INFER
INTERNATIONAL NETWORK FOR ECONOMIC RESEARCH

INFER WORKING PAPER SERIES

INTERNATIONAL NETWORK FOR ECONOMIC RESEARCH

No. 12 | 2021

Fiscal and current account imbalances: the cases of Germany and Portugal

António Afonso *(Universidade de Lisboa)*
José Carlos Coelho *(Universidade de Lisboa)*

Website:
https://infer-research.eu/

Contact:
publications@infer.info

Fiscal and current account imbalances: the cases of Germany and Portugal*

António Afonso,[$] José Carlos Coelho[#]

December 2021

Abstract

We investigate the bilateral relationship between government budget balances and current account balances for Portugal and Germany. We find that the response of the current account balance to the budget balance is greater in Portugal than in Germany. On the other hand, the response of the budget balance to the current balance is higher in Germany than in Portugal. In Portugal and Germany, a fiscal rules index has a negative impact on the current account balance and the government effectiveness index has a positive impact on the government balance. The public debt as a percentage of GDP positively affects the current account balance in Portugal, and in Germany it does not. During the period of implementation of the external assistance programme in Portugal, the current account balance improved, while the government balance did not.

Keywords: budget deficit; external deficit; Portugal; Germany; fiscal rules; time-series
***JEL* codes**: F32, F41, H62, C31, C32

* This work was supported by the FCT (*Fundação para a Ciência e a Tecnologia*) [grant number UIDB/05069/2020]. The opinions expressed herein are those of the authors and not necessarily those of their employers.
[$] ISEG - Lisbon School of Economics & Management, Universidade de Lisboa; REM/UECE. R. Miguel Lupi 20, 1249-078 Lisbon, Portugal. Email: aafonso@iseg.ulisboa.pt.
[#] ISEG - Lisbon School of Economics & Management, Universidade de Lisboa; REM/UECE. R. Miguel Lupi 20, 1249-078 Lisbon, Portugal. Email: jcarlosmcoelho@phd.iseg.ulisboa.pt. Corresponding author.

1. Introduction

The relationship between the budget balance and the current account balance is one of the most studied topics in applied macroeconomics. In the 1980s, the United States had significant budget deficits and current account deficits, and the relationship between both variables deserved the attention of researchers. Since then, many empirical studies on this topic have been published, although the conclusions obtained are different. Depending on the sample, period and empirical method, the results differ, which is in line with the explanatory perspectives on the relationship between the budget balance and the current account balance. Therefore, there is no consensus on the relationship between both balances. In this regard, see the Šuliková and Gazda (2016) ´s work, which it is an extensive empirical literature review on the relationship between the budget balance and the current account balance.

In the context of participation in the Economic and Monetary Union (EMU), Portugal and Germany exhibited until 2010 different dynamics with regard to the evolution of the external position of their economies as well as the budgetary position. Portugal recorded high budget and external deficits and increasing levels of public and external debt, while Germany had significant external surpluses and its public and external debts remained under control. From 2010, external deficits in Portugal decreased considerably and budget deficits were reduced, and, in the context of the Eurozone, the external imbalances of the economies vanished.

The aim of this article is to carry out a comparative analysis between Portugal and Germany regarding the existence of a bidirectional relationship between the budget balance and the current account balance and the role of a set of explanatory factors on both balances, using quarterly data. More specifically, it is intended to identify similar and distinct elements in the developments of the budget balance and the current account balance for Portugal and Germany, and, as a result, to propose economic policy recommendations. This constitutes the novelty of our empirical investigation. In order to do so, and assuming that there is interdependence between the variables under study, we resorted to several econometric methodologies, namely the Granger Causality Test (1969), ARDL (Autoregressive Distributed Lags) models, IV (Instrumental Variables) estimations and SUR (Seemingly Unrelated Regressions) models.

The paper is organized as follows. Section 2 is a brief literature review and in section 3 we present the methodological framework. Section 4 describes the data. Section 5 reports and discusses the results. Section 6 concludes.

2. Literature

The literature puts forward five explanatory perspectives on the relationship between the budget balance and the current account balance. The Twin Deficit Hypothesis, advanced by Mundell (1960) and Fleming (1962) and present in the Keynesian Absorption Theory, suggests that budget deficits result in deteriorating external accounts. The Ricardian Equivalence Hypothesis, developed in Barro (1974, 1989), points to the absence of a relationship between both deficits. According to the Current Account Targeting Hypothesis, from Summers (1988), the worsening of the external deficit translates into a deterioration of the budget balance, with the direction of the linkage between the variables being contrary to that of the Twin Deficit Hypothesis. The feedback linkage of Feldstein and Horioka (1980) holds that the relationship between the budget balance and the external balance is bi-directional, that is, it materializes in both directions. Finally, the twin divergence hypothesis of Kim and Roubini (2008) states that both deficits move in the opposite directions.

The empirical studies applied to the relationship between the budget balance and the current account balance generally use panel data methodologies, considering a large sample of countries, and analysis time series, for one or several countries. Thus, there are examples of studies applied to individual countries. In this regard, Darrat (1988), Abell (1990), Rosenweig and Tallman (1993), Dibooglu (2007), Kim and Roubini (2008) and McFarlane *et al.* (2020) have as empirical scope the United States and obtain different evidence. More specifically, Darrat (1988) finds that the relationship between both balances is bi-directional. Abell (1990), Rosenweig and Tallman (1993), Dibooglu (2007) and McFarlane *et al.* (2020) corroborate the Twin Deficit Hypothesis.

Kim and Roubini (1998), in turn, conclude that there is a twin divergence between the budget balance and the current account balance. Greece is also the subject of empirical analysis in Vamvoukas (1999), Kalou and Paleologou (2012) and Nikiforos *et al.* (2015), with verification of the Twin Deficit Hypothesis in the first study and the Current Account Targeting Hypothesis in the others. Kaufman *et al.* (2002) reject the Twin Deficit Hypothesis for Austria and Makin and Narayan (2013) and Janko (2020) obtain empirical support for the Twin Deficit Hypothesis for Australia and Canada, respectively. Finally, Afonso *et al.* (2020) report that for 65 countries over the period 1985-2015, the twin-deficits hypothesis is confirmed, and the impact of the budget balance on the current account balance is increased when fiscal rules are considered.

3. Methodological framework

3.1. The Macro identity

The link between the current account balance (*CA*) and the government budget balance (*GB*) stems from the standard macro identity:

$$Y \equiv C + I + G + X - M \tag{1}$$

where *Y* is domestic output, *C* is private consumption expenditure, *I* is private investment, *G* is government expenditure, *X* are exports of goods and services, and *M* are imports of goods and services. Using the definition of national income (*R*) and net factor income (*NFI*) from the rest of the world we have:

$$R \equiv Y + NFI. \tag{2}$$

Therefore, disposable income $(R - T)$ is consumed or saved:

$$R \equiv C + S + T \tag{3}$$

where S denotes private saving and *T* taxes and the *CA* is the sum of the trade balance $(X - M)$ and *NFI*:

$$CA \equiv (X - M) + NFI. \tag{4}$$

From the previous relationships, the CA is defined as the sum of net private saving (net lending position of the private sector) and net public saving, the general government balance, $(GB = T - G)$:

$$CA \equiv (S - I) + (T - G). \tag{5}$$

Hence, fiscal shocks could drive the current account in the same direction. In particular, a government budget deficit ($T - G < 0$) would imply a current account deficit ($CA < 0$). Naturally, this argument holds when the government budget is not fully financed by domestic private saving and needs to be financed by foreign capital inflows. However, a budget deficit can lead to an increase in the net lending position of the private sector to such an extent that there is no effect on the current account balance – or the latter may even move towards an opposite direction and turn positive, resulting in a "twin divergence".

3.2. Empirical methodology

In this article, we develop several empirical methodologies. The first methodology is the Granger Causality Test (1969), whose objective is to verify the existence and direction of the linkage between the budget balance and the current account balance. The Granger Causality

Wald tests carried out in the framework of a VAR model aim to determine whether the inclusion of lagged observations of the general government balance as a percentage of GDP (current account as a percentage of GDP) reduces the forecast error of the current account balance as a percentage of GDP (general government balance as a percentage of GDP). The purpose is to know whether the budget balance (current account balance) is predicted by the current account (budget balance) by comparing with a model that only includes past observations of the current account balance as a percentage of GDP (general government balance as a percentage of GDP).

More specifically, we check if 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 have the following form:

$$CA_t = \alpha_0 + \sum \alpha_i GB_{t-i} + \sum \beta_j CA_{t-j} + \mu_{1t}, \quad (6)$$

$$GB_t = \gamma_0 + \sum \gamma_i CA_{t-i} + \sum \delta_j GB_{t-j} + \mu_{2t}. \quad (7)$$

The null hypothesis are: GB_t does not Granger cause CA_t in equation (6), and CA_t does not Granger cause GB_t in equation (7). μ_{1t} and μ_{2t} are the random disturbance terms of the equations (6) and (7), respectively.

The second methodology followed consists of estimating ARDL (Autoregressive Distributed Lags) models, based on Pesaran and Shin (1999), to examine the existence of a bi-directional long-term relationship between the budget balance and the current account balance, admitting the presence of other relevant explanatory variables, namely the real effective exchange rate, the real interest rate and the real GDP growth rate. The use of this methodology is essentially justified because the series under study have different integration orders (the series of the government balance and the effective real exchange rate are stationary in levels and the remaining series are only stationary in first differences). Regarding the dynamic behaviour of current variables, this model considers the past disequilibrium (error-correction term) as an explanatory variable and explores the impact of short run movements and tests the existence of a long run relationship between determinants. If there is a cointegration relationship between the variables under analysis, this implies that these variables do not drift arbitrarily over time, but rather move closely together.

The representation between the general government balance (current account balance) and its explanatory variables is given by:

$$Y_t = \alpha_0 + \theta_1 Y_{t-1} + \ldots + \theta_p Y_{t-P} + \beta_{i0} X_{it} + \ldots + \beta_{ip} X_{it-p} + \mu_t \quad (8)$$

where Y_t is the dependent variable (general government balance as a percentage of GDP or current account balance as a percentage of GDP); X_i is a vector of k explanatory variables; and p is the lag length. With this specification, the model can be rewritten to define the short run dynamics and the cointegrated vector:

$$\Delta Y_t = \beta_0 + \sum_{p=1}^{n-1} \gamma_p \Delta Y_{t-p} + \sum_{p=0}^{n-1} \sigma_{1p} \Delta X_{1t-p} + \sum_{p=0}^{n-1} \sigma_{2p} \Delta X_{2t-p} + \ldots + \sum_{p=0}^{n-1} \sigma_{kp} \Delta X_{kt-p} + \varphi_1 ECT_{t-1} + \varepsilon_t \quad (9)$$

where p is the lag length; and σ_{ki} are the short run impacts of each respective explanatory variables. The error correction vector is given by $ECT_{t-1} = Y_{t-1} - \sum_{i=1}^{k} \omega_i X_{it-1}$.

The error correction vector captures the disequilibrium in the last period, where φ_1 indicates the long run speed of adjustment. The long run coefficients for each variable are given by ω_i.

As a third methodology, we estimate multivariate IV (Instrumental Variables) models considering the year-on-year (y-o-y) quarterly changes of the variables, assessing the impact of the general government balance on the current account balance and the impact of the current account balance on general government balance, both as a percentage of GDP. The use of the IV method to determine the bilateral impacts between both balances allow us to control the endogenous nature of the budget balance and the current account balance. In this exercise, we consider a set of control variables commonly used in the literature. Through yoy quarterly changes of the variables, we guarantee the stationarity of the series under study, and, thus, the robustness of the estimates.

The baseline specifications of this analysis are as follows:

$$CA_t = \beta_0 + \beta_1 GB_t + \beta_2 REER_t + \beta_3 RIR_t + \beta_4 GR_t + \varepsilon_t, \quad (10)$$

$$GB_t = \theta_0 + \theta_1 CA_t + \theta_2 REER_t + \theta_3 RIR_t + \theta_4 GR_t + \varphi_t. \quad (11)$$

where CA_t is the current account balance-to-GDP ratio in year *t* (*t* = 1, …, *T*); GB_t is the general government balance-to-GDP in year *t*; $REER_t$ is the real effective exchange rate in year *t*; RIR_t is the real interest rate in year *t*; GR_t is the real GDP growth rate in year *t*; and ε_t and φ_t are the random disturbance terms in year *t*.

Finally, we estimate SUR (Seemingly Unrelated Regressions) models taking as endogenous variables the budget balance, the current account balance, the real effective exchange rate, the real interest rate and the real GDP growth rate. In the SUR model, we assume that the disturbances from the different regressions are correlated due to common unobservable

factors. The main advantage of this methodology, proposed by Zellner (1962), lies in the fact that, by assuming interdependence between the variables that integrate the system of equations, it avoids specification errors and it is more efficient when compared with the single-equation approach. The econometric specification consists of a system of five equations describing the empirical interdependence between the relevant endogenous variables.

4. Data

The dependent variables under study are the current account balance as a percentage of GDP (CA) and the general government balance as a percentage of GDP (GB). Moreover, we consider the following determinants as explanatory variables in the models: real effective exchange rate (REER), real interest rate (RIR), real GDP growth rate (GR), public debt as a percentage of GDP (D), fiscal rules index (FR), and government effectiveness index (GOV).

We also considered several dummy variables, namely: DGFC (assumes the value 1 in the first quarter of 2009, when the global financial crisis (GFC) broke out); D2010 (assumes the value 1 from the first quarter of 2010); and DTROIKA (takes the value 1 in the quarters in which the economic and financial adjustment programme in Portugal was implemented, between 2011Q2 and 2014Q2).

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. In addition, the real effective exchange rate was obtained through the relative variation of an exchange rate index based in 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 as well as the public debt as a percentage of GDP are retrieved from Eurostat. The fiscal rules index is obtained from the European Commission website and the government effectiveness index comes from the Worldwide Governance Indicators website.

The period under analysis for Portugal is between 1999Q4 and 2020Q4 and for Germany it is between 2002Q4 and 2020Q4.

Regarding the existing thresholds that the European Union set in 2011 in the context of the Macroeconomic Imbalances Procedure (MIP), a three year backward moving average of the current account as a percentage of GDP, with thresholds of -4% and 6%, we can highlight some facts. First, until the 2011, Portugal was outside that corridor, with CA deficits. Second, Germany was also outside the corridor, for most of the period under analysis, reporting CA surpluses (see Figures 1 and 2).

Figure 1: Evolution of CA and GB, Portugal, 1999Q4-2020Q4 (% of GDP)

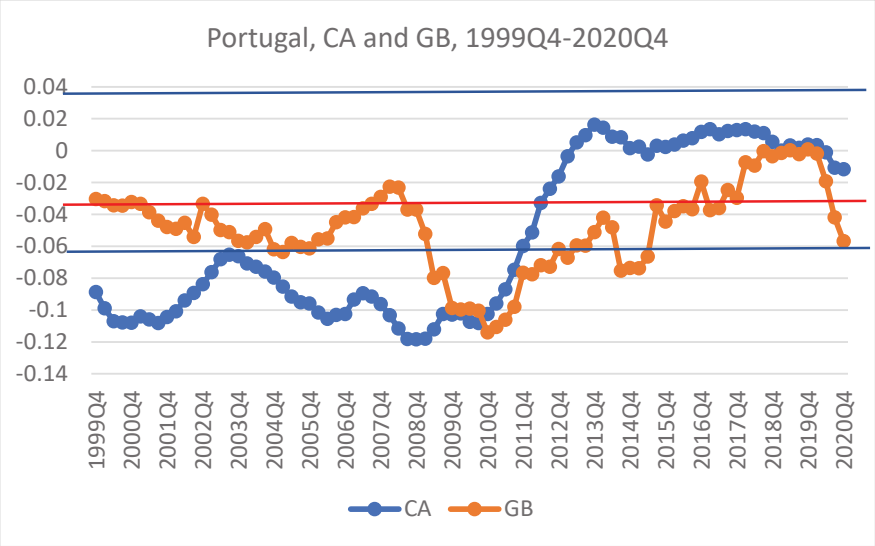
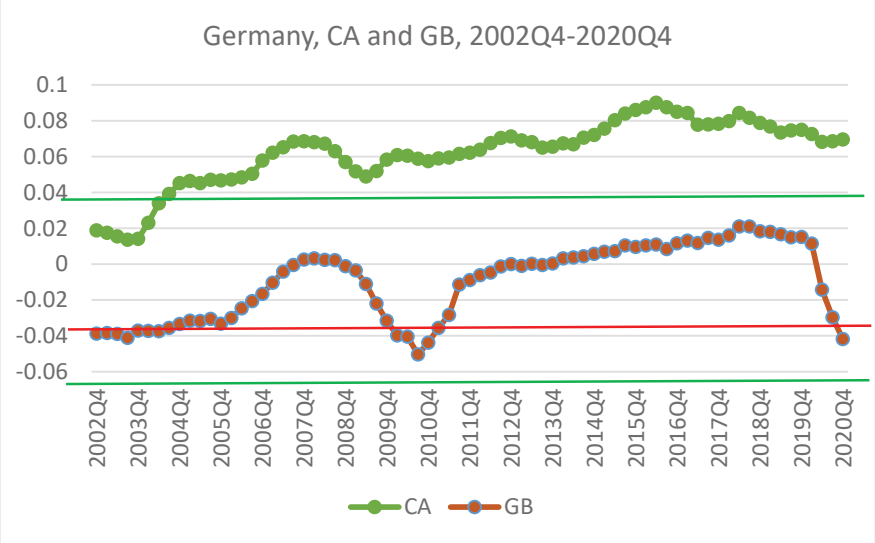


Figure 2: Evolution of CA and GB, Germany, 2002Q4-2020Q4 (% of GDP)



In the Appendix, we report descriptive statistics and correlation matrices between the variables employed in the study for Portugal and Germany as well as the results of the unit roots tests, without and with breakpoints (see Tables A1-A8). Also in the Appendix, we illustrate the breakdown of GDP from the perspective of expenditure and the general government balance breakdown into total revenues and expenditures, on an annual basis (see Figures A1-A4).

5. Results

5.1. Granger Causality Tests

In order to carry out the Multivariate Granger Causality Wald Tests for Portugal and Germany, we performed pre-estimation tests first to select the order of the VAR models, considering a maximum lag order selection of eight. For each model VAR estimated, the optimal number of lags obtained was four, using the criterion FPE (Final Prediction Error). As there are variables *I(1)* in each VAR model, these tests were implemented considering the variables in first differences.

Table 1: Granger Causality Tests

Country	Null Hypothesis (H0)	Obs.	Lags	Wald statistic	*p-value*
Portugal	D.GB does not Granger cause D.CA	76	8	14.378	0.072*
	D.CA does not Granger cause D.GB			25.711	0.001***
Germany	D.GB does not Granger cause D.CA	66	6	12.874	0.045**
	D.CA does not Granger cause D.GB			12.311	0.055*

Notes: (a) The optimal number of lags was chosen based on FPE (Final Prediction Error) criterion; (b) *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table 1 shows that for Portugal at six lags and for Germany at eight lags there is Granger causality in both directions between the budget balance and the current account balance, at the 10% level of significance. This result suggests the existence of a bilateral relationship between both balances, and, therefore, the verification of the feedback linkage advanced by Feldstein and Horioka (1980).

5.2. ARDL Models

For Portugal, in the context of the implemented ARDL model, Table 2 reports the long run estimates and Table 3 shows the estimates of the short run dynamics and the error correction

term, where the dependent variable is the general government balance as a percentage of GDP.[1] In the long-term, the current account balance as a percentage of GDP and the real GDP growth rate are highly significant, and the real interest rate is significant at a 5% level. In addition, the impact of the real effective exchange rate is non-significant. Results of the Pesaran *et al.* (2001) ARDL Bounds Test indicate that the null hypothesis of no long-term cointegration relationship in levels is rejected at a 1% level of significance, with F-statistic of 6.892 and t-statistic of -4.425. We can thus conclude that there is a cointegration relationship between the general government balance as a percentage of GDP, the current account balance as a percentage of GDP, the real interest rate, and the real GDP growth rate, for Portugal.

In addition, Table 2 also shows that the impact of the current account balance as a percentage of GDP on the general government balance as a percentage of GDP is positive. More specifically, the 1 pp change in the current account balance as a percentage of GDP translates into a 0.6 pp change on the budget balance as a percentage of GDP, ceteris paribus. The signs of the real interest rate and the real GDP growth rate are positive and suggest that higher real interest rates and economic growth induce public savings, through lower interest paid on public debt and higher tax revenues.

In the short-term dynamics, reported by Table 3, the real GDP growth rate in first differences has a negative effect on the government balance as a percentage of GDP in first differences, at a 5% level of significance. The estimate of speed of long run adjustment is -0.195, indicating that every period 19.5% of disequilibrium between the current account balance and the government balance is eliminated, and in six quarters the total deviation from equilibrium is eliminated.

In terms of the qualitative impact of the variables on the government balance, the long run effects are very different from the short run dynamics, which suggests that the short term and long-term dynamics of the government balance could be different for Portuguese economy. Unlike the results in Table 2, the current account balance and the real interest rate are not determinants of the government balance in the short run. The real GDP growth rate has a positive effect on long-term, and, in the short run, the impact is negative.

[1] We also tested the existence of a cointegration relationship, within the framework of an ARDL model, between the current account balance and the budget balance for Portugal and between the budget balance and the current account balance for Germany, however, there is no cointegration relationship or the results are not robust.

Table 2: ARDL Model – Long Run Impact, dependent variable: government balance, Portugal, 1999Q4-2020Q4

Variable	Coefficient	t statistic
CA	0.6***	4.07
REER	0.814	1.49
RIR	1.041**	2.6
GR	3.091***	3.44

Notes: (a) Government balance as a percentage of GDP; (b) The number of observations is 84; (c) ** and *** denote statistical significance at the 5% and 1% level, respectively.

Table 3: ARDL Model – Short Run Dynamics and Cointegration Vector, dependent variable: government balance, Portugal, 1999Q4-2020Q4

Variable	Coefficient	t statistic
D.GR$_t$	-0.453**	-2.29
Cointegration Equation φ	-0.195***	-4.42

Notes: (a) First difference of the government balance as a percentage of GDP; (b) Constant term estimated but omitted for reasons of parsimony; (c) ** and *** denote statistical significance at the 5% and 1% level, respectively.

In turn, for Germany, according to the ARDL model that we have implemented, Table 4 reports the long run estimates and Table 5 shows the estimates of the short run dynamics and the error correction term, where the dependent variable is current account balance as a percentage of GDP. In the long-term, just the government balance as a percentage of GDP is highly significant. The remaining independent variables (real effective exchange rate, real interest rate and real GDP growth rate) are non-significant. Results of the Pesaran *et al.* (2001) ARDL Bounds Test indicate that the null hypothesis of no long-term cointegration relationship in levels is rejected at a 5% level of significance, with F-statistic of 2.995 and t-statistic of -3.631. We can thus conclude that there is a cointegration relationship between the current account balance and the general government balance, both as a percentage of GDP, for the German economy.

Additionally, Table 4 also shows that the impact of the government balance as a percentage of GDP on the current account balance as a percentage of GDP is positive. More specifically, the 1 pp change in the budget balance as a percentage of GDP corresponds to a 0.497 pp change in the current account balance as a percentage of GDP, ceteris paribus.

Based on Table 5, in the short-term dynamics, the current account balance in first differences lagged by one period has a positive and highly significant impact on the current account balance in first differences, which shows the persistence of the variable. The real GDP

growth rate in first differences has, in turn, a positive and highly significant effect on the current account balance in first differences. This result allows us advance that, in the short run, real GDP growth in Germany results from the growth of exports, which, in turn, positively influences the current account balance. In addition, the estimate of speed of long run adjustment is -0.098, indicating that every period 9.8% of disequilibrium between the budget balance and the current account balance is eliminated. This is a very slow speed of adjustment, since just in eleven quarters the total deviation from equilibrium is eliminated.

Finally, in terms of the qualitative impact of the variables on the current account balance, the long run effects are very different from the short run dynamics, which suggests that the short term and long-term dynamics of the current account balance for Germany could be different. On the contrary to the results of Table 4, the government balance is not determinant of the current account balance in the short-term. The real GDP growth rate in first differences has a positive effect on the short run, and, in the long term, the variable does not influence the current account balance.

Table 4: ARDL Model – Long Run Impact, dependent variable: current account balance, Germany, 2002Q4-2020Q4

Variable	Coefficient	t statistic
GB	0.497***	3.22
REER	0.123	0.54
RIR	-0.282	-1.51
GR	0.199	0.45

Notes: (a) Current account balance as a percentage of GDP; (b) The number of observations is 72; (c) ** and *** denote statistical significance at the 5% and 1% level, respectively.

Table 5: ARDL Model – Short Run Dynamics and Cointegration Vector, dependent variable: current account balance, Germany, 2002Q4-2020Q4

Variable	Coefficient	t statistic
D.CA$_{t-1}$	0.572***	6.41
D.GR$_t$	0.233***	3.98
Cointegration Equation φ	-0.098***	-3.63

Notes: (a) First difference of the current account balance as a percentage of GDP; (b) Constant term estimated but omitted for reasons of parsimony; (c) *** denotes statistical significance at the 1% level, respectively.

5.3. IV Estimates

According to regression (1) in Table 6, for Portugal, the budget balance has a positive and highly significant impact on the current account balance. More specifically, the change in the budget balance as a percentage of GDP in 1 pp translates into the change in the current

account balance as a percentage of GDP by 0.55 pp, ceteris paribus. In regressions (1)-(7), the real effective exchange rate and the real GDP growth rate have no effect on the current account balance and the real interest rate has a negative and highly significant effect. Additionally: (i) the public debt as a percentage of GDP has a positive and highly significant effect, which points to the existence of a Ricardian effect by private agents of the Portuguese economy; (ii) the global financial crisis, which began in the first quarter of 2009, has a negative and highly significant effect; (iii) from the first quarter of 2010, there is an improvement in the current account balance; (iv) the fiscal rules index has a negative and highly significant effect; (v) the government effectiveness index is not significant; and (vi) during the period of the Troika's economic and financial adjustment programme, the current account balance improved by 0.034 pp. Note that in regression (7) and compared to regression (1), the estimate of the budget balance is reduced to about half after the introduction of the dummy variable that takes the value 1 in the quarters in which the Troika´s programme was implemented.

Table 6: Current account balance, Portugal, 2000Q4-2020Q4 (yoy quarterly changes)

Regressors/ Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GB	0.550***	0.736***	0.547***	0.507***	0.796***	0.608***	0.272***
	(0.164)	(0.099)	(0.163)	(0.167)	(0.218)	(0.159)	(0.086)
REER	-0.061	-0.137	-0.064	-0.060	-0.120	-0.072	-0.023
	(0.170)	(0.118)	(0.169)	(0.167)	(0.178)	(0.170)	(0.092)
RIR	-0.940***	-0.856***	-0.946***	-0.903***	-1.193***	-1.110***	-0.769***
	(0.266)	(0.163)	(0.263)	(0.266)	(0.340)	(0.287)	(0.142)
GR	-0.183	0.007	-0.208	-0.176	0.164	-0.197	-0.101
	(0.210)	(0.183)	(0.209)	(0.202)	(0.309)	(0.207)	(0.128)
D		0.186***					
		(0.023)					
DGFC			-0.012***				
			(0.003)				
D2010				0.006*			
				(0.004)			
FR					-0.006***		
					(0.002)		
GOV						-0.026	
						(0.017)	
DTROIKA							0.034***
							(0.004)
Observations	78	78	78	78	74	76	78
R-squared	0.219	0.501	0.225	0.251	0.231	0.230	0.644

Notes: (a) The dependent variable is the current account balance as a percentage of GDP; (b) All estimations were obtained by IV (Instrumental Variables) method; (c) Robust standard errors in parentheses; (d) Constant term estimated but omitted for reasons of parsimony; (e) * and *** denote statistical significance at the 10% and 1% level, respectively.

Table 7 shows that, for Germany, the change in the budget balance as a percentage of GDP by 1 pp translates into a change of 0.257 pp in the current account balance as a percentage of GDP, ceteris paribus, a lower estimate compared to that obtained for Portugal. When the fiscal rules index is introduced, in regression (5), the estimate of the budget balance increases considerably, a result also found for Portugal. The real effective exchange rate and the real interest rate have no effect on the current account balance (in regression (5), the real interest rate has a negative sign and it is highly significant, after introduction of the fiscal rules index) and the real GDP growth has a positive and highly significant impact, a result found in Table 5. Furthermore: (i) the public debt as a percentage of GDP has no effect; (ii) the global financial crisis has a significant and highly significant effect, with an estimate close to that found for Portugal; (iii) unlike Portugal, from the first quarter of 2010, there is a deterioration of the current account balance; and (iv) as found in Portugal, the fiscal rules index has a negative and significant effect and the government effectiveness index has a non-significant impact.

Table 7: Current account balance, Germany, 2003Q4-2020Q4 (yoy quarterly changes)

Regressors/ Specification	(1)	(2)	(3)	(4)	(5)	(6)
GB	0.257***	0.330***	0.250***	0.239***	0.580***	0.299***
	(0.066)	(0.077)	(0.062)	(0.071)	(0.128)	(0.074)
REER	-0.050	-0.060	-0.043	-0.045	-0.058	-0.045
	(0.050)	(0.055)	(0.050)	(0.052)	(0.055)	(0.054)
RIR	-0.040	-0.029	-0.055	-0.031	-0.386***	-0.070
	(0.099)	(0.100)	(0.096)	(0.106)	(0.130)	(0.098)
GR	0.360***	0.377***	0.331***	0.384***	0.650***	0.398***
	(0.102)	(0.109)	(0.103)	(0.113)	(0.132)	(0.106)
D		0.049				
		(0.036)				
DGFC			-0.011***			
			(0.003)			
D2010				-0.005**		
				(0.002)		
FR					-0.003**	
					(0.001)	
GOV						-0.016
						(0.014)
Observations	68	68	68	68	64	68
R-squared	0.253	0.258	0.271	0.309	0.352	0.259

Notes: (a) The dependent variable is the current account balance as a percentage of GDP; (b) All estimations were obtained by IV (Instrumental Variables) method; (c) Robust standard errors in parentheses; (d) Constant term estimated but omitted for reasons of parsimony; (e) ** and *** denote statistical significance at the 5% and 1% level, respectively.

Based on Table 8, the current account balance has a positive and highly significant impact on the budget balance in all the regressions presented. The real interest rate has a positive and highly significant effect and the real GDP growth has a positive and significant effect, with the exception of regressions (2) and (5), on the budget balance. The public debt as a percentage of GDP has a negative and highly significant effect on the budget balance as a percentage of GDP. One possible explanation is related to the interest on public debt that contributes to the deterioration of the budget balance. The fiscal rules index and the government effectiveness index, in turn, improve the budget balance.

Table 8: Government balance, Portugal, 2000Q4-2020Q4 (yoy quarterly changes)

Regressors/ Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CA	0.460***	0.680***	0.454***	0.441***	0.463***	0.475***	0.548***
	(0.107)	(0.111)	(0.109)	(0.117)	(0.099)	(0.116)	(0.162)
REER	0.247	0.250*	0.245	0.242	0.247*	0.240	0.246
	(0.169)	(0.136)	(0.169)	(0.167)	(0.147)	(0.158)	(0.166)
RIR	1.328***	1.126***	1.321***	1.315***	1.301***	1.461***	1.379***
	(0.163)	(0.135)	(0.165)	(0.161)	(0.149)	(0.165)	(0.174)
GR	0.517**	0.226	0.502**	0.512**	-0.264	0.487**	0.518**
	(0.231)	(0.186)	(0.241)	(0.240)	(0.246)	(0.223)	(0.231)
D		-0.160***					
		(0.028)					
DGFC			-0.007				
			(0.005)				
D2010				0.003			
				(0.004)			
FR					0.006***		
					(0.001)		
GOV						0.036**	
						(0.015)	
DTROIKA							-0.005
							(0.008)
Observations	77	77	77	77	73	76	77
R-squared	0.481	0.622	0.482	0.485	0.594	0.510	0.482

Notes: (a) The dependent variable is the government balance as a percentage of GDP; (b) All estimations were obtained by IV (Instrumental Variables) method; (c) Robust standard errors in parentheses; (d) Constant term estimated but omitted for reasons of parsimony; (e) *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Finally, the global financial crisis, as measured in the first quarter of 2009, has no effect on the budget balance. In addition, the dummy variables that assume the value 1 from the first quarter of 2010 and in the quarters in which Portugal implemented the Economic Adjustment Programme (consigned in a Memorandum of understanding on financial assistance, signed

between the Portuguese government, the European Commission, the European Central Bank CB and the International Monetary Fund) are not significant. These results mean that, from the point of view of the evolution of the budget balance, there is no statistically significant difference before and after 2010 and also during the period of validity of the economic and financial adjustment programme.

Table 9 points to a positive and significant effect of the current account balance on the budget balance for Germany in the several presented regressions. Albeit in regression (5), with the introduction of the fiscal rules index, the estimate is reduced to less than half and there is loss of significance. Comparing the budget balance estimates obtained for Germany and Portugal, according to regressions (1) in Tables 8 and 9, we find that the estimate for Germany is higher. As for Portugal, the impact of public debt as a percentage of GDP is negative and highly significant, the dummy variables DGFC and D2010 are not significant, and the government effectiveness index is positive (in the case of Germany, highly significant). However, the index of fiscal rules is not significant.

Table 9: Government balance, Germany, 2003Q4-2020Q4 (yoy quarterly changes)

Regressors/ Specification	(1)	(2)	(3)	(4)	(5)	(6)
CA	0.600***	0.507***	0.605***	0.596***	0.279*	0.542***
	(0.205)	(0.128)	(0.212)	(0.187)	(0.149)	(0.146)
REER	0.025	0.062	0.023	0.025	0.049	-0.001
	(0.070)	(0.075)	(0.072)	(0.070)	(0.051)	(0.081)
RIR	0.542***	0.335*	0.548***	0.542***	0.848***	0.569***
	(0.177)	(0.196)	(0.168)	(0.175)	(0.105)	(0.143)
GR	-0.385	-0.368*	-0.377	-0.383	-0.749***	-0.506***
	(0.254)	(0.205)	(0.267)	(0.269)	(0.127)	(0.184)
D		-0.191***				
		(0.074)				
DGFC			0.004			
			(0.007)			
D2010				-0.000		
				(0.003)		
FR					-0.000	
					(0.001)	
GOV						0.076***
						(0.027)
Observations	68	68	68	68	64	68
R-squared	0.255	0.433	0.256	0.255	0.639	0.406

Notes: (a) The dependent variable is the government balance as a percentage of GDP; (b) All estimations were obtained by IV (Instrumental Variables) method; (c) Robust standard errors in parentheses; (d) Constant term estimated but omitted for reasons of parsimony; (e) * and *** denote statistical significance at the 10% and 1% level, respectively.

5.4. SUR Models

Tables 10 and 11 show for Portugal and Germany, respectively, the results of the regressions estimated under a SUR model that considers the current account balance, the budget balance, the real effective exchange rate, the real interest rate and the real GDP growth rate as endogenous variables. A first aspect to mention has to do with the fact that the estimates obtained for the coefficients of the current account balance and the budget balance regression for both countries are higher in module than the estimates reported in Tables 6, 7, 8 and 9. This is explained by the fact that the SUR system considers the interdependence of the variables under study, assuming that the errors of the equations to be estimated are correlated. As we have already seen in Tables 6, 7, 8 and 9, the response of the current account balance to the change in the budget balance is higher for Portugal (compared to Germany), while the response of the budget balance to the change in the current account balance is higher for Germany (than for Portugal). In the case of Germany, the estimate is around one. The results therefore confirm again the feedback linkage of Feldstein and Horioka (1980).

Table 10: SUR Model, Portugal, 2000Q4-2020Q4 (yoy quarterly changes)

Regressors/ Specification	(1)	(2)	(3)	(4)	(5)
	CA	GB	REER	RIR	GR
CA		0.770***	-0.123	-0.360***	-0.124**
		(0.089)	(0.087)	(0.045)	(0.057)
GB	0.782***		0.281***	0.448***	0.266***
	(0.090)		(0.085)	(0.036)	(0.054)
REER	-0.199	0.448***		-0.166**	-0.344***
	(0.1407)	(0.136)		(0.067)	(0.068)
RIR	-1.537***	1.883***	-0.439**		-0.457***
	(0.192)	(0.150)	(0.178)		(0.113)
GR	-0.469**	0.986***	-0.801***	-0.404***	
	(0.213)	(0.199)	(0.157)	(0.100)	
R-squared	0.112	0.307	0.003	0.271	0.015

Notes: (a) The number of observations is 81 in each estimation; (b) Standard errors in brackets; (c) Constant term estimated but omitted for reasons of parsimony; (d) ** and *** denote statistical significance at the 5% and 1% level, respectively.

Table 11: SUR Model, Germany, 2003Q4-2020Q4 (yoy quarterly changes)

Regressors/ Specification	(1)	(2)	(3)	(4)	(5)
	CA	GB	REER	RIR	GR
CA		1.052***	-0.348	-0.146	0.654***
		(0.181)	(0.254)	(0.135)	(0.111)
GB	0.360***		0.058	0.392	-0.314***
	(0.062)		(0.151)	(0.070)	(0.070)
REER	-0.075	0.037		0.066	-0.135**
	(0.055)	(0.095)		(0.063)	(0.057)
RIR	-0.115	0.901***	0.238		0.324***
	(0.106)	(0.161)	(0.228)		(0.109)
GR	0.591***	-0.829***	-0.561**	0.372***	
	(0.100)	(0.184)	(0.238)	(0.125)	
R-squared	0.146	0.099	0.048	0.079	0.076

Notes: (a) The number of observations is 69 in each estimation; (b) Standard errors in brackets; (c) Constant term estimated but omitted for reasons of parsimony; (d) ** and *** denote statistical significance at the 5% and 1% level, respectively.

6. Conclusions

The main conclusion of this empirical study is the existence of a bilateral relationship between the budget balance and the current account balance for Portugal and Germany, according to the various empirical methodologies implemented.

Nevertheless, the budget balance and the current account balance have, for both countries, similar and distinct developments, reflecting common and different characteristics of their economies. In particular, the response of the current account balance to the change in the budget balance is greater in Portugal than in Germany. On the other hand, the magnitude of the response of the budget balance to the changes in the current balance is higher in Germany than in Portugal. Furthermore, public debt as a percentage of GDP has a positive and highly significant impact on the current account balance in Portugal, while, for Germany, the impact is non-significant.

From 2010, the current account balance improved in Portugal and deteriorated in Germany, which reflects the adjustments that took place in the Eurozone after the GFC. In both countries, the impact of the GFC was negative, the fiscal rules index has a negative effect, and the government effectiveness index is non-significant. In Portugal, during the years in which the external assistance programme was in force, there was a significant improvement in the current account balance.

With regard to the effects on the budget balance, in Portugal and Germany, the general government debt-ratio has a negative effect, the impact of the global financial crisis is non-

significant, there is no statistically significant difference before and after 2010, and the government effectiveness index has a positive and significant impact. For Portugal, the fiscal rules index has a positive and highly significant effect, improving the budget balance, while in the case of Germany, the effect is non-significant.

Given that we find evidence of a bilateral relationship between the budget balance and the current account balance for Portugal and Germany, and in order to ensure sustainable fiscal and external positions, it is necessary to monitor public expenditure, imports and both income and transfers balances with the Rest of the World and promote exports, especially in the Portuguese case.

Finally, Portugal has typically faced high levels of government debt as a percentage of GDP. Considering the empirical results obtained, eventual better public governance would allow improvements in the budget balance and, consequently, a reduction in public debt, simultaneously with an improvement in the current account balance. Moreover, an economic growth strategy based on exports with high added value would improve public accounts and ensure the external balance of the Portuguese economy.

References

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

Afonso, A., F. Huart, J. Jalles and P. Stanek (2021), "Twin Deficits Revisited: a role for fiscal institutions?", *Journal of International Money and Finance*, forthcoming.

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.

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.

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

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.

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.

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.

Pesaran, M. H. and Y. Shin (1999), "An autoregressive distributed lag modeling approach to cointegration analysis", in Econometrics and Economic Theory in the 20th Century, Chapter 11, The Ragnar Frisch Centennial Symposium, S. Strom (Ed.), Cambridge University Press.

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.

Šuliková, V. and V. Gazda (2016), "A review of the state-of-the-art research on the twin deficit hypothesis", *Journal of Applied Economic Sciences*, Vol. 1, Issue 4, pp. 720-740.

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

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

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: Descriptive Statistics, Portugal, 1999Q4-2020Q4

	CA	GB	REER	RIR	GR
Obs.	85	85	85	85	85
Mean	-0,0541	-0,0485	0,0007	0,0117	0,0013
Std. Dev.	0,05	0,0268	0,0098	0,018	0,0077
Maximum	0,0164	0,0008	0,0288	0,0512	0,0101
Minimum	-0,1183	-0,114	-0,0229	-0,031	-0,0409

Table A2: Descriptive Statistics, Germany, 2002Q4-2020Q4

	CA	GB	REER	RIR	GR
Obs.	73	73	73	73	73
Mean	0,0621	-0,0094	0,0002	0,0086	0,0024
Std. Dev.	0,0184	0,0208	0,0132	0,0160	0,0072
Maximum	0,09	0,0210	0,0337	0,0493	0,0154
Minimum	0,0137	-0,0504	-0,0369	-0,0205	-0,028

Table A3: Correlation matrix, Portugal, 1999Q4-2020Q4

	CA	GB	REER	RIR	GR
CA	1				
GB	0,3537	1			
REER	-0,0449	0,1201	1		
RIR	-0,7021	0,0628	-0,122	1	
GR	-0,0558	0,2564	-0,2213	0,1978	1

Table A4: Correlation matrix, Germany, 2002Q4-2020Q4

	CA	GB	REER	RIR	GR
CA	1				
GB	0,7908	1			
REER	-0,0864	0,0549	1		
RIR	-0,5188	-0,3672	-0,0711	1	
GR	0,1656	0,0345	-0,2395	0,0815	1

Table A5: Unit root tests, Portugal, 1999Q4-2020Q4

Series	Levels		First differences	
	ADF	**PP**	**ADF**	**PP**
CA	-1.359	-1.359	-4.317***	-4.385***
GB	-1.793	-2.082	-8.549***	-8.651***
REER	-8.136***	-8.118***	-8.634***	-29.178***
RIR	-2.186	-4.632***	-3.995***	-39.929***
GR	-3.279**	-3.283**	-10.732***	-10.979***

Notes: (a) ADF corresponds to the Augmented Dickey-Fuller test and PP is the Phillips-Perron test; (b) The null hypothesis of ADF and PP tests is the presence of unit root; (c) Both tests are carried out with constant; (d) In ADF tests, it is considered the lag length automatic based on Schwarz Information Criterion, with maxlag=12; (e) In PP tests, spectral estimation method is based on Bartlett kernel and bandwitch is automatically selected following Newey-West method; (f) Test statistics are reported; (g) ** and *** denote statistical significance at the 5% and 1% level, respectively.

Table A6: Unit root tests, Germany, 2002Q4-2020Q4

Series	Levels		First differences	
	ADF	**PP**	**ADF**	**PP**
CA	-2.856*	-2.386	-4.243***	-4.344***
GB	-2.077	-1.875	-3.743***	-3.818***
REER	-7.341***	-7.285***	-10.486***	-27.134***
RIR	-1.629	-2.682*	-3.467**	-13.307**
GR	-3.166**	-3.376**	-8.693***	-8.694***

Notes: (a) ADF corresponds to the Augmented Dickey-Fuller test and PP is the Phillips-Perron test; (b) The null hypothesis of ADF and PP tests is the presence of unit root; (c) Both tests are carried out with constant; (d) In ADF tests, it is considered the lag length automatic based on Schwarz Information Criterion, with maxlag=12; (e) In PP tests, spectral estimation method is based on Bartlett kernel and bandwitch is automatically selected following Newey-West method; (f) Test statistics are reported; (g) *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Table A7: Unit root tests with breakpoints, Portugal, 1999Q4-2020Q4

Series	VP(IO)		VP(AO)	
	t-stat	Break	t-stat	Break
CA	-4.863**	2010Q3	-4.388*	2009Q4
GB	-3.585	2014Q3	-2.589	2015Q1
REER	-8.746***	2003Q2	-8.857***	2003Q2
RIR	-5.483***	2008Q4	-5.217***	2007Q4
GR	-5.244***	2019Q4	-3.541	2020Q1

Notes: (a) In Vogelsang–Perron (VP) test, "IO" means innovational outlier and "AO" means additive outlier; (b) The null hypothesis of VP tests is the presence of unit root; (c) Both tests are carried out with constant, it is considered the lag length automatic based on Schwarz Information Criterion, with maxlag=12, and the break selection minimize Dickey-Fuller t-statistic; (d) Test statistics are reported; (e) *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Table A8: Unit root tests with breakpoints, Germany, 2002Q4-2020Q4

Series	IO		AO	
	t-stat	Break	t-stat	Break
CA	-4.649**	2003Q4	-4.534**	2003Q4
GB	-3.325	2010Q3	-3.583	2010Q1
REER	-8.048***	2010Q2	-8.160***	2010Q2
RIR	-5.452***	2008Q4	-5.064***	2007Q4
GR	-5.318***	2020Q2	-5.173***	2020Q1

Notes: (a) In Vogelsang–Perron (VP) test, "IO" means innovational outlier and "AO" means additive outlier; (b) The null hypothesis of VP tests is the presence of unit root; (c) Both tests are carried out with constant, it is considered the lag length automatic based on Schwarz Information Criterion, with maxlag=12, and the break selection minimize Dickey-Fuller t-statistic; (d) Test statistics are reported; (e) ** and *** denote statistical significance at the 5% and 1% level, respectively.

Figure A1 – Portugal, million EUR. GDP

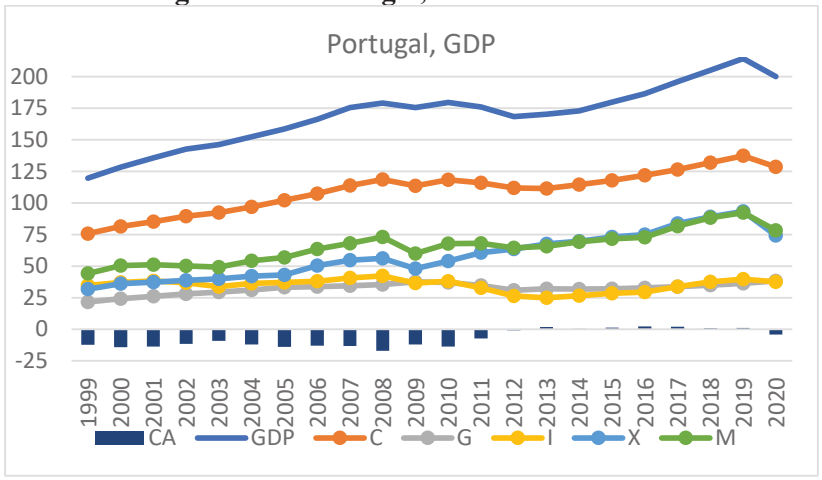


Figure A2 – Portugal, million EUR. Fiscal position

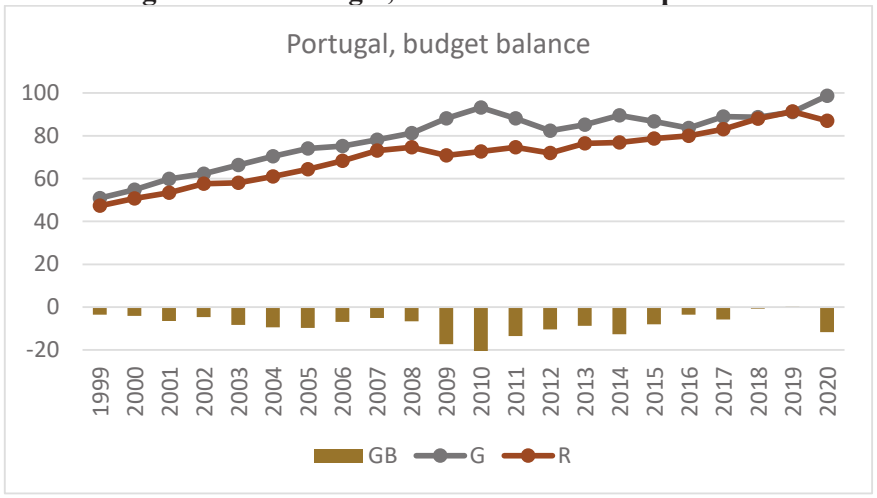


Figure A3 – Germany, million EUR. GDP

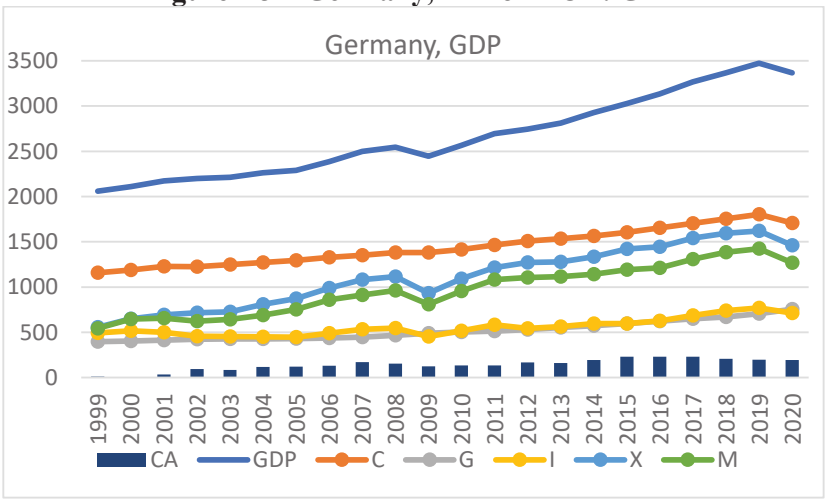
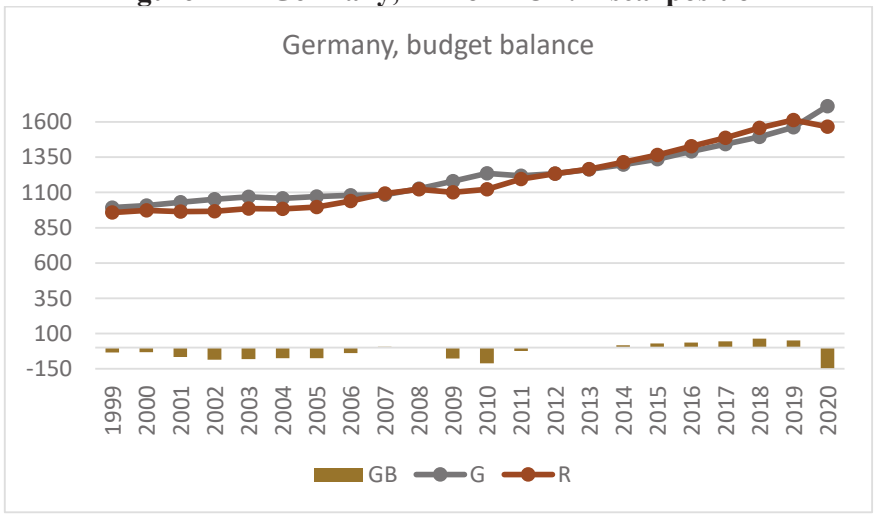


Figure A4 – Germany, million EUR. Fiscal position



Notes: CA – Current Account Balance; C – Private Consumption; G – Public Consumption; I – Investment; X – Exports; M – Imports; GB – Government Budget Balance; G – General Government Spending; R – General Government Revenue. Source: AMECO.