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60%, -4% and 6%, a tale of thresholds for EU fiscal and current account developments*

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September 2021

Abstract

We study the relationship between the budget balance and the current account balance for European Union (EU) countries, using quarterly data from 1995 to 2020. Through the use of panel Granger causality tests and a panel SUR model, we conclude that the relationship is bi-directional for the EU panel as a whole. Furthermore, we find that in Eurozone countries, before 2010, for those countries with an average current account balance-to-GDP ratio outside the range of -4 to 6%, and also in countries whose average debt-to-GDP ratio is greater than 60%, the impact of the budget balance on the current account balance is greater. Conversely, in non-Eurozone countries, after 2010, in countries with a current account balance-to-GDP ratio of -4 to 6%, and also in countries with an average debt-to-GDP ratio of less than 60%, the impact of the fiscal balance on the current account balance is less relevant.

Keywords: budget deficit; external deficit; European Union; panel data; time series
***JEL* codes**: F32, F41, H62, C32, C33

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1. Introduction

From 1995 to 2010, several EU countries, especially in the Eurozone, accumulated significant budget and external deficits. Simultaneously, public and external debt grew substantially, which led to a debate regarding its sustainability, the outbreak of debt crises in peripheral Eurozone countries, and the subsequent crisis in the monetary area in 2010. Those countries subject to international economic and financial assistance all adopted fiscal austerity measures and their external imbalances diminished significantly.

In 2011, the European Commission established the Macroeconomic Imbalances Procedure (MIP) following on from the Eurozone crisis. The MIP uses a scoreboard of headline imbalances indicators with indicative thresholds that are designed to signal the existence of macroeconomic imbalances and thus constitutes an alert mechanism. Two of the indicators used are the current account balance, which is assessed through the use of a three year backward moving average of the current account as a percentage of GDP, with thresholds of -4% and 6%, and also the general gross government debt, expressed as a percentage of GDP, with a maximum threshold of 60%. It should also be borne in mind that the Stability and Growth Pact (SGP) establishes that the general government deficit must not exceed 3% of GDP annually. Accordingly, an institutional framework of surveillance in the Eurozone exists with the objective to avoid the accumulation of macroeconomic imbalances, which in turn could compromise the sustainability of the economic and monetary union.

Based on the historical experience of the Eurozone before 2010, we are able to assess the relationship between the budget balance and the current account balance, and, especially, the possible impact of fiscal balances on current account balances. Alternatively, the inverse effect could also play a role. There is a vast literature, mainly empirical, about the relationship between both balances. Existing empirical studies point to different results in terms of significance, sign, and direction of the relationship between the budget balance and the current account balance (see, for instance, Darrat, 1988; Daly and Siddiki, 2009; Afonso *et al.*, 2013; Nikiforos *et al.*, 2015). The diversity of empirical evidence is in line with existing theoretical perspectives (Twin Deficits Hypothesis, Ricardian Equivalence Hypothesis, Current Account Targeting Hypothesis, feedback linkage and twin divergence).

We contribute to the literature in two ways. First, in this paper we use a panel data set for European Union countries (including the United Kingdom) at a quarterly frequency from 1995 to 2020. According to Algieri (2013), the quarterly data structure

enables a better understanding of the interactions between budget and current account deficits, and is more suitable for carrying out a more concise and more in-depth analysis of the underlying dynamics. Second, bearing in mind that the panel is long (as it has more time units than sectional), the econometric analysis combines elements from time series studies with studies using panel data. Consequently, we proceeded to study the relationship between the budget balance and the current account balance considering the panel of countries, as well as the study of the individual series for each country.

The paper is organized as follows. Section 2 reviews the related literature. Section 3 describes the methodologies used in the paper. Section 4 reports the empirical assessment and Section 5 concludes.

2. Literature

In the related literature, the Twin Deficit Hypothesis (TDH), which was developed by Mundell (1960) and Fleming (1962) and is present in the Keynesian Absorption Theory, states that budget and current account deficits are twins, that is to say, that budget deficits result in current account deficits. The Ricardian Equivalence Hypothesis (REH), from Barro (1974, 1989), maintains that there is no relationship between both deficits. In other words, in an open economy, a change in taxes does not influence the real interest rate, neither investments, nor consumption (Barro, 1989).

On the other hand, the Current Account Targeting Hypothesis (CATH), advanced by Summers (1988), admits that the direction of the relationship between the budget balance and the current account balance operates contrary to that of the TDH, in other words, current account deficits result in budget deficits. The feedback linkage, based on Feldstein and Horioka (1980), suggests that the relationship between both deficits materializes bilaterally. The twin divergence hypothesis, as supported by Kim and Roubini (2008), assumes that the budget balance and the current account balance move in opposite directions.

The empirical verification of these perspectives has different economic policy implications, as the economic policy measures to be implemented will be different, depending on how the budget balance and the current account balance are related. Hence, the relevance of studying this topic specifically in those Eurozone countries that share a common currency and have autonomous fiscal policies, even if within a commonly-agreed framework.

The empirical literature on the relationship between the budget balance and the current account balance is based on two types of studies. First there are time series studies, which are generally applied to individual countries or to a group of countries with similar characteristics, using Granger causality tests, cointegration, and impulse-response function analyses, VAR (Vector Auto-Regressive), and ARDL (Autoregressive Distributed Lag) models. The articles of Vamvoukas (1999), Dibooglu (2007), Kim and Roubini (2008), and Janko (2020) belong to this methodological line. Secondly, there are also studies, which are less frequent than the first type, which use panel data, through applying the usual techniques of econometric estimation (linear models and GMM – Generalized Method of Moments approach). Piersanti (2000), Salvatore (2005), Forte and Magazzino (2013), and Badinger *et al.* (2017) are examples of panel studies.

The empirical literature on the relationship between the budget balance and the current account balance thus presents a diversity in terms of the empirical scope, period of analysis, implemented methodologies, and conclusions obtained. Table 1 is a summary of the selected empirical articles.

Table 1 – Empirical Literature

Authors	Countries	Period	Methods	Results
Darrat (1988)	United States	Quarterly, 1960-1984	Causality	Bi-directional relationship
Abell (1990)	United States	Quarterly,1979Q2-1985Q2	VAR	Budget deficits positively influence trade deficits.
Rosenweig and Tallman (1993)	United States	Quarterly, 1961-1989	VAR	Twin Deficits Hypothesis
Vamvoukas (1999)	Greece	1948-1994	Cointegration, Causality	Budget deficit has a positive short and long run effect on the trade deficit.
Piersanti (2000)	OECD countries	1970-1997	Causality, GMM	Twin Deficits Hypothesis
Kaufmann *et al.* (2002)	Austria	Quarterly, 1976-1998	VAR	Reject the Twin Deficit Hypothesis
Fidrmuc (2003)	10 OECD countries	Quarterly, 1970-2001	Cointegration	Twin Deficits Hypothesis
Salvatore (2006)	G7 countries	1973-2005	GLS	Twin Deficits Hypothesis
Dibooglu (2007)	United States	Quarterly, 1960-1994	Cointegration, VEC	Twin Deficits Hypothesis
Kim and Roubini (2008)	United States	Quarterly, 1973-2004Q1	VAR	Twin divergence
Daly and Siddiki (2009)	23 OECD countries	1960-2000	Cointegration	Twin Deficits Hypothesis
Kalou and Paleologou (2012)	Greece	1960-2007	Cointegration, Causality, Multivariate VEC	Current Account Targeting Hypothesis

Afonso *et al.* (2013)	European Union and OECD countries	1970-2007	Panel cointegration, SUR	Depending on the country: Twin Deficits Hypothesis, Ricardian Equivalence Hypothesis and Current Account Targeting Hypothesis
Algieri (2013)	Greece, Ireland, Italy, Portugal and Spain	Quarterly, 1980Q2-2012Q2	Causality	Ricardian Equivalence Hypothesis
Forte and Magazzino (2013)	33 European countries	1970-2010	FE, System GMM, Panel cointegration, Causality	Twin Deficit Hypothesis
Makin and Narayan (2013)	Australia	Quarterly, 1983-2009	Cointegration	Twin Deficit Hypothesis
Trachanas and Katrakilidis (2013)	Greece, Ireland, Italy, Portugal and Spain	1971-2009	Cointegration	Twin Deficit Hypothesis
Nikiforos *et al.* (2015)	Greece	Quarterly, 1980-2010	Causality, Cointegration	After 1995, the external deficit has a positive impact on the budget deficit.
Badinger (2017)	Panel of 73 countries	1985-2012	LSDV, System GMM	Fiscal rules reduce the effect of the fiscal balance on the current account.
Litsios and Pilbeam (2017)	Greece, Portugal and Spain	Quarterly, 1980Q2-2015Q2	ARDL, Panel cointegration	Twin Deficit Hypothesis
Janko (2020)	Canada	Quarterly, 1981-2018	ARDL	Twin Deficit Hypothesis
McFarlane *et al.* (2020)	United States	Three structural periods: 1947Q1-1984Q3, 1984Q4-1999Q4, 2000Q1-2017Q3	OLS, Causality, Cointegration, VEC	The Twin Deficits Hypothesis is supported only in the period 1947Q1-1984Q3.

Note: VAR – Vector Auto-Regressive; GMM – Generalized Method of Moments; GLS – Generalized Least Squares; VEC – Vector Error Correction; SUR – Seemingly Unrelated Regressions; FE – Fixed Effects; LSDV – Least Squares Dummy Variables; ARDL – Autoregressive Distributed Lag; OLS – Ordinary Least Squares.

3. Methodological framework

The empirical analysis of this paper is carried out through the implementation of several methodologies. We start with Granger Causality Wald Tests, based on Granger (1969), to assess the relationship between the general government balance as a percentage of GDP and the current account balance as a percentage of GDP. We perform panel Granger causality tests for the countries of the European Union as a whole. To do so, we follow the approach of Abrigo and Love (2016). In addition, we also carry out Granger causality tests for each country taken individually. The purpose of this analysis is to investigate whether the relationship between the budget balance and the current account

balance for countries as a whole is different from the relationship between both balances in the several countries and between them.

The Granger Causality Wald tests carried out in the framework of a VAR model are designed to determine whether the inclusion of lagged observations of the general government balance as a percentage of GDP reduces the forecast error of the current account balance as a percentage of GDP. The purpose is to know whether the budget balance is predicted by the current account, in comparison to a model that only includes past observations of the current account balance as a percentage of GDP.

We carry out a set of tests for both the panel of European Union countries and also for each country taken individually. More specifically, we check whether the general government balance (% of GDP) Granger causes the current account balance (% of GDP), GB => CA; if the current account balance (% of GDP) Granger causes the general government balance (% of GDP), CA => GB; if there is bi-directional Granger causality, GB <=> CA; or if there is no relationship between the two variables.

The basic equations of the Granger causality tests are the following:

$$CA_t = \alpha_0 + \sum \alpha_i GB_{t-i} + \sum \beta_j CA_{t-j} + \mu_{1t}, \quad (1)$$

$$GB_t = \gamma_0 + \sum \gamma_i CA_{t-i} + \sum \delta_j GB_{t-j} + \mu_{2t}. \quad (2)$$

The null hypothesis are: GB_t Granger does not cause CA_t in equation (1), and CA_t does not Granger cause GB_t in equation (2). μ_{1t} and μ_{2t} are the random disturbance terms of the equations (1) and (2), respectively.

In this regard, an important aspect to note is the fact that when it is stated, for example, that "the general government balance as a percentage of GDP Granger causes the current account balance as a percentage of GDP", this does not mean that the latter is an effect or the result of the former. Granger causality does not indicate the existence of causality between two variables in the most common sense of this concept, but rather it measures the content of the information and the precedence of both. The test enables one to check whether one variable leads to the other, but only allow one to know the short run dynamics between the variables under study.

Next, we implement the panel cointegration tests of Westerlund (2007) and Pedroni (2004), in order to find a cointegration relationship between the government balance and the current account balance. The panel cointegration tests proposed by Westerlund (2007) enable the testing of the null hypothesis of non-cointegration against two separate alternatives, namely: i) at least one cross-section is cointegrated and the

panel is possibly heterogenous, and ii) the panel is cointegrated in its entirety. In the second case, the long-run equilibrium relationship of the variables would be the same for all the cross-sections. The panel cointegration tests of Pedroni (2004) are a set of residual-based tests that assumes the null hypothesis of non-cointegration in heterogenous panels and which does not consider structural breaks in the cointegration relationship and cross-sectional dependence.

Since the panel under analysis is long (T close to 100 for $N = 28$) and that there is presence of heteroskedasticity, auto-correlation, and cross-section dependence, we opt to use the POLS (Pooled Ordinary Least Squares) method with Driscoll-Kraay (1998) standard errors in order to determine the impact and significance of the government balance on the current account balance.

The panel baseline specification to estimate is as follows:

$$CA_{it} = \alpha_0 + \alpha_1 GB_{it} + \alpha_2 REER_{it} + \alpha_3 RIR_{it} + \alpha_4 GR_{it} + \mu_{it} \quad (3)$$

where CA_{it} is the current account balance-to-GDP ratio of country i ($i = 1, \ldots, n$) in year t ($t = 1, \ldots, T$); GB_{it} is the general government balance-to-GDP of country i in year t; $REER_{it}$ is the real effective exchange rate of country i in year t; RIR_{it} is the real interest rate of country i in year t; GR_{it} is the real GDP growth rate of country i in year t; and μ_{it} is the random disturbance term of country i in year t.

The Twin Deficit Hypothesis argues that both the real exchange rate and the real interest rate play an important role as mediating variables between the budget deficit and the current account deficit. The decrease (increase) in the real effective exchange rate results in a(n) increase (decrease) in prices of imports and a(n) decrease (increase) in the prices of exports, contributing to a(n) decrease (increase) in imports and a(n) increase (decrease) in exports, which consequently improves (aggravates) the current account deficit.

From a theoretical point of view, the increase in the real interest rate results in an increase in the opportunity cost of present consumption and investment, thus leading to an increase in savings, which positively influences the current account balance (substitution effect). In the scenario of an increase in the real interest rate, the income effect translates into an increase in present and future consumption and in investment, which causes a deterioration in the current account balance. The total effect of the real interest rate on the current account balance depends on which effect is dominant.

The inclusion of the real GDP growth rate is justified, partly by the need to control the cyclical components of the variables under study, and partly because this variable is generally associated with an increase in real income, which translates into an increase in aggregate consumption and investment and, consequently, in imports. In such a scenario, the current account balance worsens.

Given the potential degree of interdependence between the current account balance and the budget balance, it is necessary to implement an empirical method that considers their mutual impact in order to avoid specification errors. Moreover, we include the real exchange rate, the real interest rate, and the real GDP growth rate as endogenous variables. Therefore, a system of seemingly unrelated regressions (SUR), proposed by Zellner (1962) was considered, with current account balance, general government balance, real efective exchange rate, real interest rate, and real GDP growth rate. The econometric specification consists of a system of five equations that describe the empirical interdependence between relevant endogenous variables. In the SUR model, we assume that the disturbances from the different regressions are correlated due to common unobservable factors. As this method assumes interdependence between the errors terms of the system equations, it is consequently more efficient in comparison to the single-equation approach.

Finally, in order to determine the bilateral impacts between the budget balance and the current account balance, we estimate the following equations for each European Union country, using OLS (Ordinary Least Squares):

$$CA_t = \beta_0 + \beta_1 GB_t + \beta_2 REER_t + \beta_3 RIR_t + \beta_4 GR_t + \varepsilon_t, \quad (4)$$

$$GB_t = \theta_0 + \theta_1 CA_t + \theta_2 REER_t + \theta_3 RIR_t + \theta_4 GR_t + \varphi_t. \quad (5)$$

The variables already have a known meaning, in that ε_t and φ_t are the random disturbance terms of equations (4) and (5), respectively. We consider the year-on-year (yoy) quarterly changes of the variables to guarantee the stationarity of the series under study. The OLS estimates using stationary series are robust and could indicate the existence of a bilateral relationship between the two balances.

4. Empirical analysis

4.1. Data

The sample in our paper includes quarterly data for 28 European Union countries, namely: Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark,

Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom, from 1995Q1 to 2020Q4.

The dependent variable under study is the current account balance as a percentage of GDP (CA). Furthermore, we consider the following macroeconomic determinants as explanatory variables in the models: general government balance as a percentage of GDP (GB), real effective exchange rate (REER), real interest rate (RIR), and real GDP growth rate (GR).

In addition, we also considered several dummy variables, namely: DGFC (which assumes the value 1 in the first quarter of 2009, when the global financial crisis broke out); DEUROZONE (which assumes the value 1 if a country in a given quarter is part of the Eurozone); D2010 (which assumes the value 1 from the first quarter of 2010); DGB (which assumes the value 1 if the share of the budget balance on GDP is less than -3%); DCA (which assumes the value 1 if the share of the current account balance on GDP is outside the range between -4 and 6%, as provided in the Macroeconomic Imbalances Procedure of the European Commission); and DPD (which assumes the value 1 if the share of public debt on GDP is greater than 60%).

In order to smooth the data, we calculate moving sums of four quarters for the quarterly current account balance, the budget balance, and the nominal GDP series. Hereafter, we determine the shares of the current account balance and the general government balance on GDP for each observation, dividing the moving sums of the current account balance and of the budget balance by the moving sum of the nominal GDP.[1] In addition, the real effective exchange rate was obtained through the relative variation of an exchange rate index based on 42 foreign partners (industrial countries) and deflated by a consumer price index (with basis in 2010), using monthly data. The real interest rate is the difference between the nominal interest rate and the inflation rate, at three months. The inflation rate is the relative variation of the Harmonized Index Consumer Price (the year base is 2015), using monthly data. The real GDP growth rate is the relative variation of real GDP. These data are all obtained from Eurostat.

Table 2 presents the usual descriptive statistics for the variables and Table 3 is the correlation matrix.

[1] The data of the current account balance, the general government balance, and the nominal GDP for the United Kingdom was obtained from the Office for National Statistics.

Table 2: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Maximum	Minimum
CA	2306	-0,0123	0,0559	0,1549	-0,2409
GB	2341	-0,0232	0,0354	0,0944	-0,3206
REER	2800	0,0021	0,0228	0,4022	-0,1943
RIR	2473	0,0308	0,0604	0,8071	-0,0573
GR	2671	0,0058	0,0114	0,1695	-0,1947

Table 3: Correlation matrix

	CA	GB	REER	RIR	GR
CA	1,0000				
GB	0,2258	1,0000			
REER	-0,1246	0,0263	1,000		
RIR	-0,2813	-0,0719	0,0886	1,0000	
GR	-0,1170	0,2547	-0,0123	0,0247	1,0000

We performed the Pesaran (2004) cross-section dependence test of the contemporaneous error terms (called the CD test),[2] and concluded that a cross-section dependence exists between the variables under study. Since, in this scenario, the first-generation panel stationarity tests fail, we the go on to proceed to carry out a Pesaran (2007) second-generation panel stationarity test.[3] We found that the variables are stationary in the panel. The results of these tests are shown in Tables A1, A2, and A3 in the Appendix.

4.2. Results

4.2.1. Granger Causality Tests

We present the results of the Granger causality tests for the panel in Table 4, considering 4 and 8 lags. With 4 lags, there is a bi-directional relationship between the budget balance and the current account balance for the group of European Union countries, at a 1% level of significance. When we consider 8 lags, the bilateral relationship remains, albeit at a significance level of 10% for the case when the budget balance

[2] This test uses the pairwise average of the off-diagonal sample correlation coefficients in a seemingly unrelated regressions model and works with unbalanced panels. In addition, the test is robust for single and multiple structural breaks in the slope coefficients and the error variances of the individual regressions.

[3] This test is based on the mean of the individual ADF (Augmented Dickey-Fuller) t-statistics of each unit in the panel and is able to eliminate the presence of cross-section dependence by augmenting the ADF regressions with the lagged cross-sectional mean and its first differences of the individual series to capture cross-sectional dependence by a single factor model. Additionally, the test allows for heterogeneity in the autoregressive coefficients of the Dickey-Fuller regressions and also for the presence of single unobserved common factor with heterogenous factor loadings in the data.

Granger causes the current account balance. Consequently, the feedback linkage of Feldstein and Horioka (1980) is more appropriate for interpreting the relationship between both balances for the panel constituted by the countries of the European Union.

Table 4: Panel Granger Causality Tests

Lags	Granger causality	Chi-square statistic	P-value
4	GB => CA	13.630	0.009
	CA => GB	31.411	0.000
8	GB => CA	14.114	0.079
	CA => GB	35.110	0.000

Notes: (a) The null hypothesis is CA or GB does not Granger cause GB or CA, respectively; (b) Wald statistics are reported.

Before carrying out the Granger causality tests by country, we tested the stationarity of the series of the current account balance and the general government balance in levels and their order of integration, through two complementary tests, namely the ADF (Augmented Dickey-Fuller) and the PP (Philipps-Perron) tests, which were developed by Dickey and Fuller (1979) and Phillips and Perron (1988), respectively. The results are reported in Table A4 in the Appendix.

Most series have a unit root and are not stationary in levels. In first differences, all series are stationary, being integrated of order 1, *I(1)*. Since, in each VAR model, there is at least one variable *I(1)*, the Granger causality tests by country were implemented, considering the variables in first differences.

Next we perform a pre-estimation test to select the order of the VAR model, considering a maximum lag order selection of eight. For each VAR estimated model, the selection of the optimal number of lags was obtained through the following criteria: sequential modified LR test, FPE (Final Prediction Error), AIC (Akaike Information Criterion), HQIC (Hannan-Quinn Information Criterion), and SBIC (Schwarz Bayesian Information Criterion).

The dynamic stability of each estimated model was tested, using both the inverse roots of the characteristic polynomial and the Lagrange-multiplier test of the second order serial autocorrelation that was implemented. Only the results obtained in a stable VAR system and those with no second-order serial autocorrelation up to 10% level of significance are reported.

Table 5 shows a diversity of results regarding the short-run dynamics between the budget balance and the current account balance for the countries of the European Union.

In can be seen that in countries such as Austria (at a 4, 5 and 8 lags), Belgium (at a 4 lags), Bulgaria (at an 1 and 2 lags), Croatia (at an 1 lag), Cyprus (at a 4 lags), Denmark (at an 1 lag), Finland (at a 6 lags), France (at an 1 lag), Germany (at an 1 lag), Greece (at an 1 lag), Hungary (at an 1 and 5 lags), Ireland (at a 4 lags), Italy (at an 1 lag), the Netherlands (at an 1, 4 and 8 lags), Poland (at an 1 lag), Portugal (at an 1 lag), Romania (at an 1 lag), Slovakia (at an 1 lag), Slovenia (at a 4 lags), and Sweden (at an 1 and 4 lags) there is no Granger causality in both directions between the budget balance and the current account balance, which may validate the Ricardian Equivalence Hypothesis for these countries. In Croatia (at a 4 and 5 lags), Cyprus (at an 8 lags), Denmark (at a 4 lags), Estonia (at a 5 lags), France (at a 5 lags), Germany (at a 5 lags), Poland (at a 4 lags), Romania (at a 5 lags), and Slovenia (at an 1 lag), the Granger causality direction is running from the budget balance to the current account balance. The direction of causality is reversed in the case of Bulgaria (at a 7 lags), the Czech Republic (at an 8 lags), Finland (at an 1 lag), Greece (at a 5 and 7 lags), Lithuania (at a 5 lags), Luxembourg (at a 4 lags), and Spain (at a 5 lags). Finally, there is Granger causality in both directions in the following countries: Denmark (at an 8 lags), Estonia (at a 7 lags), Germany (at a 6 lags), Latvia (at a 6 lags), Lithuania (at an 8 lags), Malta (at an 1 lag), Portugal (at an 8 lags), Slovakia (at an 8 lag), Spain (at a 2 lags), and the United Kingdom (at a 2 and 7 lags).

Table 5: Granger Causality Tests by country

Country	Obs.	Lags	Granger causality: GB => CA	Granger causality: CA => GB
Austria	72	4	0.99772	3.5403
	71	5	0.94292	3.6831
	68	8	3.6769	6.2493
Belgium	64	4	1.866	2.0392
Bulgaria	83	1	1.7715	0.64826
	82	2	1.7279	1.4982
	77	7	9.6338	18.436***
Croatia	79	1	2.3927	0.1955
	76	4	9.9511**	1.699
	75	5	11.11**	1.6918
Cyprus	60	4	2.9509	6.2846
	56	8	18.18**	7.4386
Czech Republic	76	8	5.0731	13.853*
Denmark	59	1	1.0575	0.78428
	56	4	9.6077**	2.9654
	52	8	20.175***	24.338***
Estonia	67	5	15.818***	8.7222
	65	7	18.953***	19.691***
Finland	83	1	0.04838	5.3565**

	78	6	4.8925	7.4316
France	83	1	0.67206	0.71431
	79	5	11.416**	1.6741
Germany	71	1	0.39703	0.77853
	67	5	10.818*	9.0116
	66	6	12.874**	12.311*
Greece	71	1	0.21729	2.528
	67	5	6.721	15.077***
	65	7	8.3826	22.744***
Hungary	83	1	0.81394	0.4216
	79	5	7.0975	1.5888
Ireland	68	4	0.70113	1.24
Italy	83	1	1.4073	0.45157
Latvia	74	6	17.835***	16.811***
Lithuania	79	5	7.4427	14.42**
	76	8	17.01**	20.022***
Luxembourg	68	4	1.69	10.368**
Malta	63	1	11.472***	3.2711*
Netherlands	66	1	0.55291	1.4924
	63	4	0.80443	2.0581
	59	8	9.5385	4.4251
Poland	63	1	2.2314	1.6495
	60	4	14.326***	2.8515
Portugal	83	1	0.44672	1.26
	76	8	14.378*	25.711***
Romania	83	1	0.05544	0.19972
	79	5	9.5467*	6.3859
Slovakia	63	1	2.3452	0.0147
	56	8	25.724***	22.847***
Slovenia	83	1	2.7322*	0.24942
	80	4	6.9171	2.8674
Spain	98	2	7.3589**	17.567***
	95	5	9.1021	13.113**
Sweden	99	1	0.83486	0.04821
	96	4	1.2908	1.759
United Kingdom	89	2	8.5675**	13.873***
	84	7	32.006***	26.508***

Notes: (a) The null hypothesis is CA or GB does not Granger cause GB or CA, respectively; (b) Wald statistics are reported; (c) *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

4.2.2. Panel Cointegration Tests

Table 6 presents the Westerlund (2007) four different panel cointegration tests for the relationship between the government balance and the current account balance. G_t and G_a are group mean tests which test the alternative hypothesis of at least one unit being cointegrated. In turn, P_t and P_a are panel mean tests which test whether the panel is cointegrated.

The bootstrap p-values (column five) do not point to the existence of a cointegration correlation between the budget balance and the current account balance. However, when the short-run dynamics is maintained fixed, at a 5% level of significance, it is found that there is a cointegration relationship between both variables and that the panel is cointegrated in at least one country.

Table 6: Westerlund (2007) Panel Cointegration Tests (GB and CA)

Statistic	Value	Z-Value	P-Value	Robust P-Value
G_t	-1.899	-0.712	0.238	0.300
G_a	-7.329	-0.182	0.428	0.280
P_t	-9.914	-2.267	0.012	0.280
P_a	-6.283	-2.446	0.007	0.190
Fixed short-run dynamics				
Statistic	Value	Z-Value	P-Value	Robust P-Value
G_t	-2.023	-1.448	0.074	0.020
G_a	-7.297	-0.150	0.440	0.020
P_t	-10.003	-2.357	0.009	0.040
P_a	-5.831	-1.908	0.028	0.010

Notes: (a) The null hypothesis is non-cointegration; (b) The tests are all normally distributed and are carried out with a constant; (c) The average AIC selected lag length is 1.32 and the average AIC selected lead length is 0.25; (d) Short run dynamics is restricted to one lag and one lead; (e) The critical values are a one-sided test, based on normal distribution; (f) The robust p-values are a one-sided test, based on 100 bootstrap replications.

The results of Pedroni (2004) cointegration tests, as reported in Table 7, point to the existence of a cointegration relationship between the budget balance, the current account balance, and the real effective exchange rate for the panel constituted by the countries of European Union and for at least one of the countries.[4]

Table 7: Pedroni (2004) Panel Cointegration Tests (GB, CA and REER)

Test Statistics	Panel	Group
v	0.1678	
ρ	1.226	2.042
ADF	0.9588	1.42
PP	2.506	2.583

Notes: (a) The null hypothesis is non-cointegration; (b) Under the null hypothesis, all the statistics follow a standard normal distribution.

[4] We also performed Pedroni (2004) panel cointegration tests considering only the budget balance and the current account balance and did not conclude that there was a cointegration relationship between both variables.

4.2.3. POLS Estimations

Table 8 shows that the fiscal balance has a positive and highly significant impact on the current account balance. According to Specification (1), the variation of 1 pp in the budget balance-to-GDP ratio translates into a change in the same direction in the current account balance-to-GDP of 0.404 pp, ceteris paribus. In the four regressions presented, the real effective exchange rate and the real GDP growth rate have the expected signs and are both statistically significant. The real interest rate is negative and is statistically significant. This result indicates that, during the period under analysis, the income effect dominates the substitution effect associated with the variation in the real interest rate in all the European Union countries.

Table 8: CA Baseline Estimates with dummies

Regressors/Specification	(1)	(2)	(3)	(4)
GB	0.404***	0.441***	0.410***	0.465***
	(0.064)	(0.061)	(0.066)	(0.056)
REER	-0.375***	-0.351***	-0.362***	-0.252**
	(0.123)	(0.107)	(0.125)	(0.102)
RIR	-0.362***	-0.229**	-0.353***	-0.128**
	(0.110)	(0.092)	(0.106)	(0.057)
GR	-0.769**	-0.659**	-0.850**	-0.672**
	(0.364)	(0.309)	(0.376)	(0.313)
DGFC		-0.040***		
		(0.007)		
DEUROZONE			0.026***	
			(0.006)	
D2010				0.036***
				(0.005)
Observations	2,063	2,063	2,063	2,063
R-squared	0.150	0.192	0.157	0.220
Number of groups	28	28	28	28

Notes: (a) The dependent variable is the current account balance as a percentage of GDP; (b) Driscoll-Kraay standard errors in brackets; (c) The constant term is estimated, but is omitted for reasons of parsimony; (d) *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively; (e) DGFC (assumes the value 1 in the first quarter of 2009), DEUROZONE (assumes the value 1 if a country in a given quarter is part of the Eurozone), and D2010 (assumes the value 1 from the first quarter of 2010).

Advancing to the base regression, three dummy variables are added, namely: DGFC (assumes the value 1 in the first quarter of 2009), DEUROZONE (assumes the value 1 if a country in a given quarter is part of the Eurozone), and D2010 (assumes the value 1 from the first quarter of 2010). The effects of these dummies on the current account balance as a percentage of GDP are as follows. The global financial crisis (GFC),

which started broadly in the first quarter of 2009, has a negative and highly significant effect of 0.04 pp. If a country in a given quarter belongs to the Eurozone, then the impact is positive and highly significant, at around 0.026 pp. As of the first quarter of 2010, the current account balance as a percentage of GDP registered an improvement of 0.036 pp. The estimates of the impact of the budget balance on the current account balance are relatively similar in the various estimations carried out.

Table 9: CA Estimates with interacting dummies

Regressors/Specification	(1)	(2)	(3)	(4)	(5)
GB	0.197	0.100*	0.471***	0.722***	0.779***
	(0.130)	(0.051)	(0.084)	(0.071)	(0.066)
REER	-0.381***	-0.333***	-0.395***	-0.326**	-0.452***
	(0.123)	(0.117)	(0.124)	(0.123)	(0.155)
RIR	-0.362***	-0.294***	-0.474***	-0.282**	-0.172*
	(0.109)	(0.092)	(0.138)	(0.102)	(0.100)
GR	-0.803**	-0.771**	-0.764**	-0.761**	-2.084***
	(0.375)	(0.346)	(0.358)	(0.348)	(0.615)
GB*DGB	0.258**				
	(0.118)				
GB*DCA		0.736***			
		(0.087)			
GB*DPD			-0.120		
			(0.100)		
GB*D2010				-0.487***	-0.553***
				(0.105)	(0.112)
REER*D2010					0.423**
					(0.177)
RIR*D2010					-0.141
					(0.114)
GR*D2010					2.325***
					(0.596)
Observations	2,063	2,063	1,987	2,063	2,063
R-squared	0.155	0.220	0.169	0.245	0.245
Number of groups	28	28	28	28	28

Notes: (a) The dependent variable is the current account balance as a percentage of GDP; (b) Driscoll-Kraay standard errors in brackets; (c) The constant term is estimated, but is omitted for reasons of parsimony; (d) *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively; e) DGB (assumes the value 1 if the budget balance-to-GDP ratio is less than -3%), DCA (assumes the value 1 if the current account balance-to-GDP ratio is outside the range of -4 to 6%), DPD (assumes the value 1 if the debt-to-GDP ratio is greater than 60%), and D2010 (assumes the value 1 from the first quarter of 2010).

In Table 9, we consider four dummy variables in interaction with the budget balance: DGB (assumes the value 1 if the share of the budget balance on GDP is less than -3%), DCA (assumes the value 1 if the share of the current account balance on GDP is

outside the range of -4 to 6%, as provided in the Macroeconomic Imbalances Procedure of the European Commission), DPD (assumes the value 1 if the share of public debt on GDP is greater than 60%), and D2010 (assumes the value 1 from the first quarter of 2010). The results obtained are as follows. First, the positive and significant effect at a 5% level of the budget balance on the current account balance only occurs when the budget deficit is above 3% of GDP. Second, if the current account balance is within the limits foreseen in the Macroeconomic Imbalances Procedure, that is to say, from -4 to 6% of GDP, then the impact of the budget balance on the current account balance is reduced by 0.1 pp, and is significant only at a 10% level. If the current account balance is out of range, then the impact is exacerbated, attaining 0.836 (= 0.1 + 0.736) pp. Third, if the share of public debt on GDP is greater than 60% of GDP, then this has no influence on the relation between the budget balance and the current account balance. Fourth, before the first quarter of 2010, the effect of the budget balance on the current account balance is 0.722 pp, whereas after the first quarter of 2010, the effect is diminished, reducing to 0.235 (= 0.722 – 0.487) pp. In addition, when we make the D2010 dummy interact with all the regressors, we again conclude that not only is the effect of the budget balance on the current account balance reduced, but also that the negative effect of the real effective exchange rate is strongly mitigated and that real GDP growth starts to have a positive sign. This result may be because of the fact that from 2010 onwards, exports have become the main driver of economic growth in the Eurozone economies, after the restructuring of peripheral economies in the Eurozone that were subject to economic and financial assistance programmes. Finally, the estimate of the real interest rate is reduced in module and loses statistical significance.

The sample was divided according to five criteria, namely: i) whether the countries are part of the Eurozone, or not; ii) before and after 2010; iii) whether the budget balance as a percentage of GDP is lower or higher than -3%; iv) whether the current account balance as a percentage of GDP is within the range of -4 to 6%, or is outside it; and v) whether the share of public debt on GDP is lower or greater than 60%. Tables 10 and 11 present the results obtained.

Table 10: Sub-samples I and II

Sub-sample	Eurozone countries	non Eurozone countries	Before 2010	After 2010
Regressors/Specification	(I.1)	(I.2)	(II.1)	(II.2)
GB	0.516***	0.334***	0.677***	0.320***
	(0.078)	(0.078)	(0.044)	(0.047)
REER	-0.737***	-0.211*	-0.412**	-0.025
	(0.183)	(0.103)	(0.153)	(0.075)
RIR	-0.744***	-0.217**	-0.087	-0.296***
	(0.129)	(0.092)	(0.062)	(0.056)
GR	-1.088**	-0.533	-1.731***	0.069
	(0.382)	(0.380)	(0.569)	(0.154)
Observations	1,464	599	969	1,094
R-squared	0.194	0.139	0.183	0.106
Number of groups	19	9	28	28

Notes: (a) The dependent variable is the current account balance as a percentage of GDP; (b) Driscoll-Kraay standard errors in brackets; (c) The constant term is estimated, but is omitted for reasons of parsimony; (d) *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table 11: Sub-samples III, IV and V

Sub-sample	GB > -3% of GDP	GB < -3% of GDP	CA between -4 and 6% of GDP	CA outside interval	Public debt < 60% of GDP	Public debt > 60% of GDP
Regressors/ Specification	(III.1)	(III.2)	(IV.1)	(IV.2)	(V.1)	(V.2)
GB	0.251**	0.254***	0.365***	0.574***	0.302***	0.413***
	(0.087)	(0.078)	(0.069)	(0.100)	(0.099)	(0.065)
REER	-0.535**	-0.229*	-0.234***	-0.736**	-0.385**	-0.369***
	(0.187)	(0.110)	(0.078)	(0.240)	(0.159)	(0.082)
RIR	-0.751***	-0.225**	-0.564***	-0.238*	-0.324**	-0.643***
	(0.099)	(0.091)	(0.067)	(0.120)	(0.117)	(0.093)
GR	-0.960*	-0.291	-0.165	-1.889***	-1.091**	-0.019
	(0.500)	(0.410)	(0.153)	(0.572)	(0.512)	(0.295)
Observations	1,190	873	1,348	715	1,153	910
R-squared	0.135	0.112	0.200	0.172	0.153	0.197
Number of groups	16	12	18	10	16	12

Notes: (a) The dependent variable is the current account balance as a percentage of GDP; (b) Driscoll-Kraay standard errors in brackets; (c) The constant term estimated, but is omitted for reasons of parsimony; (d) *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Based on the results, we find that the impact of the budget balance on the current account balance is greater in the following circumstances: for those countries that are part of the Eurozone, before 2010, in countries whose average share of the current account balance on GDP is outside the range of -4 to 6%, and in countries whose average share of public debt on GDP is greater than 60%. The impact of the fiscal balance on the current

account balance is less in the cases of those countries outside the Eurozone, after 2010, whose average share of the current account balance on GDP is within the range of -4 to 6%, and in those whose average share of public debt on GDP is less than 60%. The criterion of the average share of the budget balance as a percentage of GDP being above, or below -3% does not seem to be relevant, since the estimates of the budget balance are almost identical.

The real interest rate is negative and significant, with the exception of the sub-sample of before 2010. In turn, the real GDP growth rate has a negative and significant impact in Eurozone countries, before 2010, in countries whose average share of the budget balance on GDP is greater than -3%, as well as in countries whose average share of the current account balance on GDP is outside the range of - 4 to 6%, and in countries whose average share of public debt on GDP is less than 60%. For the remaining sub-samples, the effect is not significant.

4.2.4. SUR Relationships

The results of the estimates obtained with the SUR model are shown in Table 12. Comparing the estimates reported in the first column with the estimates obtained using POLS in the first column of Table 8, we find that, in module, the former are higher. This is not surprising, since the SUR procedure considers the interdependence between the variables under study. The estimate of the budget balance is almost double the estimate presented in the first column of Table 8. In particular, the change in the government balance as a percentage of GDP of 1 pp translates into a change of 0.768 pp in the current account balance as a percentage of the GDP, ceteris paribus. The second column of Table 12 points to a positive impact of the current account balance on the budget balance. More specifically, the change in the current account balance as a percentage of GDP in 1 pp results in a change of 0.306 pp in the government balance as a percentage of GDP, ceteris paribus. Combining both results, we can conclude that a bilateral relationship does indeed exist between the budget balance and the current account balance for the European Union countries. This result is in line with the results of the panel Granger causality tests reported in Table 4.

Furthermore, i) the budget balance and real GDP growth rate are positively related, ii) the current account balance negatively affects the real effective exchange rate, the real interest rate, and also the real GDP growth rate, and iii) the budget balance has a positive impact on the real effective exchange rate.

Table 12: Panel SUR Model

Regressors/ Specification	(1)	(2)	(3)	(4)	(5)
	CA	GB	REER	RIR	GR
CA		0.306***	-0.084***	-0.315***	-0.072***
		(0.013)	(0.007)	(0.014)	(0.005)
GB	0.768***		0.081***	0.036	0.186***
	(0.033)		(0.012)	(0.024)	(0.007)
REER	-0.749***	0.288***		-0.190***	-0.008
	(0.065)	(0.041)		(0.046)	(0.014)
RIR	-0.645***	0.029	-0.044***		0.006
	(0.030)	(0.020)	(0.011)		(0.007)
GR	-1.613***	1.668***	-0.021	0.063	
	(0.101)	(0.060)	(0.035)	(0.073)	

Notes: (a) The number of observations is 2,063 in each estimation; (b) Standard errors in brackets; (c) The constant term is estimated, but is omitted for reasons of parsimony; (d) *** denote statistical significance at the 1% level.

4.2.5. Bilateral Relationships

Table 13 shows for each European Union country the estimated coefficients of the fiscal balance and current account balance coefficients in the respective current account balance and fiscal balance equations, using yoy quarterly changes.[5] The results obtained point to the confirmation of the Ricardian Equivalence Hypothesis for Austria, Cyprus, the Czech Republic, Finland, Greece, Hungary, Italy, Malta, Poland, Romania, Slovakia and Sweden. For Denmark, France, Germany, Luxembourg, the Netherlands, Portugal, and the United Kingdom, thus verifying the feedback linkage of Feldstein and Horioka (1980). The twin divergence hypothesis of Kim and Roubini (2008) is found in both directions for Belgium, Bulgaria, Estonia, Ireland, Latvia, Lithuania, Slovenia, and Spain. For Croatia, evidence was only obtained in the direction fiscal balance/current account balance.

[5] For reasons of parsimony, we only present the estimated coefficients for the budget balance and the current account balance. The remaining results are available upon request.

Table 13: Bilateral relationship between GB and CA by country (y-o-y quarterly changes)

		CA Equation			GB Equation		
Country	Obs.	Estimated coefficient of GB	Standard error	R-squared	Estimated coefficient of CA	Standard error	R-squared
Austria	73	-0.045	0.072	0.144	-0.164	0.220	0.217
Belgium	65	-0.473***	0.164	0.254	-0.146**	0.067	0.610
Bulgaria	58	-0.972***	0.254	0.303	-0.210***	0.061	0.308
Croatia	54	-0.406*	0.242	0.087	-0.142	0.099	0.320
Cyprus	61	0.043	0.102	0.092	0.050	0.121	0.182
Czech Republic	58	-0.058	0.089	0.151	-0.081	0.128	0.176
Denmark	57	0.186**	0.092	0.199	0.330*	0.175	0.359
Estonia	69	-0.950**	0.371	0.237	-0.133***	0.046	0.725
Finland	81	-0.112	0.092	0.210	-0.181	0.160	0.540
France	81	0.141***	0.030	0.269	0.720**	0.295	0.477
Germany	69	0.207***	0.052	0.257	0.604***	0.153	0.250
Greece	69	0.119	0.091	0.159	0.322	0.243	0.178
Hungary	56	-0.022	0.123	0.138	-0.022	0.121	0.158
Ireland	69	-0.170**	0.0679	0.045	-0.089**	0.041	0.053
Italy	81	0.008	0.061	0.037	0.020	0.141	0.151
Latvia	77	-1.519***	0.272	0.625	-0.265***	0.036	0.553
Lithuania	81	-0.638**	0.261	0.342	-0.194***	0.063	0.323
Luxembourg	69	0.418*	0.250	0.150	0.116*	0.061	0.170
Malta	61	0.200	0.264	0.285	0.071	0.104	0.341
Netherlands	64	0.311***	0.113	0.168	0.254**	0.100	0.271
Poland	38	-0.145	0.141	0.354	-0.179	0.173	0.260
Portugal	81	0.465***	0.112	0.242	0.458***	0.108	0.472
Romania	58	0.260	0.189	0.302	0.168	0.127	0.340
Slovakia	61	-0.101	0.144	0.120	-0.059	0.096	0.149
Slovenia	81	-0.111**	0.048	0.113	-0.503**	0.192	0.070
Spain	95	-0.325***	0.072	0.387	-0.634***	0.156	0.566
Sweden	95	0.024	0.049	0.198	0.066	0.136	0.191
United Kingdom	88	0.132*	0.074	0.076	0.494*	0.288	0.257

Notes: (a) Robust standard errors reported; (b) *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

5. Conclusions

This paper investigates the relationship between the budget balance and the current account balance for European Union countries with a quarterly data set from 1995 to 2020, using various time series and panel data empirical methodologies.

Using panel Granger causality tests, we conclude that the relationship between both balances is bi-directional, that is to say, that the budget balance and the current account balance influence each other. Performing Granger causality tests to individual countries, we found a variety of results, which corroborate the explanatory perspectives on the relationship between the budget balance and the current account balance.

With regards the panel cointegration tests carried out, the Westerlund tests (2007) point to the existence of a cointegration relationship between the budget balance and the current account balance when the short-run dynamics is maintained fixed. In turn, the Pedroni (2004) cointegration tests suggest the existence of a cointegration relationship between the budget balance, the current account balance, and the real effective exchange rate. In other words, there is a stable long-run relationship underlying the dynamics between the budget balance, the current account balance, and the real effective exchange rate for the full panel.

Additionally, we carry out panel estimates and conclude that: i) the budget balance has a positive impact on the current account balance, ii) the impact of the global financial crisis is negative, iii) belonging to the Eurozone has a positive effect, and iv) after 2010, there is an improvement in the current account balance. Moreover, we find that the impact of the budget balance on the current account balance is greater in the cases of those countries that are in the following situations: being part of the Eurozone, before 2010, having an average share of the current account balance on GDP outside the range of -4 to 6% and an average share of public debt on GDP greater than 60%. Being outside the Eurozone, after 2010, possessing an average share of the current account balance on GDP within the range of -4 to 6%, and when the average share of public debt on GDP is less than 60% results in less impact of the fiscal balance on external accounts. The criterion of the average share of the budget balance as a percentage of GDP being above or below -3% does not seem to be relevant, since the estimates of the budget balance are almost identical.

By using a panel SUR model, we conclude that there is a bilateral link between the budget balance and the current account balance, which confirms the conclusion obtained from the panel Granger causality tests. This result can be explained, as there is a dissociation between saving and investment and these variables are not highly correlated. In this scenario, the fiscal balance and the current account balance move together.

Using yoy quarterly changes for each country taken individually, we find a diversity of results regarding the bilateral impacts between both balances. This diversity of results can be explained from the perspectives of the Ricardian Equivalence Hypothesis, the feedback linkage of Feldstein and Horioka (1980), and the twin divergence hypothesis of Kim and Roubini (2008).

Finally, the empirical results obtained enable us to advance two main conclusions. First, depending on the country, the relationship between the budget balance and the current account balance is different, and, therefore, the economic policy measures that should be adopted to mitigate the macroeconomic imbalances associated with both balances need to be differentiated from country to country. Second, for the European Union as a whole, the relationship between the budget balance and the current account balance is bilateral. Accordingly, given the existence of feedback effects between economies, as a whole, the resolution of imbalances in countries requires the coordination of macroeconomic policies. For it is not sufficient for governments to simply cut the budget deficit in order to reduce the current account, given the existence of a bi-directional relationship between the budget balance and the current account balance. Neither is it advisable for governments to solely strengthen the external competitiveness of their countries' economies by promoting exports.

References

Abell, J. D. (1990), "Twin Deficits the 1980s: An Empirical Investigation", *Journal of Macroeconomics*, Vol. 12, Issue 1, pp. 81-96.

Abrigo, M. R. M. and I. Love (2016), "Estimation of panel vector autoregression in Stata", *The Stata Journal*, Vol. 16, Issue 3, pp. 778-804.

Afonso, A., C. Rault and C. Estay (2013), "Budgetary and external imbalances relationship: a panel data diagnostic", *Journal of Quantitative Economics*, Vol. 11, Issues 1-2, pp. 84-110.

Algieri, B. (2013), "An empirical analysis of the nexus between external balance and Government budget balance: The case of the GIIPS countries", *Economic Systems*, Vol. 37, Issue 2, pp. 233-253.

Badinger, H., A. F. Clairfontaine and W. H. Reuter (2017), "Fiscal Rules and Twin Deficits: The Link between Fiscal and External Balances", *The World Economy*, Vol. 40, Issue 1, pp. 21-35.

Barro, R. J. (1974), "Are Government Bonds Net Wealth?", *Journal of Political Economy,* Vol. 82, Issue 6, pp. 1095-1117.

Barro, R. J. (1989), "The Ricardian Approach to Budget Deficits", *Journal of Economic Perspectives,* Vol. 3, Issue 2, pp. 37-54.

Daly, V. and J. U. Siddiki (2009), "The twin deficits in OECD countries: cointegration analysis with regime shifts", *Applied Economic Letters,* Vol. 16, Issue 11, pp. 1155-1164.

Darrat, A. (1988), "Have Large Budget Deficits Caused Rising Trade Deficits?", *Southern Economic Journal,* Vol. 54, Issue 4, pp. 879-887.

Dibooglu, S. (2007), "Accounting for US current account deficits: an empirical investigation", *Applied Economics,* Vol. 29, Issue 6, pp. 787-793.

Dickey, D. A. and W. A. Fuller (1979), "Distribution of the Estimators for Autoregressive Time Series With a Unit Root", *Journal of the American Statistical Association*, Vol. 74, Issue 366, pp. 427-431.

Driscoll, J. C. and A. C. Kraay (1998), "Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data", *The Review of Economics and Statistics*, Vol. 80, Issue 4, pp. 549–560.

European Commission (2016). "The Macroeconomic Imbalance Procedure. Rationale, Process, Application: A Compendium", Institutional Paper 039, November.

Feldstein, M. and C. Horioka (1980), "Domestic Saving and International Capital Flows", *The Economic Journal,* Vol. 90, Issue 358, pp. 314-329.

Fidrmuc, J. (2003), "The Feldstein–Horioka Puzzle and Twin Deficits in Selected Countries", *Economic Changing and Restructuring,* Vol. 36, Issue 2, pp. 135-152.

Fleming, J. M. (1962), "Domestic Financial Policies under Fixed and under Floating Exchange Rates", *Staff Papers - International Monetary Fund,* Vol. 9, November, pp. 369-379.

Forte, F. and C. Magazzino (2013), "Twin Deficits in the European Countries", *International Advances in Economic Research,* Vol, 19, Issue 3, pp. 289-310.

Granger, C. W. J. (1969), "Investigating Causal Relations by Econometric Models and Cross-spectral Methods", *Econometrica,* Vol. 37, Issue 3, pp. 424-438.

Janko, S. (2020), "On the relationship between the current account and the fiscal balance: The case of Canada", *North American Journal of Economics and Finance,* Vol. 54, November, 101241.

Kalou, S. and S. – M. Paleologou (2012), "The twin deficits hypothesis: Revisiting an EMU country", *Journal of Policy Modelling*, Vol. 34, Issue 2, pp. 230-241.

Kaufmann, S., J. Scharler and G. Winckler (2002), "The Austrian current account deficit: Driven by twin deficits or by intertemporal expenditure allocation?", *Empirical Economics*, Vol. 27, Issue 3, pp. 529-542.

Kim, S. and N. Roubini (2008), "Twin deficit or twin divergence? Fiscal policy, current account, and real exchange rate in the U.S.", *Journal of International Economics*, Vol. 74, Issue 2, pp. 362-383.

Litsios, I. and L. Pilbeam (2017), "An empirical analysis of the nexus between investment, fiscal balances and current account balances in Greece, Portugal and Spain", *Economic Modelling*, Vol. 63, June, pp. 143-152.

Makin, A. J. and P. K. Narayan (2013), "Re-examining the "twin deficits" hypothesis: evidence from Australia", *Empirical Economics*, Vol. 45, Issue 2, pp. 817-829.

McFarlane, A., Y. C. Jung and A. Das (2020), "The dynamics among domestic saving, investment, and the current account balance in the USA: a long run perspective", *Empirical Economics*, Vol. 58, Issue 4, pp. 1659-1680.

Mundell, R. A. (1960), "The Monetary Dynamics of International Adjustment under Fixed and Flexible Exchange Rates", *Quarterly Journal of Economics*, Vol. 74, May, pp. 227-257.

Nikiforos, M., L. Carvalho and C. Schoder (2015), ""Twin deficits" in Greece: in search of causality", *Journal of Post Keynesian Economics*, Vol. 38, Issue 2, pp. 302-330.

Pedroni, P. (2004), "Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis", *Econometric Theory*, Vol. 20, Issue 3, pp. 597-625.

Pesaran, M. H. (2004), "General Diagnostic Tests for Cross Section Dependence in Panels", Discussion Paper No. 1240, Institute for the Study of Labor (IZA), August.

Pesaran, M. H. (2007), "A simple panel unit root test in the presence of cross-section dependence", *Journal of Applied Econometrics*, Vol. 22, Issue 2, pp. 265-312.

Phillips, P. C. B. and P. Perron (1988), "Testing for a unit root in time series regression", *Biometrika*, Vol. 75, Issue 2, pp. 335-346.

Piersanti, G. (2000), "Current account dynamics and expected budget deficits: some international evidence", *Journal of International Money and Finance*, Vol. 19, Issue 2, pp. 255-271.

Rosenweig, J. A. and E. W. Tallman (1993), "Fiscal Policy and Trade Adjustment: are the deficits really twins?", *Economic Inquiry*, Vol. 31, Issue 4, pp. 580-594.

Salvatore, D. (2006), "Twin deficits in the G-7 countries and global structural imbalances", *Journal of Policy Modelling*, Vol. 28, Issue 6, pp. 701-712.

Summers, L. H. (1988), "Tax Policy and International Competitiveness", International Aspects of Fiscal Policies, J. Frankel (ed.), Chicago University Press.

Trachanas, E. and C. Katrakilidis (2013), "The dynamic linkages of fiscal and current account deficits: New evidence from five highly indebted European countries accounting for regime shifts and asymmetries", *Economic Modelling*, Vol. 31, Issue 1, pp. 502-510.

Vamvoukas, G. A. (1999), "The twin deficits phenomenon: evidence from Greece", *Applied Economics*, Vol. 31, Issue 9, pp. 1093-1100.

Westerlund, J. (2007), "Testing for Error Correction in Panel Data", *Oxford Bulletin of Economics and Statistics*, Vol. 79, Issue 6, pp. 709-748.

Zellner, A. (1962), "An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias", *Journal of the American Statistical Association*, Vol. 57, Issue 298, pp. 348-368.

Appendix

Table A1: Pesaran (2004) cross-sectional dependence test

Variable	CD test	P-value
CA	33.07	0.000
GB	65.136	0.000
REER	58.216	0.000
RIR	125.069	0.000
GR	107.486	0.000

Notes: (a) The null hypothesis is cross-section independence; (b) Under the null hypothesis, all the statistics follow a standard normal distribution.

Table A2: Pesaran (2007) Panel Unit Root Tests in levels

Variable	Lags	CIPS*	p-value
CA	p=1	-3.399	0.000
	p=2	-5.168	0.000
	p=3	-5.903	0.000
	p=4	-0.807	0.210
GB	p=1	-2.155	0.016
	p=2	-3.360	0.000
	p=3	-4.438	0.000
	p=4	-0.400	0.345
REER	p=1	-24.038	0.000
	p=2	-20.391	0.000
	p=3	-14.417	0.000
	p=4	-15.017	0.000
RIR	p=1	-8.829	0.000
	p=2	-9.232	0.000
	p=3	-3.154	0.001
	p=4	-5.350	0.000
GR	p=1	-9.468	0.000
	p=2	-7.674	0.000
	p=3	-9.634	0.000
	p=4	-5.583	0.000

Notes: (a) The null hypothesis is non-stationary; (b) CIPS* is the Cross-section augmented Im-Pesaran-Shin statistical test.

Table A3: Pesaran (2007) Panel Unit Root Tests in first differences

Variable	Lags	CIPS*	p-value
CA	p=1	-15.754	0.000
	p=2	-11.729	0.000
	p=3	-18.774	0.000
	p=4	-11.481	0.000
GB	p=1	-20.909	0.000
	p=2	-14.978	0.000
	p=3	-19.980	0.000
	p=4	-13.608	0.000
REER	p=1	-25.585	0.000
	p=2	-25.585	0.000
	p=3	-25.541	0.000
	p=4	-25.356	0.000
RIR	p=1	-24.893	0.000
	p=2	-24.094	0.000
	p=3	-16.623	0.000
	p=4	-13.914	0.000
GR	p=1	-25.196	0.000
	p=2	-21.317	0.000
	p=3	-21.583	0.000
	p=4	-17.921	0.000

Notes: (a) The null hypothesis is non-stationary; (b) CIPS* is the Cross-section augmented Im-Pesaran-Shin statistical test.

Table A4: Unit Root Tests by country

		CA				GB			
		Levels		First differences		Levels		First differences	
Country	Sample Period	ADF	PP	ADF	PP	ADF	PP	ADF	PP
Austria	2001Q4-2020Q4	-2.139	-1.856	-7.056***	-7.035***	-1.575	-2.034	-5.185***	-5.667***
Belgium	2003Q4-2020Q4	-3.938***	-3.277***	-6.321***	-6.354***	-0.878	-1.257	-7.125***	-7.428***
Bulgaria	1999Q4-2020Q4	-1.508	-1.342	-5.048***	-5.109***	-2.571	-2.528	-7.924***	-7.943***
Croatia	2000Q4-2020Q4	-1.203	-1.190	-7.606***	-7.586***	-2.304	-1.859	-5.152***	-5.281***
Cyprus	2004Q4-2020Q4	-1.780	-1.811	-6.707***	-6.755***	-3.206	-3.189**	-9.480***	-9.495***
Czech Republic	1999Q4-2020Q4	-1.079	-1.076	-8.111***	-8.192***	-1.756	-1.758	-6.617***	-6.787***
Denmark	2005Q4-2020Q4	-1.445	-1.188	-4.462***	-4.287***	-2.204	-1.769	-4.637***	-4.436***
Estonia	2002Q4-2020Q4	-1.866	-1.497	-4.987***	-5.164***	-2.025	-1.908	-5.978***	-6.087***
Finland	1999Q4-2020Q4	-0.864	-0.872	-8.024***	-8.145***	-1.368	-0.961	-4.714***	-4.756***
France	1999Q4-2020Q4	-2.433	-3.232**	-7.525***	-7.491***	-0.899	-1.359	-4.289***	-4.352***
Germany	2002Q4-2020Q4	-1.398	-1.352	-4.810***	-5.014***	-2.077	-1.742	-3.743***	-3.814***
Greece	2002Q4-2020Q4	-1.193	-1.036	-5.217***	-5.255***	-2.065	-1.907	-5.975***	-6.145***
Hungary	1999Q4-2020Q4	-1.170	-0.943	-5.747***	-5.862***	-1.612	-1.777	-6.800***	-6.972***
Ireland	2002Q4-2020Q4	-3.215**	-3.578***	-8.008***	-8.152***	-1.383	-1.554	-7.425***	-7.648***
Italy	1999Q4-2020Q4	-1.028	-0.741	-5.162***	-5.302***	-2.248	-1.330	-4.236***	-4.415***
Latvia	2000Q4-2020Q4	-2.785*	-1.580	-3.073**	-3.453***	-1.920	-1.916	-6.226***	-6.397***
Lithuania	1999Q4-2020Q4	-1.702	-1.228	-4.600***	-4.863***	-1.522	-1.638	-6.610***	-6.831***
Luxembourg	2002Q4-2020Q4	-5.109***	-4.710***	-8.409***	-8.488***	-1.911	-1.882	-5.154***	-5.326***
Malta	2004Q4-2020Q4	-1.800	-1.686	-6.429***	-6.551***	-0.790	-1.366	-7.270***	-7.692***
Netherlands	2004Q1-2020Q4	-1.835	-2.338	-9.226***	-9.158***	-2.196	-1.805	-3.842***	-3.969***
Poland	2004Q4-2020Q4	-0.053	0.005	-4.296***	-4.381***	-2.274	-2.020	-5.346***	-5.423***
Portugal	1999Q4-2020Q4	-1.153	-0.769	-4.336***	-4.367***	-1.867	-2.067	-8.549***	-8.658***
Romania	1999Q4-2020Q4	-1.958	-1.475	-4.639***	-4.785***	-1.510	-2.140	-12.969***	-12.870***
Slovakia	2004Q4-2020Q4	-1.707	-1.760	-6.815***	-6.931***	-3.585***	-2.009	-3.760***	-3.997***
Slovenia	1999Q4-2020Q4	-0.416	-0.420	-7.344***	-7.542***	-2.063	-2.335	-8.414***	-8.532***
Spain	1995Q4-2020Q4	-1.693	-0.899	-3.230**	-3.520***	-1.325	-1.372	-3.986***	-3.996***
Sweden	1995Q4-2020Q4	-1.522	-1.595	-7.257***	-7.411***	-2.726*	-3.584***	-4.927***	-4.903***
United Kingdom	1998Q1-2020Q4	-1.904	-1.880	-7.090***	-7.181***	-1.369	-1.013	-4.611***	-4.614***

Notes: (a) The null hypothesis of ADF and PP tests is the presence of a unit root; (b) Both tests are carried out with a constant; (c) In ADF tests at levels, we consider 1 lag; (d) In PP tests, spectral estimation method is based on Bartlett kernel and the bandwith is automatically selected following the Newey-West method; (e) The test statistics are reported; (f) *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

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