THRESHOLD EFFECTS IN INTERACTIONS BETWEEN GOVERNMENT BUDGET IMBALANCES, CURRENT ACCOUNT IMBALANCES AND BUSINESS CYCLE SYNCHRONIZATION

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Abstract: *The paper focuses on interactions between fiscal dynamics and current account imbalances, and their impact on business cycle synchronization in the euro area over the years 2001-2017. To join these two effects, we used panel data threshold model, which determined three intervals of current account differences and estimated separate relation between fiscal disparities and output gap disparities in each interval. If current account differences are small (1ˢᵗ interval), the threshold model concluded for strong positive effect of smaller budget balance differences on business cycle synchronization. Nevertheless, higher current account differences (2ⁿᵈ and 3ʳᵈ interval) are accompanied by not significant or negative effect of budget balance differences on output gap differences, i.e. there is no effect of fiscal convergence on business cycle synchronization. As far as policy implications, if economic policies try to achieve tighter business cycles by a fiscal convergence, they need to take into account possible tools how to decrease current account imbalances as well.*

Keywords: *Current Account, Budget Balance, Fiscal Convergence, Business Cycle Synchronization, Euro Area, Threshold Model.*

JEL Classification: *E32, F32, F41, F44, H62.*

Introduction

Current account imbalances and the presence of current account duality between Northern and Southern European countries became a discussed topic in recent years (Schmitz and Von Hagen, 2011; Belke and Dreger, 2013) and many authors search for causes and consequences of current account imbalances (see e.g. Unger, 2017; Kang and Shambaugh, 2016). Our paper focuses on consequences of current account imbalances on business cycle synchronization and its relation with fiscal convergence. The ambition of the paper is to join together two effects. Firstly, many studies concluded that fiscal convergence leads to higher business cycle synchronization (see e.g. Darvas, 2005; Furceri, 2009; Degiannakis et al., 2016). Secondly, the others, e.g. Lukmanova and Tondl (2017) concluded for negative impact of current account imbalances on business cycle synchronization. Our paper contributes to the existing empirical research by answering the question whether a fiscal convergence always leads to tighter business cycles and how current account imbalances affect this relation. The ambition of the paper is to determine intervals of current account differences when even a fiscal convergence cannot lead to tighter business cycles because of large current account imbalances. Thereafter, the paper is a starting point for further more profound research of interactions between fiscal imbalances, current account imbalances and business cycle synchronization.

1 Statement of a problem

Europe is characterized by a "duality" in current account dynamics (Uxó et al., 2011; Simonazzi et al., 2013). Northern European countries have large and persistent current account surpluses, while Southern European countries are typically those with deficits in their current accounts. Even if southern European countries adjusted their current account deficits in post-crisis period due to decline in their domestic demand (IMF, 2014), the presence and dynamics of current account imbalances still matter during European debt crisis (Hallett and Oliva, 2015; Afonso et al., 2019).

Besides current account imbalances, presented as a "duality" or a "divergence" in Europe, empirical studies focus on fiscal convergence (Kočenda et al., 2008; Censolo and Colombo, 2016) and business cycle synchronization (Crespo-Cuaresma and Fernández-Amador, 2013; Štiblárová and Siničáková, 2017; Campos et al., 2019). Many studies tested determinants of business cycle synchronization in Europe. Besides positive effects of trade and FDI on tighter business cycles, the effect of fiscal discipline has been proved (see e.g. Antonakakis and Tondl, 2014). Degiannakis et al. (2016) proved notable effect of fiscal policy on smoother business cycles in 10 EMU countries. Thereafter, Darvas et al. (2005) concluded for positive effect of fiscal convergence (i.e. smaller inter-country differences in budget balances) on business cycle synchronization in 21 OECD countries over 40 years. Furceri (2009) measured a fiscal convergence by budget surplus / deficit to GDP ratio and also concluded that a fiscal convergence is positively related to tighter business cycles in OECD countries.

Recent empirical studies conclude rather for business cycle de-synchronization in Europe in post-crisis period (see e.g. Grigoraş and Stanciu, 2016). Lukmanova and Tondl (2017) argue that disparities in current account balances have decoupling effect on business cycles. Exporter countries can profit from additional economic growth drawn by export demand, while economic growth of importer countries suffers from smaller global demand caused by higher imports; which leads to smaller business cycle synchronization between these countries (see Lukmanova and Tondl, 2017).

These studies lead us to join two effects on business cycle synchronization in one model: I) higher fiscal convergence leads to higher business cycle synchronization (see e.g. Furceri, 2009) or a poor fiscal discipline is an important barrier of business cycle synchronization (see e.g. Antonakakis and Tondl, 2014); II) higher current account differences have negative impact on business cycle synchronization (see Lukmanova and Tondl, 2017). In our approach, we join together these two effects via a threshold model, which enables to estimate the relation between two variables, at which the relation depends on values of the third variable – a threshold variable (see Hansen, 1999). Our threshold model estimates the relation between fiscal differences (budget balance differences) and differences in business cycles (output gap differences), whereas this relation will depend on values of differences in current account balances. The idea is following. A fiscal convergence can lead to business cycle synchronization only if differences in current accounts of the euro area countries are smaller than a certain threshold. On the other hand, if differences between current account balances are too high, even a fiscal convergence does not have a positive effect on business cycle synchronization. Therefore, even if a fiscal convergence (i.e. smaller budget balance differences) can lead to tighter economic cycles, high differences in current accounts contribute to weaker business cycle synchronization.

2 Methods

2.1 Data

Our panel data set covers the euro area countries [1] over the time period 2001 - 2017. Our aim is to estimate the relation between fiscal convergence, differences in current account balances and business cycle synchronization. More precisely, we search for relation between fiscal differences and business cycles synchronization and we suppose that this relation will vary according to different intervals of current account differences. Business cycle synchronization is a dependent variable and is measured as differences in output gaps (in % of potential GDP) vis-à-vis the euro area average. Fiscal convergence is an independent variable and is expressed as a budget balance difference, i.e. government net lending / borrowing (in % of GDP). Current account differences (in % of GDP) are set as a threshold variable. Further, inspired mainly by research by Lukmanova and Tondl (2017), we add other control "regime-independent" variables explaining business cycle synchronization: countries' differences between current accounts (% of GDP), GDP growth rates (%, constant prices), inflation rates (%) and government gross debts (% of GDP); and a trade openness (% of GDP). It is evident that a real convergence, i.e. a decrease in differences between GDP growth rates (sigma convergence) leads to more similar business cycles in future. Further, smaller differences between prices (a decrease in countries' differences between inflation rates, i.e. nominal convergence) are connected with real convergence and lead to higher business cycles synchronization. A linkage between nominal and real convergence has been shown by Lein-Rupprecht et al. (2007). Thereafter, we suppose that an increase in countries' differences between current accounts and public debts lead to less synchronized business cycles (Lukmanova and Tondl, 2017). As far as current account differences, exporter countries can profit from higher output from export demand in comparison with importer countries, leading to less synchronized cycles. Different debt levels permit different fiscal policies in times of recession with different consequences on output, which lead to less synchronized cycles (Lukmanova and Tondl, 2017). Finally, as a trade intensity affects synchronization (Inklaar et al., 2008) we include a trade openness and we expect that higher trade openness leads to more synchronized business cycles. Data are retrieved from IMF database (WEO, October 2018). Data for a trade openness are based on Eurostat database.

2.2 Threshold model

To test interactions between fiscal dynamics, current account dynamics and business cycle synchronization, we estimate a panel data threshold model (for threshold model specification, see Hansen, 1999). A threshold model makes possible to estimate the relation between three variables. It estimates different relations between two variables, while these relations depend on the interval values of the third - threshold - variable. Therefore, a threshold model permits to join together two effects: 1) a positive impact of fiscal convergence on business cycle synchronization (the higher fiscal convergence, the tighter business cycles), and 2) a negative impact of increased current account differences on business cycle synchronization (the higher differences in current accounts, the smaller business cycle synchronization). To join these two effects, the idea

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[1] Latvia and Lithuania have been omitted due to data unavailability.

is that a fiscal convergence can lead to tighter business cycles, only if countries' differences in current accounts are small enough, i.e. are smaller than a certain threshold value. Our threshold model estimates the relations between fiscal convergence and business cycle synchronization, while the estimated coefficients of these relations will be different for different intervals of current account countries' differences. Note that current account countries' difference is a threshold variable in our case.

Hansen (1999) introduced a panel data threshold model with fixed effects:

$$y_{it} = \mu_i + \beta'_1 x_{it} I(q_{it} \leq \gamma) + \beta'_2 x_{it} I(q_{it} > \gamma) + e_{it} \tag{1}$$

y_{it} is an explained variable (in our case: business cycle synchronization), x_{it} is an explicative variable, whose estimated coefficients are different for each interval of threshold variable (in our case: fiscal convergence), q_{it} is a threshold variable (in our case: countries' differences in current accounts); γ is the estimated threshold value, which determines intervals of threshold variable. The index i is a country, the index t is a time and I(.) is an indicator of the function. This threshold model gives the estimation of regression coefficients β_1, β_2 and the estimated threshold γ. To estimate a threshold γ, the model uses an iteration procedure in view to find the regression coefficients β_1 and β_2 which fit the best for the relation between x_{it} and y_{it} (for more details, see Hansen, 1999).

The estimated threshold γ divides our data set in two "regimes": 1) the estimated coefficient β_1 determines the relation between x_{it} and y_{it} only if real values of threshold variable are smaller than γ. 2) the estimated coefficient β_2 determines the relation between x_{it} and y_{it} if real values of threshold variable are higher than γ. In our case, if current account countries' differences are smaller than γ, the relation between fiscal convergence and business cycle synchronization is given by β_1. If current account countries' differences are higher than γ, the relation between fiscal convergence and business cycle synchronization is given by β_2.

Hansen (1999) defines also a double threshold model with two thresholds (γ_1, γ_2; $\gamma_1 < \gamma_2$) and three intervals, in which the model estimates different β_1, β_2 and β_3 for the relation between x_{it} and y_{it}:

$$y_{it} = \mu_i + \beta'_1 x_{it} I(q_{it} \leq \gamma_1) + \beta'_2 x_{it} I(\gamma_1 < q_{it} \leq \gamma_2) + \beta'_3 x_{it} I(q_{it} > \gamma_2) + e_{it} \tag{2}$$

According to our hypothesis of joined two effects on business cycle synchronization, the relation between a fiscal convergence and a business cycle synchronization differs with different intervals of countries' differences in current accounts. We expect that a fiscal convergence leads to more synchronized business cycles only if current account differences are smaller than γ (single threshold model) or γ_1 (double threshold model).

Our single threshold model is defined as:

$$
\begin{aligned}
|GAP_i - GAP_{EA}|_t = \mu_i &+ \beta_1 |BB_i - BB_{EA}|_{t-1} I(|CA_i - CA_{EA}|_{t-1} \leq \gamma) + \\
&+ \beta_2 |BB_i - BB_{EA}|_{t-1} I(|CA_i - CA_{EA}|_{t-1} > \gamma) + \\
&+ \theta_1 |CA_i - CA_{EA}|_{t-1} + \theta_2 |GDP_i - GDP_{EA}|_{t-1} + \theta_3 |INFL_i - INFL_{EA}|_{t-1} \\
&+ \theta_4 |DEBT_i - DEBT_{EA}|_{t-1} + \theta_5 OPEN_{i,t-1} + e_{it}
\end{aligned} \tag{3}
$$

$$GAP_{DIFF\,i,t} = \mu_i + \beta_1 BB_{DIFF\,i,t-1} I(CA_{DIFF\,i,t-1} \leq \gamma) + \beta_2 BB_{DIFF\,i,t-1} I(CA_{DIFF\,i,t-1} > \gamma) +$$
$$+ \theta_1 CA_{DIFF\,i,t-1} + \theta_2 GDP_{DIFF\,i,t-1} + \theta_3 INFL_{DIFF\,i,t-1} + \theta_4 DEBT_{DIFF\,i,t-1} +$$
$$+ \theta_5 OPEN_{i,t-1} + e_{it} \qquad (4)$$

For double threshold model, we write:

$$GAP_{DIFF\,i,t} = \mu_i + \beta_1 BB_{DIFF\,i,t-1} I(CA_{DIFF\,i,t-1} \leq \gamma_1) +$$
$$+ \beta_2 BB_{DIFF\,i,t-1} I(\gamma_1 < CA_{DIFF\,i,t-1} \leq \gamma_2) +$$
$$+ \beta_3 BB_{DIFF\,i,t-1} I(CA_{DIFF\,i,t-1} > \gamma_2) +$$
$$+ \theta_1 CA_{DIFF\,i,t-1} + \theta_2 GDP_{DIFF\,i,t-1} + \theta_3 INFL_{DIFF\,i,t-1} + \theta_4 DEBT_{DIFF\,i,t-1} +$$
$$+ \theta_5 OPEN_{i,t-1} + e_{it} \qquad (5)$$

Our variables are defined in the following way:

GAP_{DIFF} is a business cycles synchronization measured as $|GAP_i - GAP_{EA}|_t$, and GAP is an output gap in % of potential GDP; i denotes a country, EA denotes the euro area average

BB_{DIFF} is a fiscal convergence expressed as $|BB_i - BB_{EA}|_t$, and BB is a budget balance: government net lending / borrowing (% of GDP)

CA_{DIFF} is difference between current account balances (% of GDP) in country i and in the euro area : $|CA_i - CA_{EA}|_t$ - a threshold variable

GDP_{DIFF} is difference between GDP growth rates (annual, %) in country i and in the euro area : $|GDP_i - GDP_{EA}|_t$

$INFL_{DIFF}$ is difference between inflation rate (annual, %) in country i and in the euro area : $|INFL_i - INFL_{EA}|_t$

$DEBT_{DIFF}$ is difference between public debt-to-GDP ratio in country i and in the euro area : $|DEBT_i - DEBT_{EA}|_t$

$OPEN$ is a country's trade openness measured as (exports + imports) / GDP (expressed in % of GDP)

Our threshold model specifies two types of explicative variables: regime-dependent variable and regime-independent variables. Firstly, regime-dependent variable (i.e. $|BB_i - BB_{EA}|$ in our model) depends on regime of threshold variable (i.e. $|CA_i - CA_{EA}|$). Its estimated coefficients $\beta_1, \beta_2, \beta_3$ are different for each interval of the threshold variable (note that threshold intervals are determined by the estimation of thresholds γ_1 and γ_2). Secondly, regime-independent variables are control variables, which explain the evolution in output gap differences (explained variable) and their estimated coefficients $\theta_1, \theta_2, \theta_3, \theta_4, \theta_5$ are same for each threshold variable interval. Our threshold model includes these regime-independent variables: CA_{DIFF}, GDP_{DIFF}, $INFL_{DIFF}$, $DEBT_{DIFF}$ and $OPEN$. Furthermore, in order to avoid an endogeneity bias in model estimation, we decided to set one-year lag for each explicative variable and threshold variable. This approach is generally applied by several authors, e.g. Baum et al. (2013).

It should be pointed out that macroeconomic theory (Mundell-Fleming model (Mundell, 1963) or Keynesian theory of absorption) states for a positive relation between budget imbalance and current account imbalance, which is known as twin deficit hypothesis (Abell, 1990). In this context, it would be also interesting to search

for this "twin relation" and show whether and how it applies to the business cycle synchronization; which offers other open opportunities for future research.

3 Problem solving

Tab. 1 presents the estimation of single and double threshold models showing the impact of current account differences vis-à-vis the euro area (CA_{DIFF}) on relation between fiscal differences (BB_{DIFF}) and business cycle synchronization (GAP_{DIFF}).

Tab. 1: Threshold model estimation

Dependent variable:		Output gap differences (GAP_{DIFF})			
		Single threshold m. Estimated threshold: T1= 5.676		Double threshold m. Estimated thresholds: T1=5.249, T2=11.696	
		Estimate	Error	Estimate	Error
Regime-dependent variables					
$BB_{DIFF,t-1}$ (if $CA_{DIFF,t-1} \leq 5.676$)	β_1	0.192 ***	(0.041)		
$BB_{DIFF,t-1}$ (if $CA_{DIFF,t-1} > 5.676$)	β_2	-0.077	(0.090)		
Regime-dependent variables					
$BB_{DIFF,t-1}$ (if $CA_{DIFF,t-1} \leq 5.249$)	β_1			0.201 ***	(0.040)
$BB_{DIFF,t-1}$ (if $5.249 < CA_{DIFF,t-1} \leq 11.696$)	β_2			-0.030	(0.085)
$BB_{DIFF,t-1}$ (if $CA_{DIFF,t-1} > 11.696$)	β_3			-0.240 *	(0.130)
Regime-independent variables					
$CA_{DIFF,t-1}$	θ_1	0.144 ***	(0.051)	0.164 ***	(0.047)
$GDP_{DIFF,t-1}$	θ_2	0.321 ***	(0.085)	0.313 ***	(0.082)
$INFL_{DIFF,t-1}$	θ_3	0.231	(0.159)	0.225	(0.153)
$DEBT_{DIFF,t-1}$	θ_4	0.060 ***	(0.013)	0.059 ***	(0.012)
$OPEN_{t-1}$	θ_5	-0.002	(0.004)	-0.0004	(0.004)

Notes: ***=.01, **=.05, *=.1 indicate 1%, 5%, 10% significance level; The threshold model is a panel data threshold model with individual fixed effect. Regime-dependent variable: budget balance differences BB_{DIFF}: the estimated coefficient between BB_{DIFF} and GAP_{DIFF} is different for each interval of CA_{DIFF} fixed by the threshold variable estimates). Regime-independent variables are independent from CA_{DIFF} intervals. A correlation matrix confirmed no co-linearity between explicative variables. Errors: heteroscedasticity corrected standard errors. Panel unit root tests concluded for stationarity in our panel: Levin et al. (2002) test: -12.548***, Im et al. (2003) test: -16.227***, Maddala and Wu (1999) test: 263.83*** (null hypothesis: no stationarity).

Source: Own calculations, output from R

Single threshold model divides current account (in % of GDP) differences in two intervals ($CA_{DIFF} \leq 5.676\%$ and $CA_{DIFF} > 5.676\%$). Double threshold model properly extends the results of single threshold model and divides our sample in three regimes: I) CA_{DIFF} smaller than 5.249%, II) CA_{DIFF} between 5.249% and 11.696%, III) CA_{DIFF} higher than 11.696%.

If current account differences (CA_{DIFF}) are smaller than 5.249% (1st interval), there is a significant positive relation between budget balance differences (BB_{DIFF}) and output gap differences (GAP_{DIFF}): $\beta_1 = 0.201$ (see Tab.1). It means that a decrease in budget balances differences, i.e. a fiscal convergence, is accompanied by a decrease in output gap differences, i.e. by higher business cycle synchronization. If current account

differences (CA_{DIFF}) are in the 2nd interval - between 5.249% and 11.696%, there is no significant relation between BB_{DIFF} and GAP_{DIFF}. It means that a decrease in budget balance differences does not lead to smaller output gap differences and we cannot conclude for higher business cycles synchronization. Here, in situation of higher current account differences, a fiscal convergence is not accompanied by tighter business cycles. If current account differences (CA_{DIFF}) are higher than 11.696%, the model concludes for a negative relation between BB_{DIFF} and GAP_{DIFF} (β_3 = -0.240, see Tab.1). If current account differences are too large, even a decrease in budget balance differences cannot lead to business cycle synchronization. The estimated model shows that a fiscal convergence, which is accompanied by high current account differences, even leads to output gap divergence (i.e. business cycle de-synchronization).

Checking for robustness of estimated model is presented in Tab.2, which concludes that our model can be considered as a robust one.

Tab. 2: Robustness check of estimated threshold model

Dependent variable:		Output gap differences (GAP_{DIFF})				
		M1	**M2**	**M3**	**M4**	**M5**
Estimated thresholds	T1	5.249	5.254	5.676	3.323	3.323
	T2	11.696	11.696	11.696	11.696	11.696
Regime-dependent variables						
$BB_{DIFF,t-1}$ ($CA_{DIFF,t-1} \leq T1$)	β_1	0.201 ***	0.205 ***	0.204 ***	0.142 ***	0.143 ***
$BB_{DIFF,t-1}$ ($T1 < CA_{DIFF,t-1} \leq T2$)	β_2	-0.029	-0.040	-0.048	-0.039	-0.043
$BB_{DIFF,t-1}$ ($CA_{DIFF,t-1} > T2$)	β_3	-0.240 *	-0.272 *	-0.273 *	-0.352 **	-0.349 **
Regime-independent variables						
$CA_{DIFF,t-1}$	θ_1	0.165 ***	0.176 ***	0.173 ***	0.187 ***	0.179 ***
$GDP_{DIFF,t-1}$	θ_2	0.312 ***	0.310 ***	0.311 ***		
$INFL_{DIFF,t-1}$	θ_3	0.226			0.213	0.199
$DEBT_{DIFF,t-1}$	θ_4	0.059 ***	0.058 ***	0.058 ***	0.062 ***	0.063 ***
$OPEN_{t-1}$	θ_5			-0.002	0.005	

Notes: ***=.01, **=.05, *=.1 indicate 1%, 5%, 10% significance level. However, the estimated coefficient of BB_{DIFF} in the third interval is more significant for models M4 and M5, we did not decide for these models because of the instability of this coefficient in comparison with their single threshold model version. Moreover, the models M4 and M5 do not include an impact of GDP_{DIFF}, which is significant in our basic model (see Tab. 1) and models M1 – M3.

Source: Own calculations, output from R

As far as regime-independent variables (see model in Tab. 1), CA_{DIFF}, GDP_{DIFF} and $DEBT_{DIFF}$ have a significant impact on output gap differences. Firstly, the model concludes for positive relation between current account and output gap differences (θ_1 = 0.164), which supports our results for regime-dependent variable in three intervals. Higher current account differences (CA_{DIFF}) lead to higher output gap differences (GAP_{DIFF}), hence a business cycle divergence. Secondly, the model concludes for a positive relation between GDP growth differences (GDP_{DIFF}) and output gap differences (θ_2 = 0.313, Tab.1). A decrease in GDP_{DIFF} leads to a decrease in GAP_{DIFF}, i.e. higher business cycles synchronization. This result supports the idea that a real convergence (e.g. a convergence of GDP growth rates measured by a sigma convergence) leads to

tighter output gaps and higher business cycle synchronization. Thirdly, the model shows a positive relation between public debt-to-GDP differences ($DEBT_{DIFF}$) and output gap differences ($\theta_4 = 0.059$, Tab.1). Higher differences in public debts (i.e. differences between northern and southern European countries) lead to higher output gap differences, hence smaller business cycle synchronization.

4 Discussion

Tab. 3 depicts a distribution of countries in three intervals of current account differences vis-à-vis the euro area average (CA_{DIFF}), which have been estimated by threshold model (see Tab. 1): 1) $\leq 5.249\%$; 2) $5.249\% - 11.696\%$; 3) $> 11.696\%$.

From 2002 to 2004, majority of countries has been situated in the 1st interval with CA_{DIFF} smaller than 5.249% (see Tab. 3), in which the threshold model confirms a positive relation between budget balance differences and output gap differences. Therefore, a decrease in budget balance differences is accompanied by a decrease in output gap differences. If budget balance differences vis-à-vis the euro area average decrease[2], the threshold model concludes for positive impact of fiscal convergence on business cycle synchronization. However, from 2005, number of countries in the 1st interval started to diminish as they moved to the 2nd interval (see Tab. 3) with CA_{DIFF} from 5.249% to 11.696%, in which the model confirms no significant impact of fiscal convergence (i.e. a decrease in budget balance differences) on business cycles synchronization. The main reason of this movement was the evolution of increasing current account imbalances discussed by many authors in that period (Cooper, 2006; Cooper, 2007; Gruber and Kamin, 2007; Aizenman and Sun, 2010). Over the time period 2005 - 2009, when we observed a rapid increase in current account deficits in southern Europe, e.g. Greece, Portugal, Spain, Malta, Cyprus; and simultaneously an increase of current account surpluses in northern Europe, e.g. Germany and Netherlands, these countries are moved into the 2nd interval and we conclude for no impact of budget balances differences on output gap differences, i.e. no relation between fiscal convergence and business cycles synchronization. Brunet and Guichard (2011) even underlined the existence of current account "duality" between northern and southern European countries, having common evolution inside the group of countries. Surplus countries gained from higher exports (having so called "mercantilist strategy"), which permitted higher economic growth without fiscal deficits. However, in deficit countries, trade deficits decreased an output and an economy had to stimulate an economic growth by government spending, leading to large fiscal deficits (strategy called as "strategy of indebtedness").

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[2] We suppose a fiscal convergence only if budget balance differences (vis-à-vis the euro area average, BB_{DIFF} in our model) decrease. Note that budget balance differences, vis-à-vis the euro area, do not decrease for each country and for each year. In this case, we cannot interpret it as a positive relation between fiscal convergence and output gap differences, but the relation between fiscal divergence and output gap differences.

Tab. 3: Percentage of countries in three regimes, by year.

CA$_{DIFF}$ interval	≤ 5.249%	5.249% - 11.696%	> 11.696%
Relation between BB$_{DIFF}$ and GAP$_{DIFF}$	Positive ($\beta_1 = 0.201$ ***)	Not significant ($\beta_2 = -0.030$)	Negative ($\beta_3 = -0.240$ *)
	Fiscal convergence ↓ BCS	Fiscal convergence ↓ no BCS	Fiscal convergence ↓ BC divergence
Year	**% of countries situated in the interval**		
2002	71% (AT, BE, CY, FR, DE, EL, IE, IT, MT, NL, SI, ES)	29% (EE, FI, LU, PT, SK)	0%
2003	65% (AT, BE, CY, FR, DE, IE, IT, MT, NL, SI, ES)	35% (EE, FI, EL, LU, PT, SK)	0%
2004	76% (AT, BE, CY, FI, FR, DE, IE, IT, MT, NL, SK, SI, ES)	18% (EL, LU, PT)	6% (EE)
2005	47% (AT, BE, FI, FR, DE, IE, IT, SI)	47% (CY, EL, LU, MT, NL, PT, SK, ES)	6% (EE)
2006	47% (AT, BE, FI, FR, DE, IE, IT, SI)	53% (CY, EE, EL, LU, MT, NL, PT, SK, ES)	0%
2007	41% (AT, BE, FI, FR, IE, IT, SI)	53% (CY, DE, EL, LU, MT, NL, PT, SK, ES)	6% (EE)
2008	47% (AT, BE, FI, FR, IT, MT, SK, SI)	41% (CY, DE, IE, LU, NL, PT, ES)	12% (EE, EL)
2009	47% (BE, FI, FR, IE, IT, MT, SK, SI)	41% (AT, EE, DE, LU, NL, PT, ES)	12% (CY, EL)
2010	59% (AT, BE, EE, FI, FR, IE, IT, SK, SI, ES)	35% (CY, DE, LU, MT, NL, PT)	6% (EL)
2011	65% (AT, BE, EE, FI, FR, IE, IT, MT, SK, SI, ES)	35% (CY, DE, EL, LU, NL, PT)	0%
2012	71% (AT, BE, CY, EE, FI, FR, IE, IT, MT, SK, SI, ES)	29% (DE, EL, LU, NL, PT)	0%
2013	82%	18% (CY, DE, NL)	0%
2014	88%	12% (CY, NL)	0%
2015	82%	18% (CY, MT, NL)	0%
2016	94%	6% (DE)	0%
2017	88%	12% (CY, IE)	0%

Notes: BCS = business cycle synchronization, BC = business cycles, CA is lagged by one year, i.e. current account in 2001 corresponds to the year 2002 in the Table.

Source: Own calculations, output from R

Thereafter, a number of countries situated in the 2nd interval diminished and the countries moved back to the 1st interval. From 2013 to 2017, 82-94% of countries are situated in the 1st interval (see Tab. 3), which confirms that, after crisis, when current accounts adjusted (see IMF, 2014), we conclude for a positive relation between budget balance differences and output gap differences, i.e. if budget balance differences decrease, we conclude for a positive impact of fiscal convergence on more similar business cycles. It should be noted that southern European countries having typically

large current account deficits (e.g. Greece, Portugal, Spain) succeeded to adjust their deficits after crisis (IMF, 2014), which is in line with our results and their movement from the 2nd (3rd) to the 1st interval. As far as countries situated in the 3rd interval; Estonia, Greece and Cyprus had deep current account deficits and their current account differences vis-à-vis the euro area average (CA_{DIFF}) were higher than 11.696% and their evolution even contributed to business cycle divergence over the years 2004 - 2005 and 2007 - 2010.

Conclusion

The paper focuses on interactions between budget balance differences (vis-à-vis the euro area average), current account differences and output gap differences. It aimed to contribute to existing empirical studies by joining together two effects in one model: the impact of fiscal convergence (i.e. budget balance differences) and current account imbalances on business cycle synchronization. In order to join the two effects, we estimated a panel data threshold model, which permitted to estimate the relation between budget balance differences and output gap differences, while this relation depends on estimated threshold values of current account differences. Annual panel data cover the euro area countries over the time period 2001 - 2017.

The estimated panel data double-threshold model determined three intervals of current account differences. In each individual interval, it estimated different relation between budget balance differences and output gap differences. Therefore, it permitted to determine if fiscal convergence leads to tighter business cycles in each interval of current account differences and how this relation depends on the extent of current account imbalances. Firstly, if current account differences are small enough (i.e. current account, in % of GDP, difference of each individual country vis-à-vis the euro area average is smaller than 5.249%), the model concluded for a positive relation between budget balance differences and output gap differences and therefore, if budget balance differences decrease, a fiscal convergence leads to higher business cycle synchronization. From 2013 to 2017, 82 – 94% of countries are situated in this 1st interval. Secondly, if current account differences are in the interval from 5.249% to 11.696%, the threshold model concluded for no significant impact of fiscal convergence on tighter business cycles. Thirdly, if current account differences are higher than 11.696%, the model reveals even a negative relation between budget balance differences and output gap differences.

As far as policy implications, economic policies can achieve more synchronized business cycles through a fiscal convergence, but they had to take into account the extent of current account imbalances. To conclude, in order to achieve tighter business cycles, it is necessary to control convergence in current account differences as well. Finally, as our results conclude for non-linear relationship, i.e. in case of small current account differences, higher fiscal synchronization leads to tighter business cycles, and in case of large current account differences, higher fiscal synchronization leads to business cycle divergence; our paper points out also many open research questions for further analysis in this field.

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