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António Afonso, José Carlos Coelho

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1249-078 Lisboa,
Portugal

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Rua Miguel Lupi, 20
1249-078 LISBOA
Portugal

Telephone: +351 - 213 925 912
E-mail: rem@iseg.ulisboa.pt

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Current Account Targeting Hypothesis versus Twin Deficit Hypothesis: the EMU experience of Portugal*

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

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Abstract: We study the relationship between the government budget balance and the current account balance for Portugal, using quarterly data from 1999 to 2019. On the one hand, the causality tests find a unidirectional relation running from the current account balance to the government budget balance. On the other hand, IV estimations show a bi-directional relationship between these variables, and the existence of a bilateral relationship between the structural components of both balances. Even so, the policy implication is that the use of fiscal policy to correct the external imbalance, especially in an economic crisis, is not substantial, due to the small size of the estimated impact. In addition, with an ARDL model, we find a negative long run relationship between the share of public consumption on GDP and the current account balance. As expected, the variation of real public consumption produces an adverse accumulated response on the current account balance. Finally, the investment rate negatively affects the cyclical component of the current account balance and contributes to the structural improvement of the budget balance.

Keywords: budget balance; external balance; current account targeting hypothesis; twin deficits; government consumption; ARDL; causality; VAR; Portugal
JEL codes: F32, F41, H62, C22

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[$] 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

Portugal has registered chronic and persistent public deficits and external deficits, especially in 1999, with the inception of the euro as a single currency in the context of the Economic and Monetary Union (EMU) participation, and in 2011, with the signature of the Economic and Financial Assistance Programme with European Commission, European Central Bank and International Monetary Fund (the *Troika*). More specifically, during this period, the average general government budget balance as a percentage of GDP was -5.4% and the average current external balance as a percentage of GDP reached -9.6%. In parallel with the occurrence of public accounts deficits and significant external imbalances, there was also an accumulation of high public debt and external debt.

The relationship between the government budget deficit and the current account deficit has been researched for several countries and has been the subject of considerable empirical work in recent years (Bird *et al.*, 2019; Karras, 2019; McFarlane *et al.*, 2020). Nevertheless, both theoretical analysis and empirical research have not been able to solve this issue. In fact, the impact of government budget deficits on current account deficits remains inconclusive. In this regard, Rosenweig and Tallman (1993) maintained that each paper contributes with important insights, even though no consensual perspective had emerged.

Understanding the links between fiscal balances and the external balances appears to be relevant, as, from the point of view of the economic policy maker, this understanding provides useful information on how measures to reduce public deficits and external deficits can be designed and implemented. In this context, it is important to know whether reducing public accounts imbalances is a necessary and sufficient condition to ensure external balances. Within the framework of the Twin Deficits Hypothesis, the government can contribute to improving the balance of external accounts through the adoption of restrictive fiscal policy measures, which can translate into a reduction in public spending, a decrease in transfers made to families, and an increase of taxation, among others. These measures result in a reduction in disposable income and, therefore, in the level of households' aggregate consumption, which decreases the amount of imports and contributes to the improvement of the external balance in this way.

Furthermore, according to the Ricardian Equivalence Hypothesis, the reduction of the budget deficit has no impact on the reduction of the external deficit, and it is ineffective to use fiscal policy to obtain the external balance of the economy. The Current Account Target Hypothesis (Poterba and Summers, 1986) suggests that the external imbalance is transmitted to the public accounts in a negative way, through the action of automatic stabilizers, as well as through the implementation of discretionary fiscal policies, which are applied with the objective

of stabilising economic activity. In such a case, the promotion of the external competitiveness of the economy can be effective in reducing the external imbalance and, consequently, in improving the government balance. Finally, the economic policy maker needs to monitor the factors that influence, simultaneously or individually, the two deficits and their evolution from the perspective of the feedback linkage of Feldstein and Horioka (1980) – which identifies the existence of a bi-directional relationship between the two deficits, where the direction of causality occurs in both directions, and also the Hypothesis of Twin Divergence, which is based on the occurrence of movements that diverge from the budget deficit and the external deficit.

Our study's contribution to the literature is twofold. First, we cover a longer timespan with quarterly data for Portugal, and second, we carry out alternative exercises using several methodologies, namely Multivariate Granger Causality Tests, OLS and IV estimations, an ARDL model, and the dynamic impulse-response functions within a VAR model.

The remainder of the paper is structured as follows. Section 2 reviews the related literature. Section 3 presents the evolution of the budgetary and external position of Portugal from 1999 to 2019. Section 4 describes the data considered in the empirical assessment. Section 5 presents the methodologies used and Section 6 reports and discusses the empirical results. Finally, Section 7 concludes.

2. Literature

The literature presents several perspectives to explain the relationship between budget deficits and external deficits. The government deficit leads to the external deficit, creating twin deficits, according to the Twin Deficits Hypothesis, which was developed in the Mundell-Fleming Model (Mundell, 1960; Fleming, 1962) and the Keynesian Absorption Theory. On the other hand, the Ricardian Equivalence Hypothesis (Barro, 1974; 1989) suggests that both deficits are not linked.

Additionally, the Current Account Targeting Hypothesis proposed by Summers (1988) advances that the relationship between the government deficit and the external deficit is inverse: from the second to the first. In turn, Feldstein and Horioka (1980) find a high correlation between savings and investment, with both variables moving together. In this context, a bi-directional relationship between the government balance and the current account balance can occur. More recently, Kim and Roubini (2008) argue that "twin divergence" is more likely than "twin deficits", considering endogenous movements of the government deficit and of the current account deficit.

Several empirical studies have addressed the relationship between the budget balance and the external balance in the context of individual countries over the last few decades, even though they sometimes point to different conclusions.

By implementing a Multivariate Granger Causality Test for the United States using quarterly data from 1960 to 1984, Darrat (1988) concludes that there is a bi-directional causality between the budget deficit and the trade deficit.

Using a VAR (Vector Auto-Regressive) model for the United States with data from 1979 to 1985, Abell (1990) concludes that budget deficits positively influence trade deficits. This influence occurs indirectly, through interest rates and exchange rates mechanisms, rather than directly, as shown by the causality tests and the impulse-response functions.

Rosenweig and Tallman (1993) also study the North American economy, with quarterly data for the period ranging from 1961 to 1989. Using a VAR model, the authors obtain evidence that increasing budget deficits contribute to the appreciation of the dollar and find support for the Twin Deficits Hypothesis (that is to say, budget deficits contribute to trade deficits).

Vamvoukas (1999) studies the relationship between the budget deficit and the trade deficit for Greece, from 1948 to 1994. Using a cointegration analysis, an error-correcting model, and the Trivariate Granger Causality Test, the author finds that the budget deficit has a positive short and long run effect on the trade deficit, with both variables measured in real terms.

Using a VEC (Vector Error Correction) model, by decomposing the variance and by carrying out an analysis of generalised impulse-response functions, Kaufmann *et al.* (2002) conclude by rejecting the Twin Deficit Hypothesis for Austria from 1976 to 1998, using quarterly data. Furthermore, the Ricardian Equivalence Hypothesis is also not supported, as an additional analysis based on a basic VAR model fails to provide evidence to verify the intertemporal allocation of expenditure.

Fidrmuc (2003) studied the relationship between the budget deficit and the current account deficit using quarterly data from 1970 to 2001 for ten OECD countries, two emerging markets, and six Eastern European economies, adding the investment rate to the analysis. Through cointegration analysis, the evidence from their research supports the Twin Deficit Hypothesis for some countries, and the author concludes that diversity exists with regards the use of international financial markets for finance investment (the Feldstein-Horioka puzzle).

Dibooglu (2007) investigates which macroeconomic factors determine the current account balance for the United States, using real quarterly data for the period of 1960-1994, based on the theoretical frameworks of the Twin Deficit Hypothesis and the Ricardian

Equivalence Hypothesis. Through the implementation of cointegration tests and using a VEC model, the decomposition of variance, and the analysis of impulse-response functions, the author concludes with the Twin Deficits Hypothesis: the existence of budget deficits and increases in real interest rates and terms of trade result in current account deficits.

Kalou and Paleologou (2012) use a Multivariate VEC model with endogenously determined structural breaks to assess the existence of a causal relationship between the budget deficit and the current account deficit for Greece. Using data from 1960 to 2007, the conclusion of their paper points to the existence of a positive link between deficits according to the Current Account Targeting Hypothesis (that is to say, the direction of the linkage operates from the current account deficit to the budget deficit).

Magazzino (2012) examines the relationship between the budget deficit and the trade deficit for Italy from 1970 to 2010. The author concludes that: i) no long-term relationship exists between both variables, with cointegration tests; and ii) there is evidence that corroborates the Current Account Targeting Hypothesis (the relationship operates between the trade balance and the budget balance), according to the Granger Causality Tests that were carried out.

Makin and Narayan (2013) studied the relationship between the budget deficit and net foreign borrowing for Australia from 1983 to 2009, using quarterly data. Through the application of Gregory and Hansen's (1996) cointegration test and long-term elasticity estimations (by OLS, dynamic OLS, and fully modified OLS), the authors conclude by verifying the Twin Deficit Hypothesis.

In a study also for Greece, Nikiforos *et al.* (2015) analyse the existence of a causal relationship between the budget deficit and the external deficit, using quarterly data, expressed in real terms, for the period of 1980 to 2010. Using the Toda-Yamamoto Methodology (1995) and an analysis cointegration, the authors conclude that the external deficit has a positive impact on the budget deficit from 1995 onwards.

More recently, using an ARDL (Autoregressive Distributed Lag) model applied to Canada for the period of 1981 to 2018, and using quarterly data, Janko (2020) finds a long run cointegration relationship between the current account balance, the government balance, private investment, and private credit. Furthermore, evidence was found of a positive relationship between the government balance and the current account balance in the long-term, as well as in the short-term, which supports the Twin Deficit Hypothesis.

Coelho (2020) investigates the existence of a relationship between the budget deficit and the current external deficit for Portugal, from 1999 to 2016, using quarterly data and two

complementary econometric methodologies: the Granger Causality Test (1969) and the Toda-Yamamoto Methodology (1995). The author concludes that a relationship exists between the budget balance and the current external balance, which corroborates the Twin Deficits Hypothesis. In addition, he also finds sufficient evidence to verify the Current Account Targeting Hypothesis.

To the best of our knowledge, Portugal has not yet been the subject of a specific study, although it either appears in studies that use extended country samples (Daly and Siddiki, 2009; Afonso *et al.*, 2013; Forte and Magazzino, 2013), or in studies applied to the PIIGS countries (Algieri, 2013; Trachanas and Katrakilidis, 2013; Litsios and Pilbeam, 2017; Panousis and Koukouritakis, 2020). Table 1 provides a summary of the related literature cited above.

Table 1 – Related Literature

Authors	Countries	Period	Methods	Results
Feldstein and Horioka (1980)	21 OECD countries	1960-1974	Simultaneous equations	Bi-directional relationship
Kim and Roubini (2008)	United States	Quarterly, 1973-2004Q1	VAR	Twin divergence
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.
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
Dibooglu (2007)	United States	Quarterly, 1960-1994	Cointegration, VECM	Twin Deficits Hypothesis
Daly and Siddiki (2009)	23 OECD countries	1960-2000	Cointegration	Twin Deficits Hypothesis
Kalou and Paleologou (2012)	Greece	1960-2007	Cointegration, Causality, Multivariate VECM	Current Account Targeting Hypothesis
Magazzino (2012)	Italy	1970-2010	Cointegration, Causality	Current Account Targeting Hypothesis
Afonso *et al.* (2013)	European Union and OECD countries	1970-2007	Panel cointegration, Seemingly Unrelated Regressions (SUR) Estimations	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.
Litsios and Pilbeam (2017)	Greece, Portugal and Spain	Quarterly, 1980Q2-2015Q2	ARDL	Twin Deficit Hypothesis
Panousis and Koukouritakis (2020)	Portugal, Italy, Spain and Greece	Quarterly, 1999Q1-2017Q3	Cointegration, Causality	For Italy and Greece, the Twin Deficits Hypothesis is supported. For Portugal and Spain this evidence is weak.
Janko (2020)	Canada	Quarterly, 1981-2018	ARDL	Twin Deficit Hypothesis
Coelho (2020)	Portugal	Quarterly, 1999-2016	Causality	Twin Deficits Hypothesis, Current Account Targeting Hypothesis

3. Budgetary and external position of Portugal: 1999-2019

In this section, we briefly present the evolution of the budgetary and external position of Portugal from 1999 to 2019. The variable used to reflect the budgetary position of Portugal is the general government balance as a percentage of GDP (*GB*), and the variable used to measure the external position of the Portuguese economy is the current external balance as a percentage of GDP (*CA*).

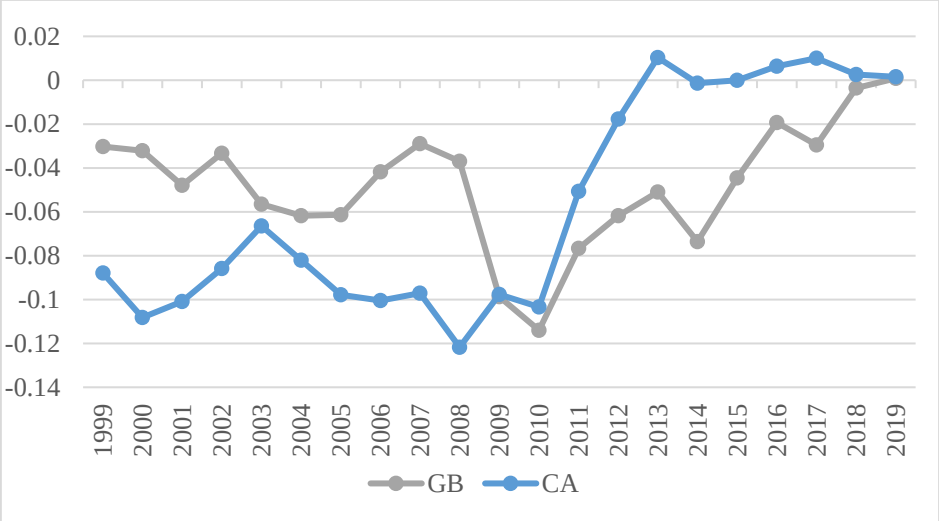
Figure 1 shows that the general government balance was in deficit up until 2017, and that it has reached a null balance more recently. Portugal attained its highest budget deficit as a percentage of GDP in 2011, -11.4%. With regards the external position of the Portuguese economy, the current external balance was negative from 1999 to 2012, assumes a positive value in 2013, and shows null or positive values from 2014 onwards. The maximum external deficit was attained in 2008, -12.2%.

In addition, Figure 2 presents the decomposition of the current account balance into its various components, namely: balance of goods and services (*TB*), net factor income from abroad (*NFI*), and net current transfers (*CT*).

During the period of 1999-2019, the net factor income from abroad is always negative and net current transfers are always positive. The external balance of goods and services is

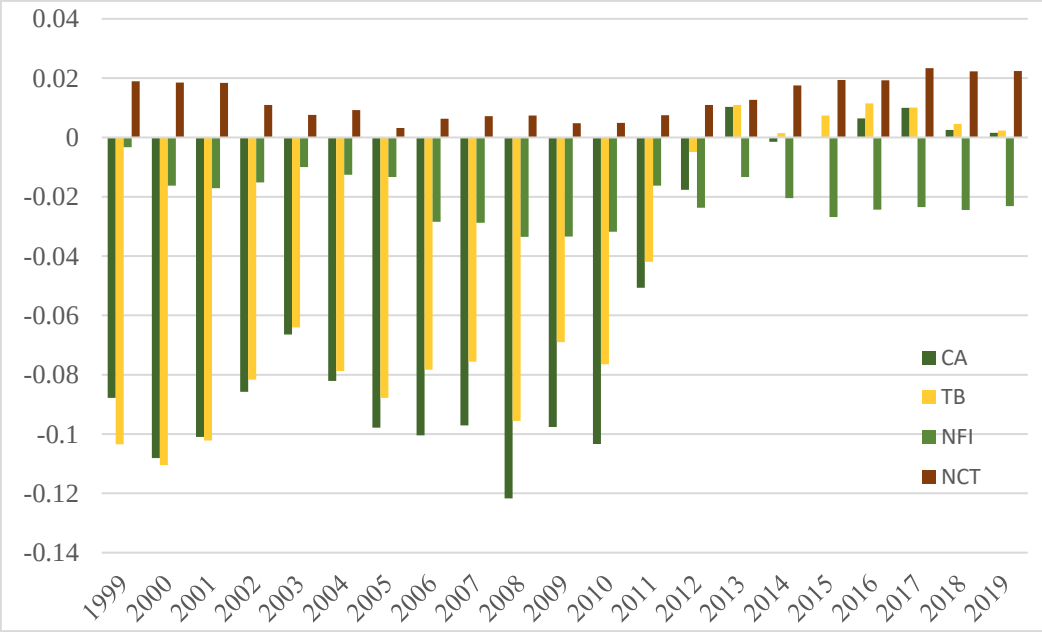
negative from 1999 to 2012, and becomes a surplus in 2013. In 1999, 2000, and 2001, deficits in the balance of goods and services are greater than current external deficits. Conversely, current external deficits are greater than deficits in the balance of goods and services from 2002 to 2012. This implies that Portugal's liabilities to the Rest of the World, which result from negative net primary income, amplified the value of the external deficit during this period.

Figure 1: Government budget balance (GB) and external balance (CA) of Portugal (% of GDP, 1999-2019)



Source: Author´s calculations based on INE data.

Figure 2: Decomposition of Portugal's current account balance (% of GDP, 1999-2019)



Source: Author´s calculations based on INE data.

From 2013 onwards, the value of the balance of goods and services is higher than the current external balance. Accordingly, while exports of goods and services are greater than imports of goods and services, the high primary income paid to the Rest of the World reverses or partially nullifies this result. There was a sharp reduction in 2011 of the magnitude of the deficits in the balance of goods and services and in the current external balance, with surpluses or null balances recorded after 2013.[1] This evidence mirrors the reduction in external financing that occurred in the Portuguese economy in early 2011, culminating in May of that year with the signature of the Economic and Financial Assistance Programme between the Portuguese Republic and international institutions.

If the occurrence of high and persistent external deficits are a sign of the structural weakness of the economy and the existence of a non-competitive tradable sector, as pointed by Algieri (2013), then the Portuguese economy experienced an important and significant structural change during last two decades. In fact, the share of exports as a percentage of GDP increased from 26% to 44% from 1999 to 2019, whereas the external deficit reduced substantially.

By definition, the current external balance represents the difference between national saving and investment. An external deficit can reflect a low savings rate relative to the level of investment made in the economy and/or a high investment rate. Should this deficit be financed by the inflow of long-term capital flows, then induced investment can increase the productive capacity of the economy, which, in turn, boosts economic growth. The external deficit does not thus represent a problem in the short-term. However, should external deficits attain high and persistent levels, they can then become unsustainable, and sudden stops might occur.[2] The reversals of external financing are usually very disruptive, as the occurrence of external financing that is no longer accessible implies a very rapid decrease in not only private consumption, but also public expenditure and investment. In this context, the economy as a whole has to generate significant external surpluses to repay existing loans to the Rest of World.

4. Data

The empirical research implemented in our paper considers the following variables: current account balance as a percentage of GDP (CA); general government balance as a

[1] The annual averages of external balance of goods and services and current external balance, in the 1999-2010 period, were, respectively, -8.5% and -9.6%. In the 2011-2019 period, they dropped to 0%.

[2] Sudden stops are a reversal of external financing and consist of the non-entry of capital flows from abroad that were previously made available to the economy and then cease to be.

percentage of GDP (GB); share of public consumption as a percentage of GDP (G); log of real government consumption (log Gov); log of real GDP (log GDP); real effective exchange rate (REER); real interest rate (RIR); and the investment rate (INV), constructed as the investment-to-GDP ratio.[3]

The data of the current account balance as a percentage of GDP, general government balance as a percentage of GDP, share of public consumption as a percentage of GDP, real government consumption, real GDP, and investment rate were taken into account or calculated based on data available from the website of INE (the Portuguese National Statistical Institute) and have been adjusted for seasonality and calendar effects. In particular, the current account balance as a percentage of GDP was computed as being the sum of external balance of goods and services with the net factor income from abroad and net current transfers over GDP.

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 a base year of 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 base year is 2015), using monthly data. These last data are sourced from Eurostat. The current plots of the series under study are shown in the Appendix.

This study covers the period from 1999 to 2019 and uses quarterly data, such as the studies of Darrat (1988), Algieri (2013), Nikiforos *et al.* (2015), and Janko (2020), rather than annual data. The use of greater frequency and disaggregation of data provides more information about the evolution of budgetary and external positions. According to Algieri (2013), this data structure allows for a better understanding of the interactions between both deficits, and is recommend for carrying out a finer and more in-depth analysis of the underlying dynamics. Table 2 presents the usual descriptive statistics for the variables. Table 3 is the correlation matrix.

[3] Due to the lack of data regarding private investment in Portugal on a quarterly basis, we use aggregate investment. In fact, public investment is already reflected in the government budget balance. When considering aggregate investment together with the government budget balance, we are in effect double counting public investment and therefore it is important to keep this aspect in mind when interpreting the results.

Table 2: Descriptive Statistics

	CA	GB	G	log Gov	log GDP	REER	RIR	INV
Obs.	84	84	84	84	84	84	84	84
Mean	-0.0565	-0.0478	0.1907	9.0271	10.7452	0.0001	0.0128	0.2115
Std. Dev.	0.0491	0.0341	0.0132	0.0513	0.0407	0.0095	0.0177	0.0453
Maximum	0.0182	0.0181	0.2140	9.1145	10.8428	0.0278	0.0512	0.2987
Minimum	-0.1308	-0.1599	0.1675	8.8882	10.6516	-0.0229	-0.0311	0.1426

Table 3: Correlation matrix

	CA	GB	G	log Gov	log GDP	REER	RIR	INV
CA	1							
GB	0.2629	1						
G	-0.7507	-0.5710	1					
log Gov	-0.2552	-0.3482	0.5902	1				
log GDP	0.1372	0.2223	-0.1566	0.6036	1			
REER	-0.0172	0.0872	0.1107	0.0371	-0.0164	1		
RIR	-0.7273	0.0086	0.4247	-0.0191	-0.2167	-0.0803	1	
INV	-0.8309	0.0591	0.3901	-0.2231	-0.2632	0.0511	0.6998	1

In order to test the stationarity of the series in levels and their order of integration, we implemented two complementary tests, namely: the ADF test (Augmented Dickey-Fuller, 1979), and the PP test (Phillips-Perron, 1988). The results reported in Table 4 point to the absence of unit roots in levels in the general government balance and in the real effective exchange rate series, which accordingly enables us to conclude that they are stationary in levels and integrated in order 0, *I(0)*. The current account balance, share of public consumption on GDP, log of real government consumption, log of real GDP, real interest rate, and investment rate series all have a unit root in levels, and are not stationary in levels. As a result, we also work with the first differences for these series and repeat the unit root tests, leading to the conclusion that these are only stationary in first differences, and are integrated of order 1, *I(1)*.[4]

[4] Usually, in the empirical literature, the series of the general government balance and current account balance are *I(1)*. Nevertheless, we conclude that the series of the general government balance is *I(0)* and the series of the current account balance is *I(1)*.

Table 4: Unit root tests

Series	Levels		First differences		Type
	ADF	PP	ADF	PP	
CA	0.8594	0.8249	0.0000	0.0000	I(1)
GB	0.0456	0.0000	0.0000	0.0000	I(0)
G	0.6922	0.7631	0.0000	0.0000	I(1)
log Gov	0.0663	0.0313	0.0015	0.0036	I(1)
log GDP	0.7300	0.6878	0.0000	0.0000	I(1)
REER	0.0000	0.0000	0.0000	0.0000	I(0)
RIR	0.2476	0.0015	0.0000	0.0000	I(1)
INV	0.4522	0.5392	0.0000	0.0000	I(1)

5. Methodology

The empirical analysis of this paper is conducted through the implementation of several methodologies. We start with Multivariate Granger Causality Wald Tests to assess the three main relationships between: i) the general government balance as a percentage of GDP and the current account balance as a percentage of GDP; ii) the share of public consumption as a percentage of GDP and the current account balance as a percentage of GDP; and iii) the log of real public consumption and the current account balance as a percentage of GDP. We also consider other variables that determine the current account balance (log of real GDP, real effective exchange rate, real interest rate and investment rate).

A multivariate framework enables us to avoid any distortion that could result from the omission of relevant explanatory variables. The log of real GDP was include as an explanatory variable in order to control for the cyclical components of the variables under study. The Twin Deficit Hypothesis suggests that both the exchange rate and the interest rate play an important role as mediating variables between the budget deficit and the current account deficit. The investment rate has a strong negative correlation with the current account balance of -0.8309, and can be an important determinant of the current account balance. Consequently, these determinants were included as explanatory variables.

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 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 by comparing with a model that only includes past observations of the current account balance as a percentage of GDP. We also include other determinants, such as the share of public

consumption on GDP and the log of real public consumption, together with the log of real GDP, the real effective exchange rate, the real interest rate, and the investment rate.

In this regard, it is important to note 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 necessarily 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 measures the content of the information and the precedence of both. The test enables checking if one variable leads the other, and only allow us to know the short run dynamics between the variables under study.

Next, we estimate multivariate OLS (Ordinary Least-Squares) and IV (Instrumental Variables) models considering the year-on-year (y-o-y) quarterly changes of the variables. Specifically, we assess 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. In addition, we investigate the impact of the structural component of the general government balance on the structural component of the current account balance and the impact of the structural component of the current account balance on the structural component of the general government balance, both as a percentage of GDP.[5][6]

The objective of these estimations is to test the existence of a bilateral relationship between the two balances. We admit that the OLS estimates, complemented with IV estimates in order to control the endogenous nature of the budget balance and the current account balance, using stationary series are robust, which can indicate the existence of a relationship between the general government balance and the current account balance.

The third methodology used in our empirical work is the estimation of an ARDL model, developed by Pesaran and Shin (1999) in order to verify the existence of a long-term relationship between public consumption and the current account balance, both as a percentage of GDP, considering the other relevant variables under study. The use of this methodology is essentially justified because the series under study have different integration orders (the series

[5] The series of the y-o-y quarterly changes of the structural components of the current account balance and the general government balance, both as a percentage of GDP, were obtained using the Hodrick-Prescott (HP), with a smoothing parameter of 1,600, and are stationary in levels and, consequently, integrated of order 0. The series of the y-o-y quarterly changes of the current account balance and the general government balance, both as a percentage of GDP, log of real GDP, real effective exchange rate, real interest rate, and investment rate are all stationary in levels. The results of the unit root tests are available upon request. Figures A1 and A2 in Appendix illustrate the CA and GB decomposition.

[6] We also test the existence of a relationship between the cyclical components of the general government balance and current account balance, albeit we have found no evidence of a relationship between both variables and in both directions. These estimates are available upon request.

of the effective real exchange rate is 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.

Compared with other cointegration tests (Engle and Granger, 1987; Johansen, 1988; Johansen and Juselius, 1990), the ARDL method has some additional advantages. Accordingly, it enables us to work with integrated series of order 0 and order 1 both at the same time. The results of the ARDL estimation are statistically significant for relatively small data samples, unlike the Johansen cointegration test, which requires a large data sample. Finally, the ARDL model can be estimated assuming different optimal lags for each variable employed, which is in contrast with the Johansen cointegration test. ARDL models are linear time series models where both the dependent and independent variables are related not only contemporaneously, but also across historical (lagged) values.

The representation between the current account balance and its explanatory variables (the share of public consumption on GDP is included) is given by:

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

where CA_t is the 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:

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

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 $ECT_{t-1} = CA_{t-1} - \sum_{i=1}^{k} \omega_i X_{it-1}$.

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

Finally, we build a VAR model, and by using the dynamic impulse-response functions, we estimate the multiplier effects of the variation in one pp of the log of real public consumption on the current account balance as a percentage of GDP, log of real GDP, effective real exchange rate and real interest rate. Since some variables are integrated in order 1, the VAR model was estimated in first differences. To deal with the endogeneity of general government balance, we used public consumption instead, because this variable is less likely to react to changes in output.

The VAR model in standard form can be written as

$$X_t = c + \sum_{i=1}^{p} A_i X_{t-i} + \varepsilon_t \qquad (3)$$

where X_t denotes the (5×1) vector of the five endogenous variables given by $X_t \equiv [\Delta log\ Gov_t \quad \Delta CA_t \quad \Delta log\ GDP_t \quad \Delta REER_t \quad \Delta RIR_t]'$; c is a (5×1) vector of intercept terms; A_i is the matrix of autoregressive coefficients of order *i*; and the vector of random disturbances $\varepsilon_t \equiv [\varepsilon_t^{Gov} \quad \varepsilon_t^{CA} \quad \varepsilon_t^{GDP} \quad \varepsilon_t^{REER} \quad \varepsilon_t^{RIR}]'$ contains the reduced form OLS residuals. The lag length of the endogeneous variables, *p*, will be determined by the usual information criteria. The VAR is identified by means of a Cholesky decomposition. The variables are ordered from the most exogenous variable to the least exogenous one, government consumption being the "most exogenous". By construction, structural shocks to all the other variables affect government consumption, with a one-period lag.

6. Results

6.1. Multivariate Granger Causality Tests

In order to carry out the Multivariate Granger Causality Wald Tests, we performed a pre-estimation test first to select the order of the VAR model, 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.

Accordingly, we preform three sets of Granger Causality Wald Tests. The first set concerns the relationship between the general government balance and the current account balance, both as a percentage of GDP. We thus check whether the general government balance (% of GDP) Granger causes the current account balance (% of GDP); if the current account balance (% of GDP) Granger causes the general government balance (% of GDP); if there is bi-

directional Granger causality; or whether no relationship exists between the two variables (see Table 5).

The second and third sets of tests respectively concern the relationship between the share of public consumption on GDP, and the current account balance as a percentage of GDP, and the log of real government consumption, and the current account balance as a percentage of GDP (see Tables 6 and 7, respectively). In addition to the aforementioned relationships, the multivariate Granger Causality Tests also enable us to assess in which direction the relationship between the remaining variables that integrate the defined VAR system is. Therefore, by considering the variables in first differences, it is possible to ascertain whether the current account balance, the budget balance, the share of public consumption, the log of real public consumption, the log of real GDP, the real effective exchange rate, the real interest rate, and the investment rate influence each other in the short run.

Table 5: Granger Causality Tests I (4 lags)

	Equation					
	D.CA	**D.GB**	**D.log GDP**	**D.REER**	**D.RIR**	**D.INV**
Variables excluded						
D.CA		20.473***	2.8722	5.5291	4.9552	3.4166
D.GB	5.4562		3.9305	1.9063	9.8266**	4.7063
D.log GDP	19.273***	8.9711*		9.8069**	4.7295	28.009***
D.REER	3.7757	11.788**	5.0002		8.08*	4.3404
D.RIR	10.626**	16.629***	2.0689	26.442***		4.7131
D.INV	3.0497	2.3476	7.312	5.4079	4.381	
All	48.79***	53.395***	21.692	51.805***	38.926***	44.822***

Notes: (a) Wald statistics are reported; (b) *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table 6: Granger Causality Tests II (4 lags)

	Equation					
	D.CA	**D.G**	**D.log GDP**	**D.REER**	**D.RIR**	**D.INV**
Variables excluded						
D.CA		21.491***	3.6773	6.0973	8.4034*	2.5235
D.G	6.7281		6.7883	4.7946	24.822***	2.618
D.log GDP	14.596***	2.2901		12.712**	13.164**	23.139***
D.REER	5.5704	7.699	2.5511		17.935***	4.6079
D.RIR	13.393***	7.7873*	0.88787	30.313***		7.459
D.INV	3.1277	13.041**	10.313**	7.0156	8.3969*	
All	50.715***	45.005***	25.161	56.474***	58.834***	41.733***

Notes: (a) Wald statistics are reported; (b) *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table 7: Granger Causality Tests III (4 lags)

	Equation					
	D.CA	**D.log Gov**	**D.log GDP**	**D.REER**	**D.RIR**	**D.INV**
Variables excluded						
D.CA		2.7077	5.9313	6.4653	7.8691*	4.9268
D.log Gov	9.1673*		13.854***	0.9665	20.44***	1.5861
D.log GDP	14.634***	6.3882		7.0716	16.834***	22.053***
D.REER	4.6046	3.4441	2.9409		12.224**	3.9684
D.RIR	11.734**	7.1247	3.1149	24.756***		6.0602
D.INV	2.5051	2.8725	16.554***	4.04	7.7567	
All	54.406***	26.242	33.74**	50.285***	53.016***	40.206***

Notes: (a) Wald statistics are reported; (b) *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

In particular, the tests in first differences show that: i) the general government balance and public consumption do not Granger cause the current account balance; ii) the log of real public consumption Granger causes the current account balance, at a 10% level of significance, although there is no statistical evidence to support inverse causality; and iii) the current account balance Granger causes the general government balance and the public consumption, at a 1% level of significance, which provides empirical evidence of the Current Account Targeting Hypothesis.

6.2. OLS and IV Estimates

Table 8 shows a positive bi-directional relationship between the current account balance and the general government balance, at a 5% level of significance, which corroborates the feedback linkage between both balances. The estimates of the second and fourth columns are obtained by IV method, and two results emerge. The first is that the variation of the budget balance by one pp has a positive impact on the current account balance by 0.3 pp, *ceteris paribus*. This result means that a significant part of the deterioration in the budget balance is offset by an increase in private savings, and the impact on the current account balance is therefore reduced. In this context, we can advance that the private sector in Portugal is partially forward-looking in their consumption and investment decisions. The second result is a highly significant impact with a magnitude of around one of the current account balance on the budget balance. In turn, the investment rate has a negative and highly significant effect on the current account balance. In module, its estimate is close to one, which shows the tendency to recourse to international financial markets to finance part of the investment expenses made in the economy, with the savings generated internally being insufficient to finance the entire

investment. The Portuguese economy consequently does not mirror what is commonly referred to in the literature as the Feldstein-Horioka puzzle. The real interest rate has a positive and highly significant effect on the budget balance, while it is not significant for the current account balance.

Table 8: Bilateral impacts between the current account balance and the budget balance (y-o-y quarterly changes)

Regressors/Specification	(1) CA	(2) CA	(3) GB	(4) GB
GB	0.116**	0.301**		
	(0.046)	(0.134)		
CA			0.626**	1.090***
			(0.277)	(0.402)
log GDP	-0.205	-0.202	0.300	0.389
	(0.125)	(0.167)	(0.231)	(0.254)
REER	0.117	0.040	0.310	0.240
	(0.110)	(0.130)	(0.296)	(0.305)
RIR	-0.160	-0.278	1.047***	1.072***
	(0.174)	(0.223)	(0.291)	(0.297)
INV	-0.796***	-0.802***	0.333	0.705*
	(0.135)	(0.170)	(0.389)	(0.415)
Observations	80	72	80	77
R-squared	0.610	0.516	0.188	0.152

Notes: (a) CA and GB denote the year-on-year quarterly changes of the current account balance and the general government balance, both as a percentage of GDP, respectively; (b) The first and third columns are estimated by OLS and the second and fourth columns are IV estimations; (c) Robust standard errors in brackets; (d) Constant term estimated but omitted for reasons of parsimony; (e) *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

The estimates in Table 9 point to the verification of a bi-directional relationship between the structural component of the current account balance and the structural component of the government budget balance, at a 5% level of significance, according to the OLS estimates (columns 5 and 7). The IV estimates, which are presented in columns 6 and 8, show that these effects are highly significant. The level of real GDP has a negative and highly significant impact on the structural component of the current account balance, which shows that the increase in aggregate income has an adverse impact on the structural component of this balance. Furthermore, the investment rate has a positive influence on the structural component of the general government balance.

The real interest rate has no influence on the structural components of the budget balance and the current account balance, but only a positive impact on the cyclical component of the budget balance. This can be explained by the fact that the increase in short-term interest rates

induces public savings, as a way of mitigating the expected increase in expenditure supported with interest on public debt.

Two crucial results of the estimations in Tables 8 and 9 are: i) the negative and highly significant impact of the investment rate on the current account balance, but not on its structural component; and ii) the positive effect of the investment rate on the budget balance, and in particular on its structural component. These results can be explained as follows. Investment is one of the components of final demand with greater imported content after exports of around 30-35%, in Portugal. Its increase thus worsens imports, and, consequently, it worsens the external accounts. However, this negative impact is not structural, but just cyclical. In addition, investment makes it possible to increase the productive capacity of the economy, which generates economic growth and accordingly a structural improvement in public accounts. In short, the investment rate has a negative effect on the cyclical component of the current account balance and a positive influence on the structural component of the budget balance.

Table 9: Structural impacts of the current account balance and the budget balance (y-o-y quarterly changes)

Regressors/Specification	(5) CA	(6) CA	(7) GB	(8) GB
GB	0.207**	0.266***		
	(0.095)	(0.094)		
CA			0.227**	0.279***
			(0.107)	(0.106)
log GDP	-0.247***	-0.288***	0.012	0.083
	(0.042)	(0.041)	(0.065)	(0.064)
REER	0.008	0.009	0.020	0.018
	(0.055)	(0.054)	(0.060)	(0.059)
RIR	-0.069	-0.104	0.065	0.111
	(0.073)	(0.070)	(0.081)	(0.071)
INV	0.018	0.052	0.185***	0.123**
	(0.067)	(0.062)	(0.065)	(0.062)
Observations	80	76	80	76
R-squared	0.409	0.437	0.172	0.212

Notes: (a) CA and GB denote the year-on-year quarterly changes of the structural component of the current account balance and the general government balance, both as a percentage of GDP, respectively; (b) The fifth and seventh columns are estimated by OLS and the sixth and eight columns are IV estimations; (c) Robust standard errors in brackets; (d) Constant term estimated but omitted for reasons of parsimony; (e) ** and *** denote statistical significance at the 5% and 1% level, respectively.

6.3. ARDL Model

In the context of the ARDL model that was implemented, Table 10 reports the long run estimates and Table 11 shows the estimates of the short run dynamics and the error correction

term, where the dependent variable is the current account balance as a percentage of GDP. In the long-term, the share of public consumption as a percentage of GDP, the log of real GDP, the real effective exchange rate, the real interest rate, and the investment rate are highly 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 6.013 and t-statistic of -5.682. We can thus conclude that there is a cointegration relationship between the current account balance as a percentage of GDP, the share of public consumption on GDP, the log of real GDP, the real effective exchange rate, the real interest rate, and the investment rate.

In addition, Table 10 also shows that the impact of the share of public consumption as a percentage of GDP on the current account balance as a percentage of GDP is negative. More specifically, the change in the share of public consumption as a percentage of GDP in one pp results in a reduction of 1.7695 pp in the current account balance. The log of real GDP estimate is negative and points to a deterioration in the current account balance as a percentage of GDP of 0.001556 when real GDP grows by 1%. The signs of the estimates of the real effective exchange rate and the real interest rate are not as expected. The sign of the real effective exchange rate would be expected to be negative and the sign of the real interest rate to be positive. Possibly, a higher real short run interest rate can translate into the attraction of foreign capital that seeks a higher real return for its short run investments. In the context of Portugal's participation in the EMU, where nominal interest rates are similar between countries, investors can explore the existence of distinct real interest rates between countries, given the observance of inflation rate differentials.

Moreover, and as expected, the investment rate signal is negative: the one pp change of the investment rate has an impact, in the opposite direction, of 0.5345 on the current account balance as a percentage of GDP. Although this estimate is lower than the estimates reported for the investment rate in Table 8, it shows that the increase in the investment rate is also financed with external capital, and not only with domestic savings. In Janko's (2020) study, which was applied to Canada, within an ARDL model, estimates for the private investment are close to what we found, around 0.5 and 0.54.

Table 10: ARDL Model – Long Run Impact, dependent variable, current account balance

Variable	Coefficient	t statistic
G	-1.7695***	-9.83
log GDP	-0.1556***	-3.10
REER	1.0767***	3.48
RIR	-1.0913***	-4.78
INV	-0.5345***	-7.55

Notes: (a) Current account balance as a percentage of GDP; (b) *** denote statistical significance at the 1% level.

Table 11 presents the short run dynamics and the error correction term, whose estimate of speed of long run adjustment is -0.4936, indicating that every period 49.4% of disequilibrium is eliminated. This is a very fast speed of adjustment, as the total deviation from equilibrium is eliminated during three quarters. For the share of public consumption on GDP at lag one, the impact of your change is positive and significant at a 1% level of significance. The effect of a change in the real effective exchange rate is negative in the short run, both contemporaneously, and at lag one. The change of the real interest rate has a positive influence contemporaneously, as well as at lag two. The variation of the investment rate negatively affects the variation of the current account balance as a percentage of GDP contemporaneously. Contrary to the results of Table 10, the log of real GDP is not a determinant of the current account balance in the short-term.

Table 11: ARDL Model – Short Run Dynamics and Cointegration Vector, dependent variable: current account balance

Variable	Coefficient	t statistic
D.G_t	-0.1632	-0.36
D.G_{t-1}	1.4448***	3.25
D.$REER_t$	-0.4941***	-3.26
D.$REER_{t-1}$	-0.3484***	-3.09
D.RIR_t	0.2341*	1.82
D.RIR_{t-1}	0.1207	1.00
D.RIR_{t-2}	0.3053***	3.39
D.INV_t	-0.6306***	-4.94
Cointegration Equation φ	-0.4936***	-5.68

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) * and *** denote statistical significance at the 10% and 1% level, respectively.

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 could be different. In the case of the real interest rate, in the short-term the substitution effect seems to dominate the income effect, while in the long-term the opposite occurs: the income effect dominates the substitution effect. The investment rate is the only variable who's short-term and long-term signals are the same.

6.4. VAR Results

Finally, Table 12 reports the multiplier effects of 1% variation of the real government consumption on the system variables, estimated by dynamic impulse-response functions, considering eight periods of response. In addition, Figure 3 shows the accumulated impulse-response functions of the current account balance, log of real GDP, real effective exchange rate and real interest rate resulting from a 1% variation of the real government consumption.

The estimates of the multiplier effects show that the variation in real public consumption in 1% has an accumulated adverse effect on the current account balance as a percentage of GDP of 0.0035 pp, in the real effective exchange rate of 0.0014 pp, and in the real interest rate of 0.0018 pp.

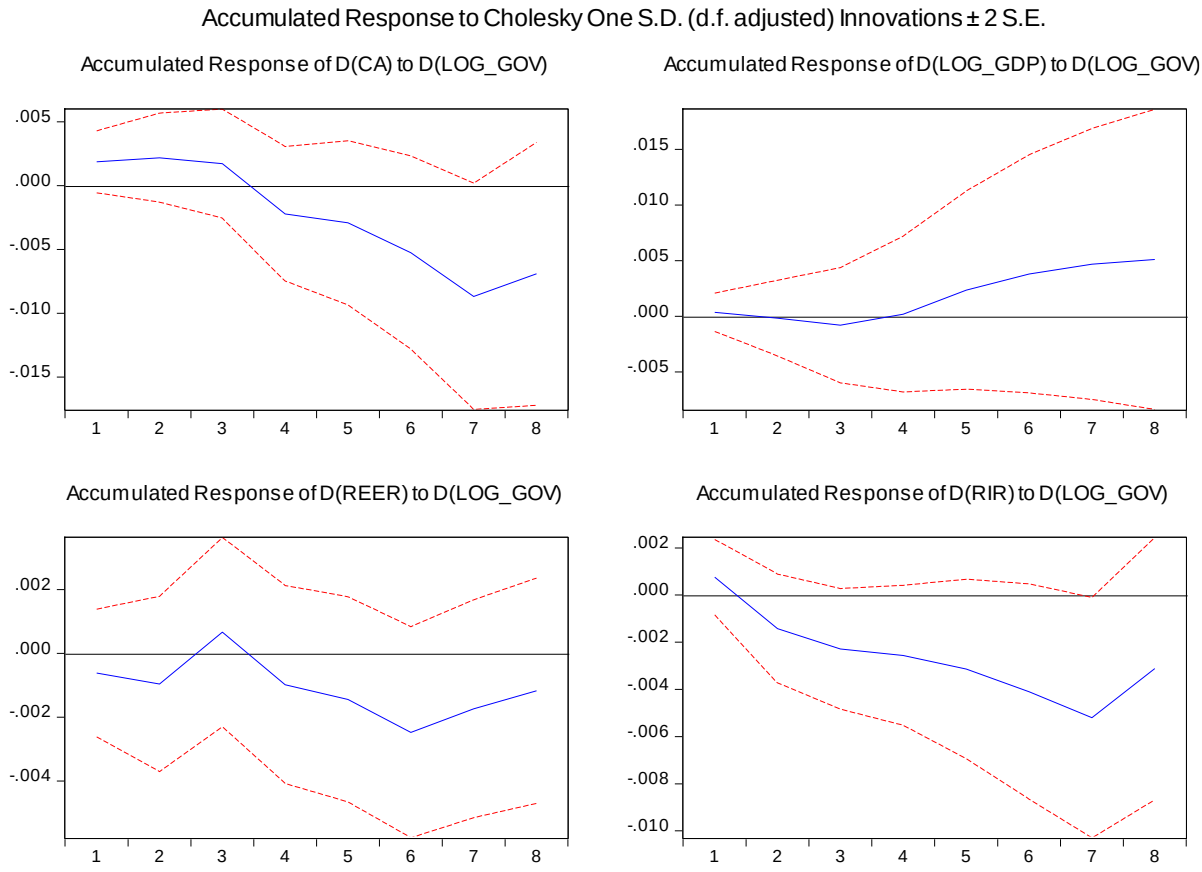
On the other hand, the impact on real GDP is positive: the change in real public consumption of 1% results an accumulated effect of 0.3545%. Therefore, a positive variation of real public consumption has an accumulated positive impact on real GDP and an accumulated negative impact on the current account balance as a percentage of GDP, as well as on the effective real exchange rate and on the real interest rate. While the negative impact on the real interest rate might be due to the increase in the inflation rate caused by the stimulus to economic activity, the exchange rate depreciation in this context does not appear to be intuitive.

Table 12: Multiplier effects of 1% variation of real government consumption

Variable	Multiplier effect
D.CA	-0.0035
D.log GDP	0.3545
D.REER	-0.0014
D.RIR	-0.0018

Note: We consider eight periods of response.

Figure 3: Accumulated responses of D.CA, D.log GDP, D.REER and D.RIR to unit-shock to D.log Gov



7. Conclusions

We have analysed the existence of a relationship between the general government balance (% of GDP), the share of public consumption on GDP, the log of real public consumption, and the current account balance (% of GDP), from 1999 to 2019 for Portugal, using a quarterly dataset.

We work with several complementary methodologies in the analysis. Using Multivariate Granger Causality Tests, in first differences, we conclude that the current account balance Granger causes the general government balance, which provides empirical evidence for the Current Account Targeting Hypothesis.

We also perform OLS and IV estimations using the year-on-year quarterly changes of the general government balance and the current account balance, both as a percentage of GDP, and using their structural components, and we find a bilateral impact between two balances. Accordingly, the feedback linkage of the Feldstein and Horioka (1980) is more appropriate for understanding the result obtained. Furthermore, two crucial results of these estimates are the

negative and highly significant impact of the investment rate on the cyclical component of the current account balance and the effect of the structural improvement of public accounts.

The results of the estimation of the ARDL model enable us to conclude that there is a long-term relationship between the current account balance as a percentage of GDP, share of public consumption on GDP, log of real GDP, real effective exchange rate, real interest rate, and investment rate. In particular, the share of public consumption on GDP has a negative signal on the current account balance as a percentage of GDP. However, in the short-term, there is an inverse relationship between the current account balance as a percentage of GDP and the share of public consumption on GDP in first differences, as the Granger Causality Tests show that the first variable Granger causes the latter, at a 1% level of significance.

The Multivariate Granger Causality Tests show that the first differences of the log of real public consumption Granger causes the first differences of the current account balance as a percentage of GDP, although at a 10% level. Using dynamic impulse-response functions, we find that the change in the log of real public consumption has an accumulated adverse impact on the current account balance as a percentage of GDP. More specifically, a variation in real public consumption in 1% results in an accumulated deterioration of 0.0035 pp on the current account balance as a percentage of GDP.

Another relevant result is the conclusion that the investment rate has a negative impact on the current account balance in the short run and as a long run determinant. Accordingly, an increase in investment considerably deteriorates the current account balance, albeit just its cyclical component. This result suggests a high degree of integration in international financial markets of the Portuguese economy and it does not corroborate the Feldstein-Horioka puzzle.

In our case, and according to the Twin Deficits Hypothesis, a reduction of the government deficit can contributes to the mitigation of external imbalance and a tightening of fiscal policy can improve the external balance of the economy. Nevertheless, the estimated effect of the general government balance on the current account balance is small. The policy implication is thus that the use of fiscal policy to correct the external imbalance is not substantial, especially in an economic crisis scenario.

Current account deficits can result from losses in the external competitiveness of the economy, which aggravate the risk of capital flow reversal with sudden stops of external financing, leads to a fall in economic activity, and negatively affect public accounts. In addition, current account deficits can encourage the government to increase public expenditure, as more foreign capital flows are available to respond to a fall in economic activity, and they contribute to the deterioration of the government balance. Consequently, and once again from a policy

perspective, the verification of the Current Account Targeting Hypothesis points to the need to monitor the external competitiveness of the economy in order to assess export and import flows, and to the importance of the inflow of foreign capital as well as that of the income and transfers received from the Rest of the World.

As the variation in public consumption and its share on GDP has a negative impact on the current account balance, and thus, worsens the external accounts, this also represents a relevant variable that needs to be monitored. Any policy that stimulates economic activity, which translates into an increase in public consumption, should consider this factor.

Finally, public policy measures, which promote investment, enhance the performance of the economy in the long-term and contribute to the structural improvement of the government balance position, even though they have a negative effect on external accounts in the short-term.

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Appendix

Table A1: Variables, definitions, and data sources

Variable	Definition	Source
CA	current account balance as a percentage of GDP, the sum of external balance of goods and services with the net factor income from abroad and net current transfers over GDP	Authors' calculations based on INE data
GB	general government balance as a percentage of GDP	INE
G	share of public consumption as a percentage of GDP	Authors' calculations based on INE data
log Gov	log of real public consumption	INE
log GDP	log of real GDP	INE
REER	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	Authors' calculations based on Eurostat data
RIR	real interest rate, 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.	Authors' calculations based on Eurostat data
INV	investment rate, the investment-to-GDP ratio	Authors' calculations based on INE data

Figure A1 – CA decomposition

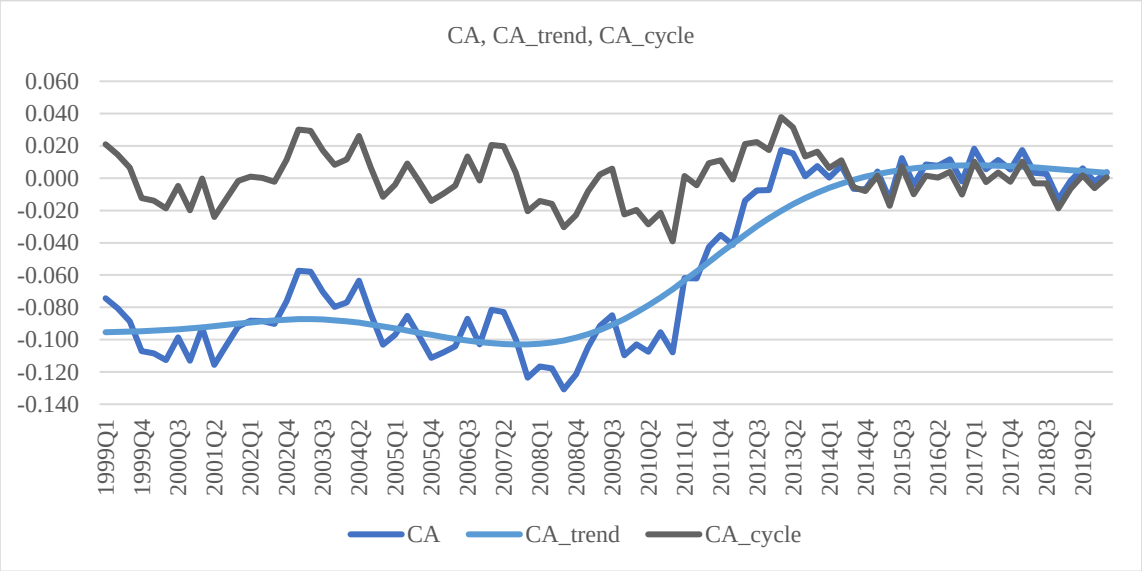
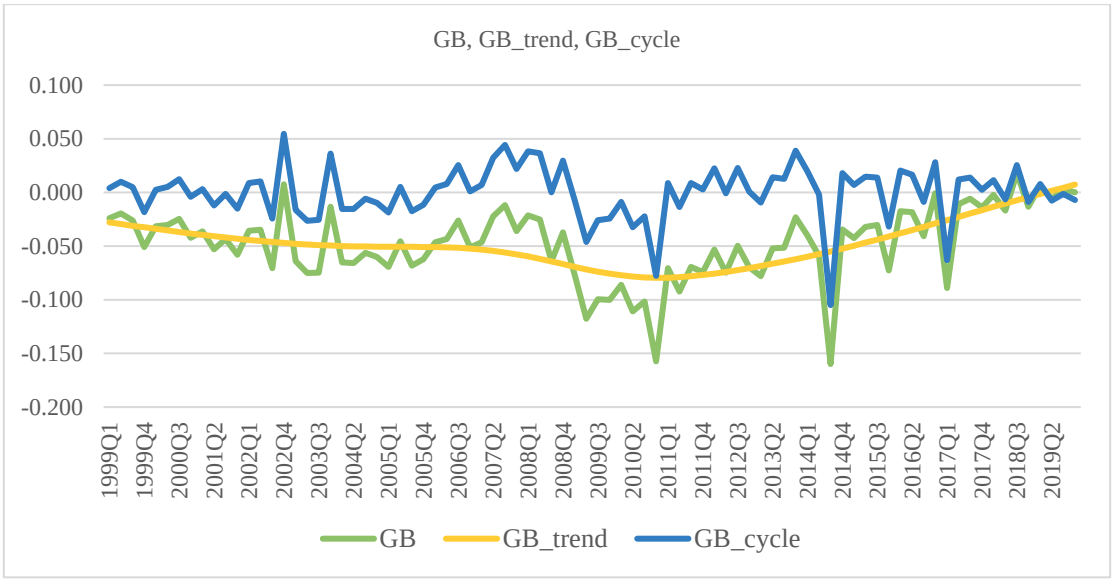


Figure A2 – GB decomposition



Note: The series of the structural components of the current account balance and the general government balance, both as a percentage of GDP, were obtained using the Hodrick-Prescott (HP), with a smoothing parameter of 1,600, and are based on INE data.

Figure A3 – Main Variables