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Abstract: This paper makes an empirical analysis applied to Portugal between 1999 and 2016 which investigates the existence of a causal relationship between the budget balance (overall and primary) and the external balance (goods and services and current). Using Granger Causality Test (1969) and the Toda-Yamamoto Methodology (1995), we conclude that there is causality between the overall budget balance and the current external balance and between the primary budget balance and the current external balance, which provides support to the Twin Deficits Hypothesis. We also found some evidence to verify the Current Account Targeting Hypothesis, which points to the possibility of bi-directional causality between the budget deficit and the external deficit in Portugal.

Keywords: budget deficit; external deficit; Portugal; Granger Causality Test (1969); Toda-Yamamoto Methodology (1995)

***JEL* codes**: F32, F41, H62, C22

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1. Introduction

Between 1999, with start of euro as single currency in the context of EMU (Economic and Monetary Union) participation, and 2011, with the signature of Economic and Financial Assistance Programme with European Commission, European Central Bank and International Monetary Fund (the *Troika*), Portugal had registered chronic and persistent budget deficits and external deficits, with the latter particularly high. More specifically, during 1999 and 2010, the average budget balance as percentage of GDP was – 5.3% and the average weights of external balance of goods and services and current external balance on GDP achieved – 8.5% and – 9.8%, respectively. In the context of EMU, only Greece had a similar dynamic, although more pronounced. Simultaneously with the occurrence of public accounts deficits and significant external imbalances, the accumulation of high public debts and external debts also occurred in these countries.

In the recent decades, a lot of empirical research has been produced on the relationship between budget deficit and external deficit. There are researchers who suggest that the deterioration of the external accounts is significantly explained by the occurrence of high budget deficits. This relationship is known as "twin deficits" and was initially studied for the United States when, in the 1980s, the country experienced significant budget deficits and external deficits, and then extensively investigated for many other countries.

Over the last decades and in several developed countries, high and persistent budget and external deficits (or current account deficits) have occurred in paralell. For example, in countries such as the United States, Germany and Sweden, the growth of budget deficits in the 1980s and 1990s was accompanied by a real appreciation of the domestic currency and, subsequently, a deterioration in the current account (Piersanti, 2000). The coincidence of these events has led to a growing controversy about the causal links between the budget deficit and the external deficit.

The relationship between both deficits has been investigated in several countries and has been the subject of considerable empirical work in recent years (Vamvoukas, 1999; Algieri, 2013). Neverthless, both theoretical analysis and empirical research have not been able to solve this issue. Then, the impact of budget deficits on current account deficits remains inconclusive. Rosenweig and Tallman (1993) maintained, in this regard, that, although no consensual perspective had emerged, each article contributes with important insights.

In this context, we can formulate the following questions: Is there a (causal) relationship between the budget deficit and the external deficit? If there is, in which direction: from the budget deficit to the external deficit? Or from the external deficit to the budget deficit? Or in both directions?

In response to these questions, there is a literature that advances that the budget deficit and the external deficit are twins – hence the concept of twin deficits –, since it considers that deficits are related in some way (Rosenweig and Tallman, 1993). Although extensively studied, over the last decades, the possible link between both deficits, from the perspective of twin deficits, is a subject of controversy among researchers, especially since there is no consensus on whether the budget deficit causes the external deficit or the opposite. Another view, called the Ricardian Equivalence Hypothesis (Barro, 1974; Barro, 1989), suggests that both deficits are not causally linked. Summers (1988), in turn, supports the Current Account Targeting Hypothesis: the causality between the budget deficit and the external deficit will be from the second to the first, that is, the opposite. Feldstein and Horioka (1980) find a high correlation between savings and investment, which translates into bi-directional causality between the budget balance and the current account balance, with both variables moving together. More recently, Kim and Roubini (2008) advance that "twin divergence" is more likely than "twin deficits" when they are considered endogenous movements of the budget deficit and the current account deficit.

Empirical research on the relationship between the budget deficit and the external deficit shows different results. More specifically, the tests implemented have obtained different results in different countries and, in some cases, the results differ for the same country. Indeed, the diversity of results in terms of empirical evidence is the result of differences in the econometric techniques used, the specifications of the models, the measurements of the data and the samples used.

This study investigates the existence of a causal relationship between the budget balance (overall and primary) and the external balance (goods and services and current) for Portugal, between 1999 and 2016, and uses quarterly data provided by INE (the Portuguese Statistical Institute). The empirical analysis carried out uses two methodologies: the Granger Causality Test (1969) and the Toda-Yamamoto Methodology (1995). The use of both methodologies is justified by the need to ensure that the causal inference between the dynamics of the budget balance and the external balance is not sensitive to the tests implemented and, simultaneously, allows to increase the robustness of the results obtained. Like Algieri (2013), we also tested the stability of the causal relationships between both balances.

The contribution of this investigation to the literature is related with two important elements. The first element consist in the fact that the country covered by the analysis is Portugal, since there are few published studies only about this country. The second element relates to the fact that are made comparisons between four relations, namely: the overall budget balance and the external balance of goods and services, the overall budget balance and the current external balance, the primary budget balance and the external balance of goods and services and the primary budget balance and the current external balance. Many studies only investigate the relationship between the overall budget balance and the current external balance; on the contrary, in this work, we study the four relationships. These distinctions are important, given that considering or missing the analysis of payments made in the framework of public debt service and net income and current transfers received from abroad allows us to know their impact on the relationship between the budget deficit and the external deficit and whether the relationship between both deficits is different depending on whether these elements are present or not.

This paper is organized as follows. Section 2 presents the explanatory perpectives about the relationship between budget deficit and external deficit. Section 3 is a synthesis of empirical literature review. Section 4 shows the evolution of budgetary and external position of Portugal during 1999 and 2016. Sections 5, 6 and 7 expose, respectively, the description of the data and the analysis carried out, the empirical methodologies implemented in the econometric analysis developed and the empirical results obtained. Finally, section 8 presents the conclusions of the paper.

2. Explanatory Perspectives

The literature advances five perspectives that explain the relationship between the budget deficit and the external deficit, namely: (i) the Twin Deficit Hypothesis; (ii) the Ricardian Equivalence Hypothesis; (iii) the Current Account Targeting Hypothesis; (iv) the feedback linkage; and (v) the Twin Divergence Hypothesis.

(i) the Twin Deficit Hypothesis

The Twin Deficit Hypothesis holds that the budget deficit tends to result in a current account deficit. This relationship can be explained in the framework of two perspectives: the Mundell-Fleming Model (Mundell, 1960; Fleming, 1962) and the Keynesian Absorption Theory.

From the first perspective, the growth of budget deficit leads to higher domestic real interest rates, which in turn attract foreign capital flows and result in appreciation of exchange rates. A

stronger national currency reduces net exports (makes exports less attractive and increases the attractiveness of imports) and translates into a loss of the economy's external competitiveness, which creates a current account deficit. This described transmission mechanism operates on a flexible exchange regime. Theoretically, in the scenario of perfect capital mobility on an international scale, capital circulates between countries and investor remuneration is equalized. In this context, the change in the budget deficit results in the same amount of change in the current account deficit. In a fixed exchange rate regime, on its turn, the increase in budget deficit results in an increase in income and prices, leading to a real appreciation of the currency, which negatively affects the current account balance. Although transmission mechanisms differ, either in a fixed or flexible exchange rate regime, the widening budget deficit aggravates the current account deficit.

The second perspective suggests that the widening budget deficit may cause upward pressure on domestic absorption, resulting in increased domestic spending, and thus contributing to increased imports, causing a deterioration in the current account balance. These effects will be more relevant how much bigger the degree of openness of the economy and the adjustment via net transfer taxes.

From both perspectives, the increase in the budget deficit and hence in aggregate demand and the real interest rate aggravates the current account deficit (or detrimentally affects its surplus).

(ii) the Ricardian Equivalence Hypothesis

According to the Ricardian Equivalence Hypothesis (Barro, 1974; Barro, 1989), the budget deficit and the external deficit are unrelated, as budget changes induce an intertemporal reallocation of savings (intertemporal substitution occurs between taxes and budget deficits), and the intertemporal fiscal constraints of private agents, the real interest rate, investment and the current account balance remain unchanged. Thus, budget deficits do not result in changes in interest and exchange rates and consequently the effects on the current account are null. Ricciuti (2003) argues that the reduction of current taxes does not affect national savings, when public spending remains constant and there are no restrictions on indebtedness.

Under the assumption of the rationality of economic agents, it is assumed that they anticipate that an expansionary fiscal policy in a given period will result in a future increase in the tax burden. Therefore, in order to support future tax increases, they reduce their consumption level and increase their savings today by the same amount as the budget deficit increase. Higher budget deficits represent only higher future taxes. Thus, for example, current tax cuts result in

future tax increases and their impact on the economy is null. A model that incorporates the Ricardian Equivalence Hypothesis may suggest that the replacement of debt by tax by a Government that increases budget deficits may be financed by increase of private savings rather than net external indebtedness (Rosensweig and Tallman, 1993).

Finally, within this theoretical perspective, there is no causal relationship between the budget deficit and the external deficit. However, temporary changes in Government expenditure may affect current account deficits.

(iii) the Current Account Targeting Hypothesis

There may also be an inverse relationship that moves from the current account deficit to the budget deficit. The underlying idea is that the external position of an economy may deteriorate due to factors exogenous to its fiscal position. According to Darrat (1988), the budget deficit can respond to this deterioration and adjust to stabilize the economy. Adjustment may be made using automatic stabilizers and/or discretionary fiscal policies. This requires considerable foreign capital inflows and the ability of the Government to borrow at a relatively low interest rate.

Summers (1988) referred to this inverse relationship as "Current Account Targeting". This results from the fact that the deterioration of the current account balance leads to a lower growth pattern and consequently to an increase in the budget deficit. This is justified as on the one hand the fall in economic activity resulting from high current account deficits increases public spending as well as reduces tax revenues. On the other hand, Governments can use fiscal stimulus to mitigate the harmful economic and financial effects of high trade imbalances. External adjustment can thus be made through fiscal policy which responds to external sector conditions. In this context, there is an inverse and positive causality current account deficit/ budget deficit.

(iv) the feedback linkage

According to Feldstein and Horioka (1980), savings and investment are highly correlated and thus this linkage translates into bi-directional causality between the budget balance and the current account balance, both moving together (that is, causality between variables operates in both directions). In this context, Vamvoukas (1999) points out that the effects of growing budget deficits on inducing a large trade deficit may be an aspect of the twin deficit phenomenon. Daly and Siddiki (2009) also argue that the correlation between saving and

investment may also result in the joint movement of the budget deficit and the current account deficit, supporting the Twin Deficit Hypothesis.

(v) the Twin Divergence Hypothesis

Kim and Roubini (2008), on the other hand, assess the topic of the existence of endogenous movements of the budget deficit and the current account deficit and suggest that "twin divergence" is also likely, that is, the current account deficit may improve when the budget deficit worse. This result is attributed to two factors: first, a partial Ricardian movement of private savings (increase in private savings), and second, a crowding out effect on investment (decline in investment), both caused by a increase of real interest rate, resulting from the implementation of an expansionary fiscal policy. There is also nominal exchange rate depreciation, which, in a context of nominal rigidity, translates into short-term real exchange rate depreciation. In addition, when both balances are affected by a shock in output and/or productivity, "twin divergence" may be more likely. A similar but weaker result occurs when considering exogenous budget shocks.

3. Empirical Literature Review

The empirical literature on the relationship between the budget deficit and the external deficit shows different results about the existence of causality between both deficits and in the direction of causality. Thus, in Abell (1990), Rosenweig and Tallman (1993), Vamvoukas (1999), Piersanti (2000), Salvatore (2006), Beetsma *et al.* (2008), Daly and Siddiki (2009), Forte and Magazzino (2013) and Trachanas and Katrakilidis (2013), empirical support is obtained for the Twin Deficit Hypothesis, that is, the budget deficit causes the external deficit. In Algieri (2013), there is no causal relationship between deficits, validating the Ricardian Equivalence Hypothesis. On its turn, in Kalou and Paleologou (2012) and Nikiforos *et al.* (2015), the Current Account Targeting Hypothesis has empirical support, being the reverse causality direction: the external deficit aggravates the budget deficit. The existence of bi-directional causality is found in Darrat (1998). Finally, in Khalid and Guan (1999), Kouassi *et al.* (2004), Baharumshah *et al.* (2006), Rault and Afonso (2009) and Afonso *et al.* (2013), the authors obtain mixed empirical evidence about the existence and direction of causality between both deficits, with occurrence of unidirectional and bi-directional causality between the budget deficit and the external deficit.

Table 1, next, presents a synthesis of mentioned papers.

Table 1: Synthesis of Empirical Literature Review

Reference	Sample	Conclusion
Darrat (1988)	United States 1960-1984 (quarterly data)	Bi-directional causality
Abell (1990)	United States 1979.2T-1985.2T (quarterly data)	Twin Deficits Hypothesis
Rosenweig e Tallman (1993)	United States 1961-1989 (quarterly data)	Twin Deficits Hypothesis
Khalid e Guan (1999)	Developed countries (United States, United Kingdom, France, Canada e Australia) 1950-1994 Developing countries (India, Indonesia, Pakistan, Egypt and Mexico) 1955-1993	Twin Deficits Hypothesis (United States, France, Egypt and Mexico); Ricardian Equivalence Hypothesis (United Kingdom and Australia); Current Account Targeting Hypothesis (Indonesia and Pakistan); Bi-directional causality (Canada and India)
Vamvoukas (1999)	Greece 1948-1994	Twin Deficits Hypothesis
Piersanti (2000)	OCDE countries (excluding Turkey, Switzerland, Portugal, Iceland, Belgium and others) 1970-1997	Twin Deficits Hypothesis
Kouassi *et al.* (2004)	20 developed countries and developing countries 1969-1998	Twin Deficits Hypothesis (Italy and Israel); Ricardian Equivalence Hypothesis (developed and developing countries); Current Account Targeting Hypothesis (Coreia); Bi-directional causality (Thailand)
Baharumshah *et al*. (2006)	Indonesia, Philippines and Thailand 1976-2000 (quarterly data) Malaysia: 1976.1T-1998.2T	Twin Deficits Hypothesis (Thailand); Current Account Targeting Hypothesis (Indonesia); Bi-directional causality (Philippines and Malaysia)
Salvatore (2006)	G7 countries (United States, Japan, Germany, United Kingdom, France, Italy and Canada) 1973-2005	Twin Deficits Hypothesis
Beetsma *et al.* (2008)	14 European countries 1970-2004	Twin Deficits Hypothesis
Daly e Siddiki (2009)	23 OCDE countries 1960-2000	Twin Deficits Hypothesis
Rault e Afonso (2009)	European Union and OCDE countries 1970-2007	Depending on the country: Twin Deficits Hypothesis; Ricardian Equivalence Hypothesis; Current Account Targeting Hypothesis
Kalou e Paleologou (2012)	Greece 1960-2007	Current Account Targeting Hypothesis
Afonso *et al.* (2013)	European Union and OCDE countries 1970-2007	Depending on the country: Twin Deficits Hypothesis; Ricardian Equivalence Hypothesis; Current Account Targeting Hypothesis
Algieri (2013)	Greece, Ireland, Italy, Portugal and Spain 1980.2T-2012.2T (quarterly data)	Ricardian Equivalence Hypothesis
Forte e Magazzino (2013)	33 European countries 1970-2010	Twin Deficits Hypothesis
Trachanas e Katrakilidis (2013)	Italy: 1971-2009 Portugal: 1977-2009 Ireland, Greece and Spain: 1975-2009	Twin Deficits Hypothesis
Nikiforos *et al.* (2015)	Greece 1980-2010 (quarterly data)	Current Account Targeting Hypothesis

Note: Author´s elaboration.

4. The evolution of budgetary and external position of Portugal between 1999 and 2016

In this subsection, the evolution of budgetary and external position of Portugal between 1999 and 2016 is presented. The variables that reflect budgetary position of Portugal are the weight of the overall budget balance in GDP (*GB*) and the weight of the primary budget balance in GDP (*PGB*). The variables that reflect the external position of the Portuguese economy are, on its turn, the weight of the external balance of goods and services in GDP (*TB*) and the weight of the current external balance in GDP (*CB*).

The analysis is made using quarterly data between the first quarter of 1999 and the fourth quarter of 2016, taken from the INE website, and expressed in nominal terms and adjusted for seasonality and calendar effects.

Figures 1 and 2 show the evolution of the budgetary position and the external position of Portugal, between the first quarter of 1999 and the fourth quarter of 2016, respectively.

Figure 1: Evolution of budgetary position of Portugal (1999.I to 2016.IV)

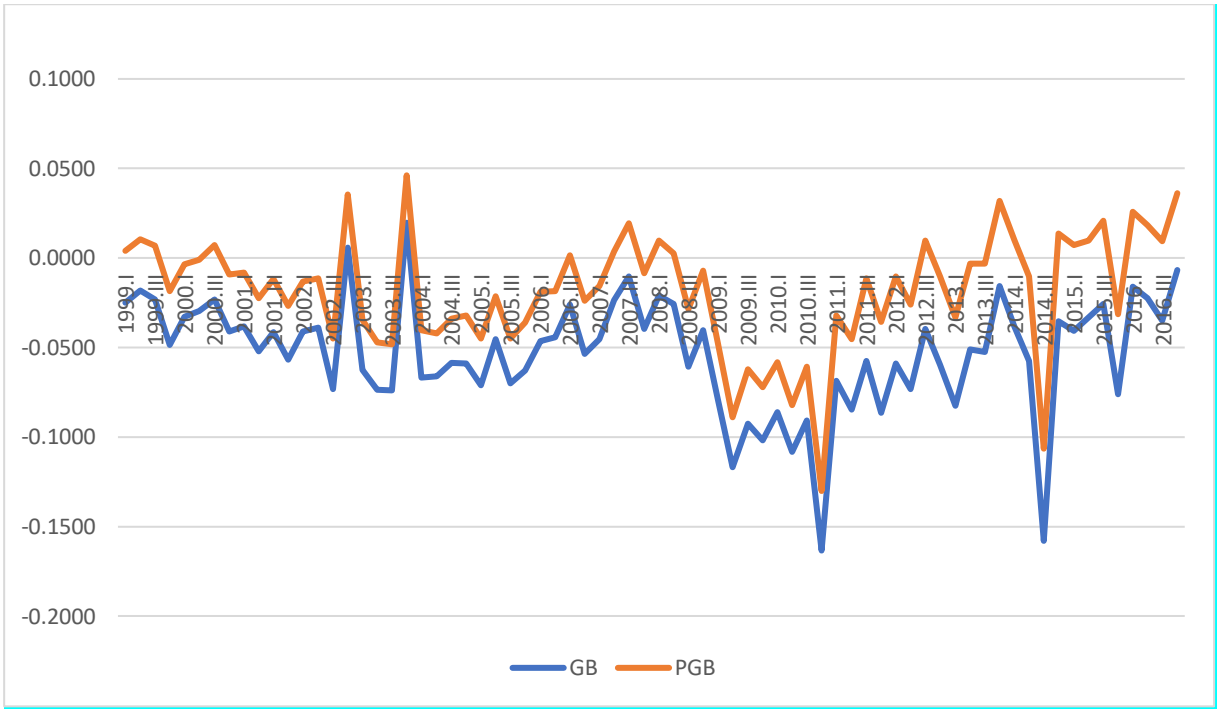

Figure 2: Evolution of external position of Portugal (1999.I to 2016.IV)

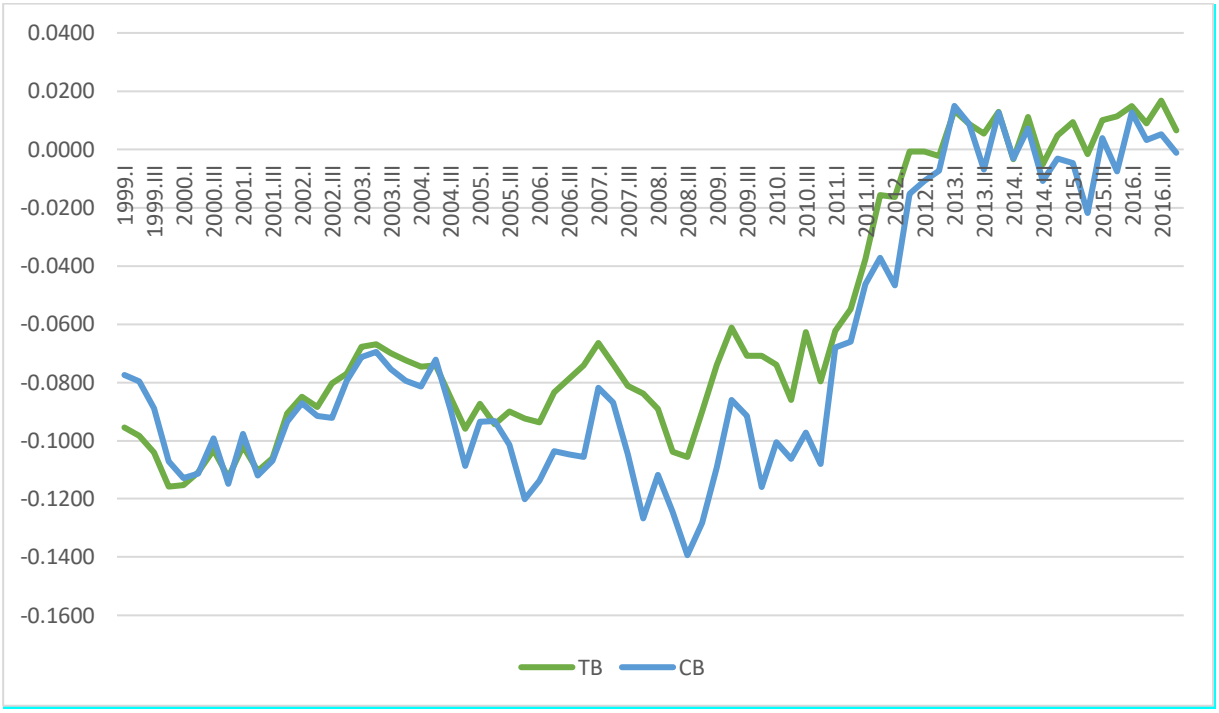

Table 2, next, presents the budgetary and external position of Portugal between 1999 and 2016.

From the analysis of Table 2, we can see that the overall budget balance for each year is always deficit, while the primary budget balance records a surplus in 1999, and, more recently, in 2015 and 2016. With regard to external position of Portugal, the external balance of goods and services is negative between 1999 and 2012, and, as of 2013, it becomes a surplus. The current external balance, in turn, assumes positive values in 2013 and 2016, showing deficits in the remaining years. In 1999 and 2000, deficits in the balance of goods and services are greater than current external deficits. On the contrary, between 2001 and 2012, current external deficits are greater than deficits in the balance of goods and services. This means that Portugal's liabilities to the outside world, motivated by the existence of negative net primary income received from the Rest of the World, amplified the external deficit in that period. In 2014 and 2015, on the other hand, there were deficits in the current account and, simultaneously, surpluses in the balance of goods and services. In 2013 and 2016, surpluses in the balance of goods and services are higher than external surpluses. This mirrors the fact that, 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. Finally, as of 2011, there was a sharp reduction in the magnitude of the deficits in the balance of goods and services and

in the external balance, with surpluses in both balances in 2013 and 2016.[1] This evidence reflects the reduction in external financing that it occurred in the Portuguese economy in early 2011 and culminated in May of that year with the signature of the Economic and Financial Assistance Programme between the Portuguese Republic and the European Commission, the European Central Bank and the International Monetary Fund (the *Troika*).

Table 2: Budgetary and external position of Portugal between 1999 and 2016

Year	*GB*	*PGB*	*TB*	*CB*
1999	– 2.88%	0.07%	– 10.34%	– 8.83%
2000	– 3.17%	– 0.17%	– 11.04%	– 10.95%
2001	– 4.72%	– 1.73%	– 10.23%	– 10.25%
2002	– 3.69%	– 0.85%	– 8.27%	– 8.76%
2003	– 4.76%	– 2.10%	– 6.93%	– 7.40%
2004	– 6.27%	– 3.71%	– 8.24%	– 8.79%
2005	– 6.25%	– 3.70%	– 9.10%	– 10.20%
2006	– 4.26%	– 1.50%	– 8.25%	– 10.69%
2007	– 2.98%	– 0.03%	– 7.63%	– 10.00%
2008	– 3.70%	– 0.59%	– 9.71%	– 12.59%
2009	– 9.75%	– 6.78%	– 6.92%	– 10.06%
2010	– 11.21%	– 8.29%	– 7.56%	– 10.31%
2011	– 7.43%	– 3.11%	– 4.26%	– 5.44%
2012	– 5.80%	– 0.93%	– 0.50%	– 2.00%
2013	– 5.05%	– 0.20%	1.01%	0.74%
2014	– 7.23%	– 2.33%	0.19%	– 0.25%
2015	– 4.40%	0.16%	0.73%	– 0.76%
2016	– 2.00%	2.24%	1.18%	0.50%

Note: Quarterly averages calculated by the author for each year.

The external balance expresses the difference between national savings and investment. A deficit in external accounts may reflect a low savings rate relative to the level of investment made in the economy or a high investment rate. If the deficit is financed through the inflow of long run capital flows, induced investment can increase the productive capacity of the economy,

[1] It should be noted that the average annual external balance of goods and services, in the 1999-2010 period, was – 8.69%; in the 2011-2016 period, it dropped to – 0.28%. On the other hand, the average annual current external balance decreased from – 9.9% to – 1.2% between both periods.

which is beneficial from the point of view of economic growth. Thus, in the short run, the external deficit is not a problem. However, if external deficits become high and persistent, they reveal them unsustainable, and reversals of external financing may occur, called sudden stops.[2] These consist of the non entry of capital flows from abroad that were previously made available to the economy and that cease to be. The reversals of external financing are usually very disruptive, as they require a very rapid decrease in private consumption, public expenditure and investment due to financing from abroad that is no longer accessible. In this context, the economy as a whole will have to generate significant surpluses to repay past loans.

5. Data

In order to test the existence of a causal relationship between the budget deficit and the external deficit for Portugal, the four variables analyzed in the previous section are considered, namely, the weight of the overall budget balance in GDP (*GB*), the weight of the primary budget balance in GDP (*PGB*), the weight of the external balance of goods and services in GDP (*TB*) and the weight of the current external balance in GDP (*CB*).

With the above mentioned variables, it is intended to establish a comparison between four relationships: (i) the overall budget balance and the external balance of goods and services; (ii) the overall budget balance and the current external balance; (iii) the primary budget balance and the external balance of goods and services; and (iv) the primary budget balance and the current external balance.[3]

The empirical research implemented uses the data considered in the analysis carried out in the previous section. Thus, this study uses quarterly data, such as Darrat (1988), Algieri (2013) and Nikiforos *et al.* (2015), among others, instead of annual data. The use of greater frequency and disaggregation of data provides more information about the evolution of budgetary and external positions and allows for a better understanding of the interactions between both and to carry out a finer and more in-depth analysis of the underlying dynamics (Algieri, 2013).

Table 3 presents the usual descriptive statistics for the four variables under study.

[2] The verification of high and persistent external deficits may reflect a structural weakness of the economy and the existence of non-competitive tradable sectors.

[3] Despite the fact that, in empirical literature, the use of the overall budget balance as a measure of the budgetary position of economy is dominant, in Trachanas and Katrakilidis (2013) and in Nikiforos *et al.* (2015), the authors use the primary budget balance.

Table 3: Descriptive Statistics

Variável	Mean	Standard Deviation	Maximum	Minimum
GB	– 5.31%	3.20%	1.97%	– 16.34%
PGB	– 1.86%	3.28%	4.61%	– 13.02%
TB	– 5.88%	4.34%	1.68%	– 11.58%
CB	– 7.00%	4.54%	1.49%	– 13.93%

Source: Author´s calculations.

Table 4 shows the correlations between the variables under study.

Table 4: Correlation matrix

	GB	*PGB*	*TB*	*CB*
GB	1.0000	0.9628	– 0.0293	0.0741
PGB	0.9628	1.0000	0.2111	0.3043
TB	– 0.0293	0.2111	1.0000	0.9543
CB	0.0741	0.3043	0.9543	1.0000

Source: Author´s calculations.

The correlations between the weight of the overall budget balance in GDP and the weight of the external balance of goods and services in GDP and between the weight of the overall budget balance in GDP and the weight of the current external balance in GDP are very low, – 0.0293 and 0.0741, respectively. The correlations between the weight of the primary budget balance in GDP and the weight of the external balance of goods and services and between the weight of the primary budget balance in GDP and the weight of the current external balance in GDP, although low, are positive. It should be noted that the second correlation assumes 0.3043, being close to 0.35, a value that usually points to the existence of a moderate correlation between two variables.

In order to test the stationarity of the series in levels and their order of integration, three complementary tests were implemented, namely, the ADF test (Augmented Dickey-Fuller, 1979), the PP test (Phillips-Perron, 1988) and the KPSS test (Kwiatkowski *et al.*, 1992). The results are reported in Table A1 (see Appendix).

The results of the ADF, PP and KPSS tests point to the absence of unitary roots in levels in the *GB* and *PGB* series, which, therefore, allows us to advance that they are stationary in levels and integrated in order 0, *I(0)*. Regarding the *TB* and *CB* series, both have a unitary root in levels,

and therefore are not stationary in levels. Thus, we also work with the first differences in these series and repeat the unit root tests, concluding that these are only stationary in first differences, being integrated in order 1, *I(1)*.[4]

6. Methodology

The empirical analysis uses two methodologies. The first consists of the implementation of the Granger Causality Test (1969), based on the VAR (Auto-Regressive Vector) models defined below:

$$GB_t = \alpha_0 + \sum ß_k GB_{t-k} + \sum \Upsilon_k TB_{t-k} + \varepsilon_t \quad (1)$$

$$TB_t = \delta_0 + \sum \eta_k TB_{t-k} + \sum \lambda_k GB_{t-k} + \upsilon_t \quad (2)$$

or

$$GB_t = \alpha_0 + \sum ß_k GB_{t-k} + \sum \Upsilon_k CT_{t-k} + \varepsilon_t \quad (3)$$

$$CT_t = \delta_0 + \sum \eta_k CT_{t-k} + \sum \lambda_k GB_{t-k} + \upsilon_t \quad (4)$$

or

$$PGB_t = \alpha_0 + \sum ß_k PGB_{t-k} + \sum \Upsilon_k TB_{t-k} + \varepsilon_t \quad (5)$$

$$TB_t = \delta_0 + \sum \eta_k TB_{t-k} + \sum \lambda_k PGB_{t-k} + \upsilon_t \quad (6)$$

or

$$PGB_t = \alpha_0 + \sum ß_k PGB_{t-k} + \sum \Upsilon_k CT_{t-k} + \varepsilon_t \quad (7)$$

$$CT_t = \delta_0 + \sum \eta_k CT_{t-k} + \sum \lambda_k PGB_{t-k} + \upsilon_t \quad (8)$$

The Granger Causality tests made in the framework of a VAR model aim to determine whether the inclusion of lagged observations of *GT* and *PGT* reduces the forecast error of *TB* and *CT*, which means to know whether these variables are predicted by the former, compared to a model that only includes past observations from *TB* and *CT*. In this regard, an important aspect to note is the fact that when it is stated, for example, that "the overall budget balance causes Granger the current external balance", this does not mean that the latter is an effect or 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 result allows to check only if one variable leads to the other.

[4] Usually, in the empirical literature, the variables with we work in this study are *I(1)*. Like the author, Forte and Magazzino (2013) conclude that the serie of the overall budget balance is *I(0)* and the serie of the current account balance is *I(1)*.

The Granger Causality Test (1969) considers the following hypotheses, null and alternative, respectively:

$H_0 : \lambda_1 = \lambda_2 = \ldots = \lambda_k = 0$

vs.

$H_1 : \lambda_1 \neq \lambda_2 \neq \ldots \neq \lambda_k \neq 0,$ (9)

where the null hypothesis implies that *GB* and/or *PGB* does not cause Granger *TB* and/or *CT*.

Also, the Granger Causality Test (1969) tests:

$H_0 : \Upsilon_1 = \Upsilon_2 = \ldots = \Upsilon_k = 0$

vs.

$H_1 : \Upsilon_1 \neq \Upsilon_2 \neq \ldots \neq \Upsilon_k \neq 0$ (10)

that is, *TB* and/or *CT* does not cause Granger *GB* an/or *PGB* against the alternative that *TB* and/or *CT* causes Granger *GB* and/or *PGB*.

The second methodology implemented is the Toda-Yamamoto non-Granger Causality Test (1995). This empirical technique uses a modified Wald statistic to test the significance of the parameters of an increased VAR model ($k + d_{max}$), where k corresponds to the size of the system lag and d_{max} is the maximum order of integration in the model. This guarantees an asymptotic chi-square distribution of the Wald statistic. The dimensions of the variable lags in the causal models are chosen according to the usual procedure for an integrated or cointegrated VAR. Since the lagged dependent variables appear in each equation of the causal models, it is expected that there will be a removal of the serial correlation between the residuals.

This approach is an alternative causality test based on an increased non-Granger causality equation with extra lags determined by a potential integration order of the series tested causally. Additionally, this test is made using a VAR model in levels and imposes (non) linear restrictions on its parameters, without the obligation to implement unit root tests and to determine the cointegration order between the variables under analysis.

In practice, the Toda-Yamamoto Methodology (1995) involves two stages. The first stage consists of estimating a VAR increased in levels, with $k + d_{max}$ lags. In the second stage, the Wald test for the matrix of the coefficients of the first k lags is obtained to test the existence of Granger causality. To test the null hypothesis, this methodology assumes that the Wald statistic converges into a distribution for a chi-square random variable with k degrees of freedom,

regardless of whether the process that generates it is stationary (possibly along a linear trend) or cointegrated.

Therefore, this methodology minimizes the risks associated with under-identification of the series integration orders or the presence of cointegration and the likelihood associated with the distortion of the test dimension that usually results from the pre-tests performed.

7. Results

The selection of the lags in each methodology was based on the order selection tests of the VAR model, using the AIC (Akaike Information Criterion), sequential modified LR test, FPE (Final Prediction Error), SBC (Schwarz Bayesian Criterion) and HQ (Hannan-Quinnn Information Criterion).

In order to carry out the Granger Causality tests, it was estimated, first, a VAR model in first differences with 1 lag. Then, the mentioned tests for selecting the order of the VAR model were performed for the lag *k*, considering $k = 1,...,8$, with eight the maximum number of lags considered. For each level of lag, the optimal number of lags was obtained.

Four batteries of the Granger Causality tests were performed. The first battery concerns the relationship between the overall budget balance and the external balance of goods and services: if the overall budget balance causes Granger the external balance of goods and services (overall budget balance => external balance of goods and services); if the external balance of goods and services causes Granger the overall budget balance (external balance of goods and services => overall budget balance); whether there is bi-directional causality (overall budget balance <=> external balance of goods and services) or if there is no relationship between the two variables. The second, third and fourth batteries concern the relationship between the overall budget balance and the current external balance, the primary budget balance and the external balance of goods and services and the primary budget balance and the current external balance, respectively, and following the same cases.

Since, in each VAR model, there is a variable *I(1)*, *TB* or *CB*, these tests were implemented considering the variables in first differences.

The results of the Granger Causality tests are shown in Tables A2-A10 (see Appendix).

These empirical results point to the absence of Granger causality, in both directions, between the overall budget balance and the external balance of goods and services and between the primary budget balance and the external balance of goods and services (with the variables

evaluated in percentage of GDP and in first differences) for Portugal, between the first quarter of 1999 and the fourth quarter of 2016. On the other hand, evidence of Granger causality was found between the overall budget balance and the current external balance and between the primary budget balance and the current external balance, considering 1 lag and 8 lags. With 1 lag, the *p-values* are 6.97% and 7.72%, respectively, with no statistical significance at 5%; with 8 lags, causality is highly significant. Then, these results allow to corroborate the Twin Deficits Hypothesis. In addition, an inverse Granger causality was found between the current external balance and the overall budget balance, taking 4 lags, at 7.58% of significance level. This result may constitute evidence to support the Current Account Targeting Hypothesis.

The results of the tests carried out under the Toda-Yamamoto Methodology (1995) are shown in Tables A11-A24 (see Appendix). Unlike the previous methodology, this procedure uses the variables in levels. Following Algieri (2013), for each estimated model, its dynamic stability was also tested, using the inverse roots of the characteristic polynomial AR, and the LM test was implemented, which allows to investigate the existence of serial autocorrelation.

The results obtained with the Toda-Yamamoto Methodology (1995) state that the overall budget balance causes non-Granger the external balance of goods and services and the primary budget balance causes non-Granger the external balance of goods and services, considering 8 lags and at a 5% level of significance, for Portugal between the first quarter of 1999 and the fourth quarter of 2016 (with the variables assessed as a percentage of GDP). Additionally, the overall budget balance causes non-Granger the current external balance, for 1, 2 and 7 lags and with *p-values* between 0.52% and 9.36%, and the primary budget balance causes non-Granger the current external balance, for 1 and 7 lags and at 5% significance level. These results also confirm the Twin Deficit Hypothesis. For 1 lag, there is evidence of non-Granger causality between the external balance of goods and services and the overall budget balance, although with a *p-value* of 6.85%, which may provide support for the Current Account Targeting Hypothesis.

Table 5, next, presents a summary of the empirical results obtained, in which, for each of the investigated causality relationships and for both tests implemented, it informs about the statistical evidence supporting the rejection of the null hypothesis of the existence of causality between the variables under study, considering a level of significance up to 10%.

Table 5: Summary table of the empirical results

Direction of causality	Granger Causality Test	Toda-Yamamoto Methodology
GB => TB	NO	**YES**
GB => CT	**YES**	**YES**
PGB => TB	NO	**YES**
PGB => CT	**YES**	**YES**
TB => GB	NO	**YES**
TB => PGB	NO	NO
CT => GB	**YES**	NO
CT => PGB	NO	NO

Source: Author´s elaboration.

From the analysis of Table 5, we find that there is statistical evidence to support the verification of a causal relationship between the overall budget balance and the current external balance and between the primary budget balance and the current external balance (with the variables assessed as a percentage of GDP), for both empirical tests implemented. The fact that we work with the series in first differences when we implement the Granger Causality Test (1969) and with the series in levels when we follow the Toda-Yamamoto Methodology (1995) does not influence these two results. Therefore, we can consider them robust and conclude by verifying the Twin Deficits Hypothesis for Portugal, between 1999 and 2016. Also, the inclusion (or not) of interest paid in public debt service does not affect the existence of causality between the budget balance and the current external balance. Additionally, the use of the Toda-Yamamoto Methodology (1995) allows to advance the existence of causality between the overall budget balance and the external balance of goods and services and between the primary budget balance and the external balance of goods and services, which reinforces the empirical support for the Twin Deficits Hypothesis, either in the version proposed by the Mundell-Fleming Model applied to economies with fixed changes or in the perspective of the Keynesian Absorption Theory.

In addition, using the Granger Causality Test (1969), we obtain evidence of an inverse causality relationship between the current external balance and the overall budget balance, and, using the Toda-Yamamoto Methodology (1995), we find a inverse causal linkage between the external balance of goods and services and the overall budget balance. These results may point to the verification of the Current Account Targeting Hypothesis.

Combining both results, we can suggest the verification of a bi-directional causality relationship between the budget balance and the external balance, in line with the feedback linkage found by Feldstein and Horioka (1980). This result is not surprising, since savings and investments are highly correlated, important feedback emerges between both balances and causality operates bilaterally.

8. Conclusions

This investigation studies the existence of a causal relationship between four links, namely: the overall budget balance and the external balance of goods and services, the overall budget balance and the current external balance, the primary budget balance and the external balance of goods and services and the primary budget balance and the current external balance (assessed as a percentage of GDP), for Portugal, between 1999 and 2016, using quarterly data.

The study was carried out using two complementary methodologies: the Granger Causality Test (1969) and the Toda-Yamamoto Methodology (1995). The results obtained by both methodologies point to the existence of causality between the overall budget balance and the current external balance and between the primary budget balance and the current external balance, which empirically corroborates the Twin Deficit Hypothesis. This result obtained for Portugal is in line with that concluded by Daly and Siddiki (2009), Afonso *et al.* (2013) and Trachanas and Katrakilidis (2013), however, in opposition to the result obtained by Algieri (2013), which finds empirical support to the Ricardian Equivalence Hypothesis. Some evidence of verification of the Current Balance Targeting Hypothesis was found. Consequently, we can advance the existence of a possible bilateral relationship between the budget deficit and the external deficit for the Portuguese economy.

Given that we found some evidence of bi-directional causality between both deficits, this result shows that the relationship between the budget deficit and the external deficit is more complex than that suggested individually by the Twin Deficit Hypothesis and the Current Account Targeting Hypothesis. Thus, the feedback linkage between savings and investment advanced by Feldstein and Horioka (1980) is more appropriate for understanding this empirical conclusion.

As long as the Twin Deficit Hypothesis is confirmed, we can advance that the reduction of the budget deficit contributes to the reduction of Portugal external imbalance. Therefore, a restrictive fiscal policy can effectively generate a surplus in external accounts. Nevertheless, the implementation of such a policy has recessive effects on economic activity. In a scenario of

economic and financial crisis, resulting from the reversal of external financing, as the country faced in early 2011, the application of a strong restrictive fiscal policy is counterproductive. In this case, the recession is aggravated, worsening the fiscal consolidation of the year in which it is applied and making the fiscal consolidation of the following year more difficult.

On the other hand, the verification of the Current Account Targeting Hypothesis points to the need to monitor the external competitiveness of the economy; adjusting export and import flows in the event of a trade deficit; and the importance of the inflow of foreign capital flows as well as of the income and transfers received from the Rest of the World, in case of current account deficit. Trade deficits and current account deficits can result from losses in the external competitiveness of the economy and lead to a fall in economic activity and negatively affect public accounts. Alternatively, trade deficits and current account deficits may encourage the Government to increase public expenditure, due to a greater availability of foreign capital flows, and contribute to the deterioration of the budget balance.

Finally, there are several important aspects to consider in future research that the present study does not analyze. One aspect is the integration in the analysis of the relationship between private savings, investment and the current account balance, since the first two variables influence the third together with the budget balance. Another aspect to be examined is the impact of the budget balance on private savings and investment, given that, in a context of deterioration in the balance of public accounts, the crowding-out effect can occur and, consequently, private savings and investment are adversely affected and the deterioration of the current account balance is more pronounced. The third important aspect to be admitted in future research is the understanding of the link between the budget balance and the income and transfers received from the Rest of the World, particularly in a context where the budget deficit does not influence the external deficit of goods and services, but the current external deficit. The fourth aspect relates to the relevance of the consideration in the analysis of the context of economic and financial integration that EMU has provided to the Portuguese economy, namely with regard to access to abundant external capital flows and with reduced interest rates and the possible loss of external competitiveness resulting from the over-appreciation of the single currency.

Appendix

Table A1: Results of unit root tests

	Serie	*GB*	*PGB*	*TB*	*CB*
ADF test	Levels: *t* statistic	– 5.874698[a]	– 3.337274[a]	– 0.519722[a]	– 0.875745[a]
	p-value	0.0000***	0.0168**	0.8804	0.7904
	Serie type	*I(0)*	*I(0)*		
	First differences: *t* statistic			– 9.830543[a]	– 10.24431[a]
	p-value			0.0000***	0.0001***
	Serie type			*I(1)*	*I(1)*
PP test	Levels: *t* statistic	– 5.973436[a]	– 5.664661[a]	– 0.530922[a]	– 0.696912[a]
	p-value	0.0000***	0.0000***	0.8781	0.8404
	Serie type	*I(0)*	*I(0)*		
	First differences: *t* statistic			– 9.716040[a]	– 10.24431[a]
	p-value			0.0000***	0.0001***
	Serie type			*I(1)*	*I(1)*
KPSS test	Levels: LM Stat	0.257097[b]	0.158098[b]	0.924557[b***]	0.719284[b**]
	Serie type	*I(0)*	*I(0)*		
	First differences: LM Stat			0.109081[b]	0.202477[b]
	Serie type			*I(1)*	*I(1)*

Notes: (1) The null hypothesis of ADF and PP tests assumes that the serie has an unit root. The null hypothesis of KPSS test assumes that the serie is stationary.
(2) ADF, PP and KPSS tests include constant.
(3) For the ADF test, is considered the lag length automatic based on SIC, MAXLAG=12. For the PP e KPSS tests, is considered the lag length bandwitch Newey-West using Bartlett kernel.
(4) [a] MacKinnon (1996) one-sided *p-values*.
(5) *** Denotes statistical significance at 1%. ** Denotes statistical significance at 5%.
(6) [b] Critical values from Kwiatkowski–Phillips–Schmidt–Shin (1992): ***level 1%: 0.739000; **level 5%: 0.463000; *level 10%: 0.347000. If the test statistic is greater than the critical value, the null hypothesis is rejected. When the test statistic is less than the critical value, the null hypothesis cannot be rejected.
(7) *I(0)* designates integrated serie of order 0. *I(1)* designates integrated serie of order 1.

Tables A2-A10: Results of Granger Causality Tests

Table A2

Sample: 1999.I to 2016.IV

Lags: 1

Null Hypothesis :	Obs	F-Statistic	Prob.
D(*TB*) does not Granger cause D(*GB*)	70	1.72628	0.1934
D(*GB*) does not Granger cause D(*TB*)		0.48906	0.4868

Note: D = First difference operator.

Table A3

Sample: 1999.I to 2016.IV

Lags: 4

Null Hypothesis :	Obs	F-Statistic	Prob.
D(*TB*) does not Granger cause D(*GB*)	67	1.29690	0.2819
D(*GB*) does not Granger cause D(*TB*)		0.77187	0.5480

Table A4

Sample: 1999.I to 2016.IV

Lags: 1

Null Hypothesis :	Obs	F-Statistic	Prob.
D(*CB*) does not Granger cause D(*GB*)	70	0.73996	0.3927
D(*GB*) does not Granger cause D(*CB*)		3.39713	0.0697

Table A5

Sample: 1999.I to 2016.IV

Lags: 4

Null Hypothesis :	Obs	F-Statistic	Prob.
D(*CB*) does not Granger cause D(*GB*)	67	2.23964	0.0758
D(*GB*) does not Granger cause D(*CB*)		1.74969	0.1515

Table A6

Sample: 1999.I to 2016.IV			
Lags: 8			
Null Hypothesis :	Obs	F-Statistic	Prob.
D(*CB*) does not Granger cause D(*GB*)	63	1.34062	0.2481
D(*GB*) does not Granger cause D(*CB*)		3.92650	0.0013

Table A7

Sample: 1999.I to 2016.IV			
Lags: 1			
Null Hypothesis :	Obs	F-Statistic	Prob.
D(*TB*) does not Granger cause D(*PGB*)	70	1.71811	0.1944
D(*PGB*) does not Granger cause D(*TB*)		0.33266	0.5660

Table A8

Sample: 1999.I to 2016.IV			
Lags: 4			
Null Hypothesis :	Obs	F-Statistic	Prob.
D(*TB*) does not Granger cause D(*PGB*)	67	1.20821	0.3172
D(*PGB*) does not Granger cause D(*TB*)		0.89005	0.4758

Table A9

Sample: 1999.I to 2016.IV			
Lags: 1			
Null Hypothesis :	Obs	F-Statistic	Prob.
D(*CB*) does not Granger cause D(*PGB*)	70	0.83611	0.3638
D(*PGB*) does not Granger cause D(*CB*)		3.22208	0.0772

Table A10

Sample: 1999.I to 2016.IV			
Lags: 8			
Null Hypothesis :	Obs	F-Statistic	Prob.
D(*CB*) does not Granger cause D(*PGB*)	63	1.25594	0.2897
D(*PGB*) does not Granger cause D(*CB*)		3.90753	0.0014

Tables A11-A24: Results of causality tests using the Toda-Yamamoto Methodology (1995)

Table A11

Sample: 1999.I to 2016.IV			
Obs: 70			
Dependent variable: *GB*			
Exclusion	Chi-sq	df	Prob.
TB	3.317909	1	0.0685
Dependent variable: *TB*			
Exclusion	Chi-sq	df	Prob.
GB	1.964420	1	0.1610

Table A12

Sample: 1999.I to 2016.IV			
Obs: 69			
Dependent variable: *GB*			
Exclusion	Chi-sq	df	Prob.
TB	3.872315	2	0.1443
Dependent variable: *TB*			
Exclusion	Chi-sq	df	Prob.
GB	0.312849	2	0.8552

Notes: (1) VAR system not stable.
(2) Possibility of existence of serial autocorrelation.

Table A13

Sample: 1999.I to 2016.IV			
Obs: 63			
Dependent variable: *GB*			
Exclusion	Chi-sq	df	Prob.
TB	11.38817	8	0.1807
Dependent variable: *TB*			
Exclusion	Chi-sq	df	Prob.
GB	19.41446	8	0.0128

Table A14

Sample: 1999.I to 2016.IV			
Obs: 70			
Dependent variable: *GB*			
Exclusion	Chi-sq	df	Prob.
CB	2.060155	1	0.1512
Variável independente: *CB*			
Exclusion	Chi-sq	df	Prob.
GB	6.093038	1	0.0136

Table A15

Sample: 1999.I to 2016.IV			
Obs: 69			
Dependent variable: *GB*			
Exclusion	Chi-sq	df	Prob.
CB	2.407630	2	0.3000
Dependent variable: *CB*			
Exclusion	Chi-sq	df	Prob.
GB	4.736773	2	0.0936

Table A16

Sample: 1999.I to 2016.IV			
Obs: 64			
Dependent variable: *GB*			
Exclusion	Chi-sq	df	Prob.
CB	10.96118	7	0.1403
Dependent variable: *CB*			
Exclusion	Chi-sq	df	Prob.
GB	20.16744	7	0.0052

Table A17

Sample: 1999.I to 2016.IV			
Obs: 63			
Dependent variable: *GB*			
Exclusion	Chi-sq	df	Prob.
CB	12.62728	8	0.1253
Dependent variable: *CB*			
Exclusion	Chi-sq	df	Prob.
GB	40.43828	8	0.0000

Note: VAR system not stable.

Table A18

Sample: 1999.I to 2016.IV			
Obs: 70			
Dependent variable: *PGB*			
Exclusion	Chi-sq	df	Prob.
TB	2.487972	1	0.1147
Dependent variable: *TB*			
Exclusion	Chi-sq	df	Prob.
PGB	1.052310	1	0.3050

Table A19

Sample: 1999.I to 2016.IV			
Obs: 69			
Dependent variable: *PGB*			
Exclusion	Chi-sq	df	Prob.
TB	3.566111	2	0.1681
Dependent variable: *TB*			
Exclusion	Chi-sq	df	Prob.
PGB	0.041717	2	0.9794

Note: VAR system not stable.

Table A20

Sample: 1999.I to 2016.IV			
Obs: 64			
Dependent variable: *PGB*			
Exclusion	Chi-sq	df	Prob.
TB	11.53941	7	0.1168
Dependent variable: *TB*			
Exclusion	Chi-sq	df	Prob.
PGB	7.213531	7	0.4070

Table A21

Sample: 1999.I to 2016.IV			
Obs: 63			
Dependent variable: *PGB*			
Exclusion	Chi-sq	df	Prob.
TB	12.15607	8	0.1444
Dependent variable: *TB*			
Exclusion	Chi-sq	df	Prob.
PGB	16.29487	8	0.0383

Table A22

Sample: 1999.I to 2016.IV			
Obs: 70			
Dependent variable: *PGB*			
Exclusion	Chi-sq	df	Prob.
CB	1.522232	1	0.2173
Dependent variable: *CB*			
Exclusion	Chi-sq	df	Prob.
PGB	4.340581	1	0.0372

Table A23

Sample: 1999.I to 2016.IV			
Obs: 69			
Dependent variable: *PGB*			
Exclusion	Chi-sq	df	Prob.
CB	2.219469	2	0.3296
Dependent variable: *CB*			
Exclusion	Chi-sq	df	Prob.
PGB	3.709248	2	0.1565

Table A24

Sample: 1999.I to 2016.IV			
Obs: 64			
Dependent variable: *PGB*			
Exclusion	Chi-sq	df	Prob.
CB	10.37892	7	0.1681
Dependent variable: *CB*			
Exclusion	Chi-sq	df	Prob.
PGB	17.27679	7	0.0157

References

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

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

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

Baharumshah, A., E. Lau and A. M. Khalid (2006), "Testing twin deficits hypothesis using VARs and variance decomposition", *Journal of the Asia Pacific Economy*, Vol. 11, Issue 3, pp. 331-354.

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 Perspetives*, Vol. 3, Issue 2, pp. 37-54.

Beetsma, R., M. Giuliodori and F. Klaassen (2008), "The effects of public spending on trade balances and budget deficits in the European Union", *Journal of the European Economic Association*, Vol. 6, Issues 2-3, pp. 414-423.

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

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

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

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.

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

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

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.

Khalid, A. and T. W. Guan (1999), "Causality tests of budget and current account deficits: Cross-country comparisons", *Empirical Economics*, Vol. 24, Issue 3, pp. 389-402.

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.

Kouassi, E., M. Mougoué and K. O. Kymn (2004), "Causality tests of the relationship between the twin deficits", *Empirical Economics*, Vol. 29, Issue 3, pp. 503-525.

Kwiatkowski, D., P. C. B. Phillips, P. Schmidt and Y. Shin (1992), "Testing the null hypothesis of stationary against the alternative of a unit root. How sure are we that economic time series have a unit root?", *Journal of Econometrics*, Vol. 54, Issues 1-3, pp. 159-178.

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.

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

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

Rault, C. and A. Afonso (2009), "Bootstrap panel granger-causality between Government budget and external deficits for the EU", *Economics Bulletin*, Vol. 29, Issue 2, pp. 1027-1034.

Ricciuti, R. (2003), "Assessing Ricardian equivalence", *Journal of Economic Surveys*, Vol. 17, Issue 1, pp. 55-78.

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

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

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

Toda, H. Y. and T. Yamamoto (1995), "Statistical inference in vector autoregressions with possibly integrated processes", *Journal of Econometrics*, Vol. 66, Issues 1-2, pp. 225-250.

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

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