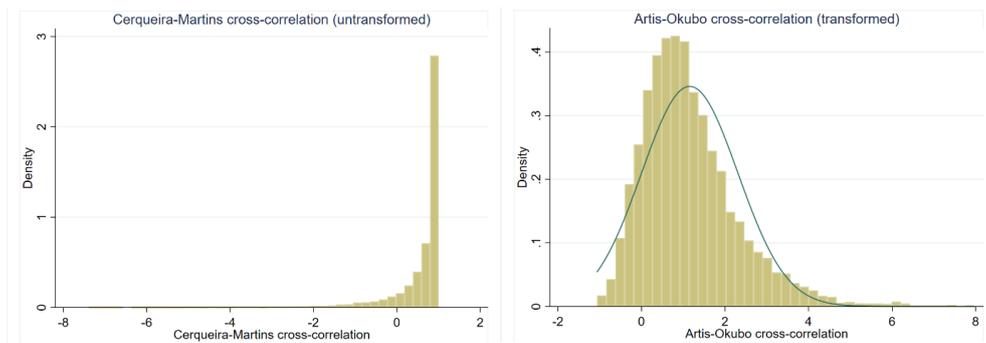


Figure no. 1 – Kernel density estimates of the Cerqueira–Martins index (a) and Artis–Okubo index (b) showing differences in distribution

Skewness of the transformed index is much lower and the distribution more symmetric, making it more suitable for the following analyses.

3. EXPLANATORY VARIABLES

Focusing on the effects of undisciplined and different fiscal policies on business cycle correlation, the following independent variables were included in the model: fiscal indiscipline and difference measures, where interactions between fiscal measures capturing the effect of fiscal indiscipline on business cycle synchronicity represent fiscal policy features; a spatial dummy for ERM II membership to address in/dependent monetary policy effects; trade intensity, intra-industry trade, and an economic structure index handling economic integration and economic structure similarity; time-specific effects to identify a possible influence of symmetric shocks.

Fiscal policy is a factor that can smooth the business cycle, but it may also produce idiosyncratic shocks that desynchronize the business cycle across countries. Darvas *et al.* (2005) stated, “irresponsible fiscal policy (a persistently high deficit) coincides with idiosyncratic (fiscal) instability, and, thus, as fiscal policies converge, fiscal shocks are also reduced.” These findings were later suggested by Perotti (2012). Accordingly, the studies theoretically tackle the problem of the effects of fiscal indiscipline, fiscal difference, and their interaction upon business cycle correlations.

We used the difference in fiscal policy settings to measure bilateral fiscal policy difference; however, it is necessary to mention that not only fiscal interventions affect the business cycle but budget balance is also dependent on it. Therefore, we addressed the problem of the endogeneity of fiscal variables that could emerge from reverse or simultaneous causality. Accordingly, fiscal difference measure $fisc_diff_{ij,t}$ was calculated as the difference of cyclically adjusted budget balances ($cycl_def$) between each country-pair i and j . The construction of the variable is similar to Gächter and Riedl (2014) or Hildebrandt and Moder (2015). Value may be 0 if the pair of countries have identical deficit in time t . The higher the measure is, the larger is the difference between the countries in a pair. Data were retrieved from the AMECO database.

$$fisc_diff_{ij,t} = |cycl_def_{i,t} - cycl_def_{j,t}| \quad (3)$$

Following previous studies (Darvas *et al.*, 2005; Gächter & Riedl, 2014; Hildebrandt & Moder, 2015), we expected a negative effect of fiscal difference on business cycle synchronization.

We continued with the idea that irresponsible fiscal policy also creates idiosyncratic fiscal shocks and, thus, macroeconomic volatility. This may become highly relevant in the current global pandemic crisis as individual countries provide large numbers of subsidies regardless of the rules of fiscal discipline. Our further investigation into the consequences of violating fiscal rules used a fiscal indiscipline dummy. For our interpretation, we used the general measure set by the Treaty on Stability, Coordination, and Governance criterion, which set the benchmark between fiscal discipline and indiscipline to 0.5 % of the structural deficit as a percentage of gross domestic product. We use this value as a reference point even though the time period in our dataset includes years before the rules in the treaty were set. This is because we are focused on the general economic phenomena of business cycle synchronicity. The political reaction on the newly established boundaries is beyond the scope of our research. Data were obtained from the AMECO database. In our bilateral setting, a dummy variable indicating fiscal indiscipline $fisc_indisc_{ij,t}$ had a value of 1 in case at least one of the countries i and j in time t had a

cyclically adjusted deficit greater than 0.5 %; otherwise, the value was 0. This country-pair view helped us examine how the business cycle synchronicity was affected if at least one in a country pair was fiscally undisciplined. Thus, we distinguish absolute fiscal discipline of the country pair and any level of fiscal indiscipline (one- and both- country fiscal indiscipline in the pair) as we expect that it is not economically and politically sufficient that only some countries were fiscally disciplined to improve business cycle synchronicity. We were thus interested if the both-sided structural deficit excesses or minimally equals to 0.5 % might affect business cycle synchronicity. We examined the hypothesis of whether fiscally disciplined country pairs had more synchronized business cycles.

We further used an interaction term $fisc_indisc_{ij,t} * fisc_diff_{ij,t}$ that described the interaction of fiscal indiscipline and difference, i.e., the marginal effect of the change in fiscal difference if the country-pair was undisciplined. Thus, we were interested in the difference in business cycle similarity caused by increasing fiscal differentials between fiscally disciplined and undisciplined country-pairs. We expected that fiscal indiscipline worsens business cycle synchronization compared to fiscally disciplined country-pairs.

To control for the (in)ability of the exchange rates to adjust to changing economic conditions, we used the corresponding dummy. Although the main symbol of monetary integration is the existence of a common currency, all of the acceding countries to the Economic and Monetary Union (EMU) first participated in the European ERM, thus, their monetary policy cannot be regarded as independent from the moment of ERM accession. We expected the change from floating to a fixed exchange rate regime had a higher impact on international transactions than the final adoption of the Euro when the exchange rate was already fixed, which is in line with Flood and Rose (2010). Thus, unlike Belke *et al.* (2017), but similar to Agnello *et al.* (2017), we controlled for ERM II membership. The ERM dummy had a value of 1 only if both countries were within the ERM II regime or had adopted the Euro for at least half the year; otherwise, the ERM dummy was 0. Regarding the positive influence of monetary integration on business cycle correlation described in the OCA endogeneity hypothesis literature, we expected a positive sign suggesting that countries out of the ERM II area had less correlated cycles. ERM is expected to be endogenous because common or dependent monetary policy affects business cycle synchronicity. Moreover, countries with higher business cycle synchronization tend to use fixed regimes or join a currency union (Frankel & Rose, 1998; Rose & Engel, 2000; Flood & Rose, 2010).

Finally, we included explanatory variables explaining the level of economic integration. The traditional explanatory variable of business cycle synchronicity is trade intensity within country-pairs:

$$TI_{ij,t} = \frac{IM_{ij,t} + EX_{ij,t}}{IM_{i,t} + EX_{i,t}} \quad (4)$$

where $TI_{ij,t}$ denotes the trade intensity index of countries i and j in time t , $IM_{ij,t}$ is import from country j to country i , and $EX_{ij,t}$ is export from country i to country j . At the same time, $IM_{i,t}$ is the total import to country i , and $EX_{i,t}$ is the total export from country i . Trade intensity is 0 in case of no trade between the examined countries, value 1 is achieved if both countries in a pair trade exclusively with each other. In line with Frankel and Rose (1998); Inklaar *et al.* (2008); Pentecôte *et al.* (2015), we expected a positive effect of trade intensity

on business cycle similarity as trade intensity boosts economic output in both economies and deepens their level of economic integration, thereby, affecting business cycle synchronization. Intra-industry trade is also expected as a driver of business cycle similarity as suggested by [Fidrmuc \(2004\)](#). This was estimated using the Grubel–Lloyd index (GLI), which measures the share of intra-industry trade within the overall trade volume between countries i and j . The values range between 0 and 100 while the increasing value of the GLI indicates a higher bilateral trade intensity and deeper integration. The index takes the form:

$$GLI_{ij,t} = \left(1 - \frac{\sum_k |X_{k,ij,t} - M_{k,ij,t}|}{\sum_k |X_{k,ij,t} + M_{k,ij,t}|} \right) * 100 \quad (5)$$

where $X_{k,ij,t}$ and $M_{k,ij,t}$ denote the export and import of commodity k (SITC classification) between country i and j .

Industrial specialization increases vulnerability to asymmetric shocks; it also leads to similar economic structures and, therefore, a similar business cycle due to factor endowments ([Frankel & Rose, 1998](#)).

$$ESI_{ij,t} = \sum_{k=1}^n \left| \frac{GVA_{i,k,t}}{GVA_{i,t}} - \frac{GVA_{j,k,t}}{GVA_{j,t}} \right| \quad (6)$$

where $ESI_{ij,t}$ denotes the economic structure index of countries i and j in time t , $GVA_{i,k,t}$ and $GVA_{j,k,t}$ are the GVA of countries i or j in the NACE k , and $GVA_{i,t}$ and $GVA_{j,t}$ are the total values added of countries i and j . Economic structure index values range from 0 to 1, the higher the value is, the less similar is the economic structure between the pair of countries.

Descriptive statistics of the measures defined above are reported in [Table no. 1](#). The dependent variable, Artis-Okubo cross-correlation index ranges between values -1.063, negative correlation, up to 7.971, strong positive correlation. In general, most of the values are positive meaning that the correlation measured by Artis-Okubo index tends to be mostly positive in the examined period.

The independent variable of main interest is fiscal difference. The lowest observed value is 0.001 meaning virtually identical government deficits. On the other hand, the largest difference observed in the dataset is 33.999, which means that in one country (Ireland, the worst performing country in 2010) reported a structural deficit higher by 33.999 percentage point than the other country in the pair – Estonia – which was the best performing country in this year. The average difference between the pair of countries was 3.098 percentage points.

Table no. 1 – Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
Artis-Okubo index	1.154	1.153	-1.063	7.971	1.268	5.773
Trade intensity	0.025	0.045	0.00001	0.405	3.432	18.031
Economic structure index	0.488	0.117	0.153	0.914	0.207	3.434
GLI	39.258	18.122	0.105	99.446	0.068	2.174
Fiscal difference	3.098	2.807	0.001	33.999	7.879	2.808
Fiscal indiscipline	0.554	0.497	0	1	-0.217	1.047
ERM	0.427	0.494	0	1	0.305	1.093

4. EMPIRICAL MODEL

To estimate the effects on business cycle synchronization, we employed a dynamic panel data model examining the link between fiscal policy conduct and business cycle correlation. The equation takes the following form:

$$ao_{ij,t} = \alpha + \beta ao_{ij,t-1} + Z'_{ij,t}\gamma + \mu_{ij,t} + \lambda_t + v_{ij,t} \quad (7)$$

where $ao_{ij,t}$ and $ao_{ij,t-1}$ denote the Artis–Okubo correlation measure of business cycle synchronicity between country i and j in time t and its one lag, respectively. $Z_{ij,t}$ is a matrix of the independent variables defined above and the interaction term; $\mu_{ij,t}$ are country-pair specific effects capturing the unobservable heterogeneity among individual country-pairs; λ_t are the time-fixed effects to account for the influence of general economic development (such as the post-2007 financial crisis or the general recovery afterward) and might act as a kind of symmetric shock. Such a shock is expected to be symmetric in terms of putting the economies in the same business cycle phase of recession and stagnation despite having a dissimilar intensity. Finally, $v_{ij,t}$ is the error term.

We focused on the signs and magnitudes of vectors that represent the determinants of European business cycle synchronization, with a special interest in fiscal variables and their interaction.

To estimate the model in Equation (7), we applied the two-step IV–GMM estimator, which can deal with both heteroskedastic and autocorrelated errors and with endogeneity arising from possible simultaneous causality issues. Regarding the error structure tested by the Arellano and Bond (1991) and Pagan and Hall (1983) tests, we used autocorrelation and heteroskedasticity-robust standard errors. Hayashi (2000) found that with this error structure, the IV–GMM estimator generates efficient estimates of both the coefficients and standard errors.

Using the IV-GMM estimator we addressed endogeneity of variables by using their own lags. Lagged endogenous variables were, thus, used as instruments. Moreover, following Calderon *et al.* (2007) and Frankel and Rose (1998) we used a set of out-of-sample instruments, namely, a natural logarithm of country-pair population (Eurostat database), a natural logarithm of the distance between country-pair capital cities (Gleditsch, 2018), kilometers of common border, and a dummy for a common border (CIA, 2021) to instrument endogenous variables. A complete list of endogenous variables and instruments is reported below Table no. 2.

5. RESULTS

The results of the estimation proposed above are reported in Table no. 2. The table shows six columns, each representing one model specification starting with the simplest up to the most complex. The first column represents the original business cycle synchronization specification extended with a fiscal differential in the second column. In the third column, the fiscal indiscipline variable was added, and in the fourth column, the previous model was extended with the interaction between fiscal differential and fiscal indiscipline.

Table no. 2 – Results of the regression estimates

Specification nr.	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Artis-Okubo index	Artis-Okubo index	Artis-Okubo index	Artis-Okubo index	3y rolling corr. HP	3y rolling corr. CF
Lagged dependent variable	0.0762*** (0.00779)	0.0756*** (0.00780)	0.0745*** (0.00776)	0.0746*** (0.00776)	0.0829*** (0.00919)	0.138*** (0.0100)
Trade intensity	0.153 (0.223)	0.149 (0.224)	0.117 (0.224)	0.0849 (0.224)	0.00913 (0.112)	-0.0357 (0.127)
Economic structure index	-0.738*** (0.0977)	-0.748*** (0.0986)	-0.827*** (0.0998)	-0.840*** (0.0998)	-0.197*** (0.0505)	-0.294*** (0.0604)
GLI	0.00181*** (0.000643)	0.00181*** (0.000645)	0.00180*** (0.000645)	0.00178*** (0.000645)	0.00245*** (0.000326)	0.00400*** (0.000382)
ERM dummy	0.121*** (0.0197)	0.120*** (0.0197)	0.119*** (0.0196)	0.119*** (0.0196)	0.0324*** (0.00971)	0.0484*** (0.0111)
Fiscal difference		0.00142 (0.00351)	-0.00590* (0.00352)	-0.0164*** (0.00469)	-0.00750*** (0.00274)	0.000981 (0.00348)
Fiscal indiscipline			-0.130*** (0.0204)	-0.194*** (0.0288)	-0.0270* (0.0155)	-0.0362* (0.0188)
Interaction term				-0.0196*** (0.00648)	-0.0175*** (0.00379)	-0.0203*** (0.00516)
Constant	1.794*** (0.0835)	1.797*** (0.0836)	1.927*** (0.0864)	1.981*** (0.0877)	0.205*** (0.0410)	0.595*** (0.0436)
N	7482	7469	7469	7469	6796	6796
time-FE $\chi^2(19)$	625.566***	615.761***	591.302***	516.111***	2477.64***	2870.75***
$\frac{\partial fisc\ discipline}{\partial time}$ if fiscal indiscipline = 1					-0.025***	-0.0153***
(marginal effect conditional to						
discipline of a country-pair)						
Endogeneity C test of suspect	23.485 (0.000)	12.896 (0.0049)	24.961 (0.000)	34.33 (0.000)	8.158 (0.0169)	8.197 (0.0166)
endogenous regressors (p-value)	0.0457 (0.831)	0.407 (0.523)	10.47 (0.00534)	0.599 (0.439)	6.358 (0.498)	13.859 (0.537)
Hansen's J statistic (p-value)	82.96 (0.000)	212.41 (0.000)	35.20 (0.000)	86.81 (0.000)	534.968 (0.000)	523.424 (0.000)
Underidentification tests: Kleibergen-Paap rk LM statistic (p-value)	103.91 (0.000)	235.77 (0.000)	35.86 (0.000)	85.94 (0.000)	305.85.89 (0.000)	29514.88 (0.000)
Underidentification tests: Kleibergen-Paap rk Wald statistic (p-value)	11.296 (9.53)	15.75 (11.04)	15.858 (9.53)	15.418 (9.53)	2999.702 (16.80)	2894.663 (16.80)
Weak identification test: Kleibergen-Paap Wald rk F statistic (Stock-Yogo IV 5% critical values)						

Note: Method used: two-step IV-GMM estimation; endogenous regressors: trade intensity, intra-industry trade intensity (GLI), economic structure index, ERM dummy; out-of-sample instruments: population, distance between capitals, kilometers of common border, border dummy, and lagged endogenous variables. HAC-robust tests and SEs: SE of the interaction term is computed according to Brambor *et al.* (2006). Standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01.

To check for robustness of our estimates, we conducted an altered version of the proposed model specification with a different measure of business cycle synchronicity. We used the traditional Pearson correlation coefficient to measure the synchronization of business cycle development. For this purpose, we used seasonally adjusted quarterly data and extracted the cyclical component of GVA using Hodrick–Prescott (HP) and Christiano–Fitzgerald (CF) filters (Frankel & Rose, 1998; Darvas *et al.*, 2005; Kunroo, 2019; Bunyan *et al.*, 2020). The final correlation coefficient was based on three-year forward-rolling windows. As shown in Table no. 2, the results are stable throughout all of the columns. Although the Artis–Okubo index spans from $(-\infty; \infty)$ and the Pearson correlation is only defined in $(-1; 1)$, the magnitude of the coefficients may differ; however, the signs and statistical significances remain. As can be seen below Table no. 2, while the endogeneity C test confirms the endogeneity of suspect endogenous regressors, the Hansen’s J statistic and the Kleibergen–Paap rk statistic show that all chosen instruments are valid and relevant.

Next, we interpreted the resulting values and signs of the coefficients of determinants in business cycle synchronicity. The results of baseline regression (column 1) are in line with other empirical findings (Gächter & Riedl, 2014; Hildebrandt & Moder, 2015). First, we focused on path dependence in business cycle co-movements, followed by economic integration and structure, and the impact of monetary and fiscal policies. Similar to Bunyan *et al.* (2020) and Gächter and Riedl (2014), it can be observed that in all model specifications, current business cycle synchronicity positively depends on its last period. This is a logical path-dependent movement as the economic output not only addresses the current situation but also previous development. The coefficient was robust and significant in all columns.

The effect of trade intensity was positive but insignificant. This traditional index varies among studies; for example, Hildebrandt and Moder (2015) proved trade intensity to be a significant regressor of business cycles in some model specifications, and Fidrmuc (2004) found that trade intensity did not significantly affect the similarity of GDP co-movements. We demonstrated that the second international integration variable, intra-industry trade, was positive and significant. Thus, the greater the intra-industry integration, the more dependent the economic output, and the greater the business cycle synchronicity (Gianelle *et al.*, 2017).

When studying the impact of similarities of economic structure, we used an economic structure index, which is a potential factor influencing business cycle synchronicity. As expected, dissimilar economic structures negatively affect business cycle synchronization as less similar structures are more vulnerable to asymmetrical economic shocks and fluctuations that desynchronize common cyclical movements of economies (Gächter & Riedl, 2014; Gianelle *et al.*, 2017; Kunroo, 2019).

The fourth and final variable employed in the baseline model was the ERM dummy. The hypothesis tested in our model was that entering the common exchange rate system positively affects the economic similarity of country-pairs. We confirmed this relationship with a positive and significant coefficient, which is in line with OCA literature, such as Agnello *et al.* (2017) or Flood and Rose (2010).

The focus of studies examining the impact of fiscal policy on business cycle synchronization is a relevant issue (Crespo-Cuaresma *et al.*, 2011; Degiannakis *et al.*, 2016; Agnello *et al.*, 2017). In this study, we distinguished between fiscal differential and fiscal in/discipline as the former affects business cycle co-movements through fiscal activities that can smooth the business cycle; the latter is assumed to influence business cycles as it may produce idiosyncratic shocks that affect business cycle synchronicity. Model specifications

2–4 examined the impact of adding fiscal variables into the baseline model. As seen in [Table no. 2](#), the addition of new variables did not affect the signs or significance of the baseline variables, and coefficients varied only slightly. First, only fiscal difference was tested in model 2, and the variable did not produce a statistically significant result. The expected negative sign appeared in model 3 when the fiscal indiscipline dummy was added and both fiscal variants were significant and negative. We showed that if the country-pair was less fiscally similar (in terms of cyclically adjusted budget deficit), their business cycles were less synchronized. This was an expected result that was also demonstrated in previous literature ([Inklaar et al., 2008](#); [Crespo-Cuaresma et al., 2011](#); [Degiannakis et al., 2016](#)).

The fiscal indiscipline dummy represents the second point of view on budgetary discipline. The dummy had the value of 1 when at least one country in the country-pair had higher cyclically adjusted deficits than 0.5 %, otherwise, it was 0. As seen in [Table no. 2](#), fiscal indiscipline itself significantly reduces business cycle synchronization. Specifically, if a country-pair is undisciplined, the Artis–Okubo index is reduced by 0.130 (column 3). Moreover, fiscal indiscipline doubles the effect of increasing fiscal differential compared to disciplined country-pairs. A one-unit increase in fiscal difference will produce a 0.036 (0.025 and 0.015) decrease in business cycle synchronicity (columns 4, 5, and 6, respectively) if the country pair is undisciplined. This information was obtained from model specifications with the interaction term $fisc_indisc_{ij,t} * fisc_dissim_{ij,t}$, which presents the marginal effect of fiscal difference when at least one country in the country-pair does not respect the 0.5% rule.

Intending to compare the magnitude of individual non-commeasurable effects on business cycle synchronicity, we first calculated the standardized coefficients. From a size perspective, the most important was the economic structure variable with a value of -0.087, and fiscal indiscipline, yielding a value of -0.084. These were followed by a lagged dependent variable with a value of 0.075. Fiscal difference was half the size (-0.040) of fiscal indiscipline and doubled (-0.079) if country-pairs were undisciplined. Here, we validated the importance of inserting fiscal in/discipline into the set of business cycle synchronicity factors even from an empirical perspective. Finally, in terms of the magnitude of the effect on business cycle similarity, monetary policy impact was 0.051, and intra-trade industry was 0.028.

Discussing the magnitudes of the effects in more detail, it is opportune to compare the impact of fiscal variables as this is the main focus of the paper. The standardized coefficient of fiscal indiscipline was valued at -0.084. This means that an increase in one standard deviation of fiscal indiscipline reduces business cycle synchronization by 0.084. As fiscal indiscipline never increases by one standard deviation (i.e., 0.497), we evaluated the effect of an increase in fiscal indiscipline by two standard deviations, corresponding to the change from 0 to 1 of the dummy variables. The change from disciplined country-pairs to at least one-sided undisciplined country-pairs, which is an increase of two standard deviations of fiscal indiscipline, reduces business cycle synchronicity by 0.168. Then, we evaluated the effect of an increase in fiscal difference by two standard deviations, which corresponds to the change of fiscal indiscipline from 0 to 1. The effect was a desynchronization of business cycles by 0.08. We followed up with the impact of fiscal difference when country-pairs became at least unilaterally undisciplined; an increase of two standard deviations of fiscal difference yielded almost a double impact, i.e., the reduction of business cycle synchronicity by 0.158. In terms of magnitude, fiscal effects are among the greatest influence on business cycle synchronization. Fiscal difference, especially, is shown to be an important determinant of business cycle synchronicity, and the impact is greater in terms of the magnitude of the effect.

6. CONCLUSIONS

Similar to the situation in 2008 when Europe dealt with the impact of the global financial crisis, the current efforts of European countries to dampen the negative socio-economic effects of the pandemic are based on large fiscal policy stimuli. Nowadays, governments use fiscal expansions in an uncoordinated way as a reaction to the economic downturn caused by the COVID-19 pandemic in Europe and worldwide. Such multilateral fiscal divergence has long-term impacts on countries' budget deficits as well as business cycle synchronicity across EU countries. [Degiannakis *et al.* \(2016\)](#) focused on Eurozone countries when covering the global financial crisis from 2007–2009 and its aftermath and concluded that fiscal policy was an important determinant of business cycle synchronization for member countries. They also found different magnitudes of the effects of fiscal policy across countries. Almost a decade of macroeconomic stagnation in the Eurozone and the whole of the EU launched a debate about the adequacy of fiscal policy expansion in a Keynesian way during the global economic crisis period and its aftermath. Regarding the similar patterns of fiscal policy usage during the COVID-19 pandemic, one might ask whether the current country-specific use of fiscal policy might contribute to the scenario, which is similar to the post crisis one from 2008 and afterwards in Europe.

In this paper, the question of the role of fiscal difference in determining business cycle synchronicity has been revisited. The paper also examined the effect of fiscal indiscipline as well as the interactions of both fiscal factors. In other words, the joint effects of bilateral fiscal difference and indiscipline upon the bilateral business cycle similarity is examined in the study. The study also contributes with testing the business cycle synchronicity factors including the similarity of economic structures, intra-industry trade intensity, and monetary policy autonomy proxied with the dummy of the ERM II country's participation.

The evidence provided by this paper suggests that bilateral fiscal policy difference and fiscal indiscipline are important factors in reducing bilateral business cycle synchronicity. The less fiscally similar in terms of increasing cyclically adjusted deficits the country-pair is, the less synchronous the countries' business cycles are. The fiscal indiscipline of at least one of the countries within the examined pair reduces bilateral business cycle synchronicity significantly. The interactions of both fiscal factors even strengthen the negative effect on business cycle synchronicity. In particular, fiscal indiscipline doubles the negative effect of increasing fiscal differentials on business cycle similarity compared to fiscally disciplined country-pairs. Furthermore, the magnitude of the effect of fiscal indiscipline together with economic dissimilarity reaches the highest values among all of the explanatory variables. This finding reinforces the need to maintain fiscal discipline across EU member countries, although this is still unenforceable in the EU despite the Growth and Stability Pact or Fiscal Compact directives.

Regarding other business cycle similarity factors, intra-industry trade intensity and the similarity of economic structures were found to have significant effects on business cycle correlation in the study. Similar to [Fidrmuc \(2004\)](#) and [Inklaar *et al.* \(2008\)](#), the study found positive links between the level of intra-industry integration and business cycle co-movement. Regarding the effects of production specialization as proposed by [Krugman \(1993\)](#), the analysis provides evidence that if countries' industrial structures are dissimilar, it negatively affects their bilateral business cycle similarity. The common monetary framework represented by the dummy variable of ERM II membership, which fixes the member countries' exchange

rates and reduces the currency risk, also positively affects the bilateral business cycle synchronicity of the country-pairs.

To conclude, the main findings of the paper suggest that fiscal policy is a factor of business cycle synchronicity in the EU, and divergent fiscal policies of countries reduce business cycle correlation. The negative effect of such fiscal heterogeneity is significantly enforced by the fiscal indiscipline of at least one of the country in a pair. Accordingly, two main policy implications can be drawn based on the results. Firstly, in line with literature the findings confirm the need for functioning coordination scheme in case of macroeconomic disturbances such as significant economic downswings, which are followed by uncoordinated fiscal reactions in individual EU states. That is especially harmful for the Eurozone members since divergent fiscal policies reduce business cycle correlations and thus make difficult to conduct effective common monetary policy. Secondly, the paper contributes by finding that the fiscal indiscipline enforces the negative effect of fiscal differentials on business cycle synchronicity. Hence fiscal discipline should become one of the macroeconomic priorities of common macroeconomic stabilization initiatives even in times of long-term economic stagnation in the EU. This paper provides some evidence to support the arguments for revisiting the efforts to open the debate on fiscal policy coordination in the EU. Crisis episodes, such as the global economic crisis in 2008 and its aftermath and the excessive fiscal spending policy of most EU countries related to the mitigation of the negative effects of locked-down economies due to the COVID-19 pandemic, have led to uncoordinated fiscal reactions by states. Such fierce reactions can have long-term negative effects on fiscal deficits as well as business cycle correlation, consecutively. Accordingly, common macroeconomic strategies to find a new growth path and consolidate public finances after this pandemic episode might then be prolonged.

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To cite this article: Issever Grochová, L., Rozmahel, P., Litzman, M. (2022). The Effect of Fiscal Policy Asymmetries on Business Cycle Correlation in the EU. *Scientific Annals of Economics and Business*, 69(3), 361-376. <https://doi.org/10.47743/saeb-2022-0022>

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