ERASMUS UNIVERSITEIT ROTTERDAM
ERASMUS SCHOOL OF ECONOMICS

The Twin Deficits Hypothesis: the case of Portugal

Abstract

The period since the so-called Great Recession in Portugal has been marked by a weak growth economic environment. Defending that domestic consumption plays a crucial role in driving economic growth, expansionary fiscal policies are currently in place, yet many doubt this Keynesian approach to growth is adequate. Both high public debt levels and a current account surplus stemming from a sharp decline in domestic consumption prompt sustainability concerns on the efficiency of fiscal policy. In this context, this paper investigates whether the use of expansionary fiscal policy in the case of Portugal is fruitful. Empirically, the Twin Deficits Hypothesis in which larger fiscal deficits are accompanied by wider current account deficits is tested. To this end, Granger causality tests in a multivariate Vector Error Correction specification (VECM) are employed while allowing for endogenously determined structural breaks in the equilibrium relationship. This paper analyzes quarterly data for the period 1999-2017, which comprises the Great Recession and Portugal's exit from the European Union's excessive deficit procedure. It finds that changes in the Portuguese current account balance precede changes in its government budget balance, suggesting that the Twin Deficits Hypothesis does not hold in Portugal's case. Accordingly, policies aimed at promoting the country's external position and addressing productivity via further technological development while avoiding rises in domestic prices, are likely to assist efforts to reduce the country's budget deficit and support a stronger growth environment. The projections for a future increase of imports as prospects for a demand restoring its initial profile appear to be strong emphasize the importance of export promotion policies.

Master Thesis submitted by:
Name: Beatriz Madeira Torrinha
Student Number: 431527
Email: 431527bm@student.eur.nl

Supervised by:
Name: Dr. Lorenzo Pozzi
Email: pozzi@ese.eur.nl

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List of Acronyms

1. ADF: Augmented Dickey Fuller
2. ARDL: Autoregressive Distributed Lag Model
3. BB: Budget Balance
4. CA: Current Account
5. CATH: Current Account Targeting Hypothesis
6. CUMSUM: Cumulative Sum
7. ECT: Error Correction Term
8. GDP: Gross Domestic Product
9. LM: Lagrange Multiplier
10. OLS: Ordinary Least Squares
11. REER: Real Effective Exchange Rate
12. REH: Ricardian Equivalence Hypothesis
13. SIR: Short-term Interest Rate
14. VAR: Vector Autoregressive
15. VECM: Vector Error Correction Model

1. Introduction

1.1. Motivation

Over the last few years, fiscal policy has become a central topic of public debate as fiscal crises spread across the Eurozone. During this time, many of these economies have reported record deleterious levels of fiscal and external imbalances. As a result, there has been a resurgence of interest in studying the "Twin Deficits Hypothesis" (Trachanas & Katrakilidis, 2013). According to this hypothesis, a current account deficit is a consequence of an existing budget deficit.

Although a great deal of empirical research is dedicated to the Twin Deficits and its alternative hypotheses, there is lack of consent on the existence and direction of a causal relation between external and fiscal deficits (Kalou & Paleologou, 2012). This lack of agreement is related to the vast array of different methodologies, theoretical assumptions and sample periods employed. However, owing to efforts directed at improving formal empirical testing during recent years, there seems to exist a convergence among researchers towards the best empirical techniques when examining the twin deficits hypothesis.

Fiscal and external deficits: alarming signal

Large persistent budget deficits can be seen as a warning sign regarding the overall health of an economy, as deficits must ultimately be repaid to avoid bankruptcy. If excessive deficits eventually culminate in insolvency, the government's capacity to pay back its debts becomes implausible. This is the case for several European economies, especially heavily indebted countries such as Portugal.

On the other hand, the current account balance, commonly defined by its larger component of net exports, reflects a nation's competitiveness. Because countries in the Eurozone cannot depreciate their currency to become more competitive as they are part of a currency union, this can result in substantial external imbalances. Most of the Southern European economies, which are particularly susceptible to world financial developments, have experienced unprecedented current account deficits in the last couple of decades. Whether an external deficit is good or bad depends on its origins; more imports than exports relate to competitiveness issues whereas an excess of

investment over savings can lead to a growing and productive economy, given effective investing (Ghosh & Ramakrishnan, 2012).

1.2. Context

The Socialist political status in Portugal

The new Portuguese government, formed by a coalition between the Socialist and other left-side parties, was instated at the end of 2015. Since then it has already reverted, or accelerated the reversion of, several austerity measures imposed by Troika during their earlier interventions in the sovereign debt crisis. While easing the tax burden that had increased significantly during the crisis, policymakers are attempting to improve Portugal's economic growth rate and reduce unemployment. Aware of the crucial role that domestic demand plays in the economic growth of a nation, they argue for a slightly looser fiscal policy along with more government intervention in the economy. Some of the anti-austerity measures currently in place include reversing salary cuts and holiday subsidies to civil servants, the establishment of the 35 hour week of work, the restoration of four national holidays that had been removed as well as of state pensions. At the moment, further anti-austerity measures such as the increase of the minimum wage and the reduction of taxes on the restaurants and catering sector are being arranged.

This emphasis on stimulating domestic demand as an important engine of economic growth is one of the fundamental pillars of the Keynesian model, referred to as demand-side economics. This doctrine posits that government intervention can be beneficial to stabilize the economy. Many remain skeptical about the potential of the current Socialist government's Keynesian approach to growth, even though it showed positive outcomes with the past year's budget (The Economist, 2017).

1.3. Overview of the Portuguese Twin Deficits history

The evolution of the Portuguese government budget balance

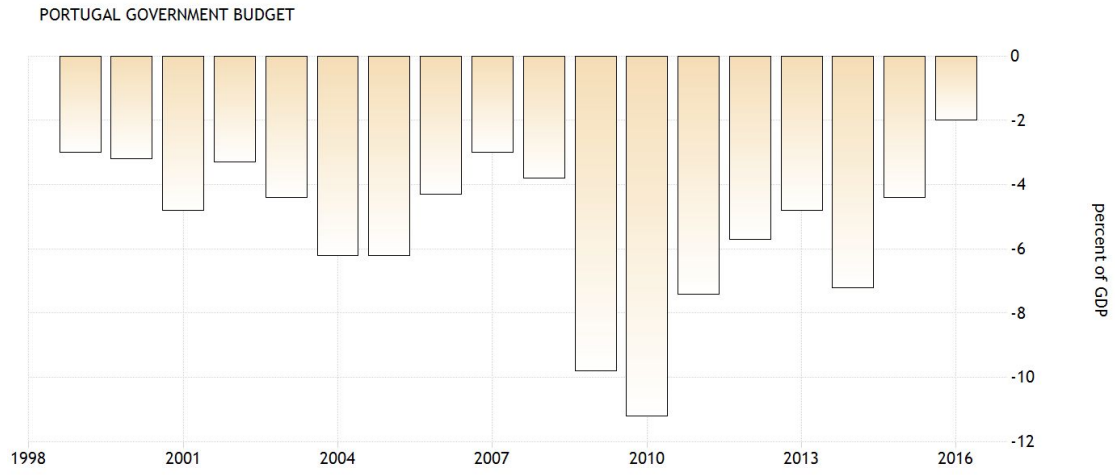


Figure 1. Government Budget Balance (% GDP). Source: Tradingeconomics.com | Eurostat

At the time of writing, Portugal's budget deficit recovery - often referred to as the Portuguese miracle - has attracted significant media attention. Given the anti-austerity policy status, many were surprised that the government budget deficit fell to its lowest level since the re-establishment of democracy, more than 40 years ago. From 1999 until 2017 the average of the Portuguese annual budget deficit was about 5% of its GDP. It peaked at 11.2% of GDP in 2010 - marking the beginning of the Great Recession in Portugal, and reached a low point of 2.1% of GDP in 2016 (Trading Economics, 2017).

During the last year, Portugal has managed to cut its budget deficit by more than half to 2.1% of the GDP, surpassing the 2.5% target agreed with the European Commission. Portugal is hence ready to leave behind the excessive deficit procedure, six years after bailout (The Economist, 2017).

Despite the shrinking budget deficit, however, according to the most recent OECD economic survey on Portugal, the country's high public debt levels combined with its fragile bank sector, present considerable risks given the weak economic growth (OECD, 2017). The public debt, presenting already a considerable size before the global crisis, has quickly enlarged after its start. This survey stresses that fiscal

consolidation, necessary to reduce the public debt, must take place in a gentle manner to avoid hindering private demand, an important engine of economic recovery.

The evolution of the Portuguese external balance

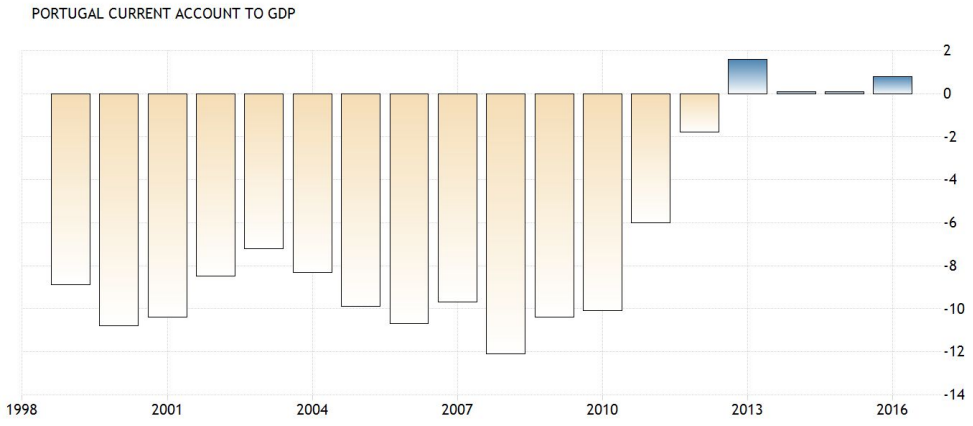


Figure 2. Current Account Balance (% GDP). Source: Tradingeconomics.com | Eurostat

From 1999 until 2017 the Portuguese current account balance presented an annual average of about -6.5% of its GDP, reaching a maximum of 1.6% of GDP in 2013 and a minimum of -12.1% of GDP in 2008 (Trading Economics, 2017).

After the adoption of the Euro, Portugal increased substantially its foreign borrowing. However, as mentioned in a report from Rabobank on the Eurozone crisis (2015), this failed to translate into economic growth due to inefficient private investment. Moreover, underestimating the advantages of investing in human capital, the government invested excessively in infrastructure. On the other hand, the largest Portuguese economic sectors of the pre-crisis period, namely apparel and footwear, have faced fierce competition from China (Rabobank, 2015). In combination, these factors led to a large current account deficit of 12% of its GDP in 2008.

In 2011 and 2012, during the first half of the Great Recession in Portugal, economic activity drastically contracted as external private financing became sharply more difficult and expensive to access. By the second quarter of 2013 the Portuguese economy started to show signs of a moderate recovery. Due to ongoing wage cuts, which improved the country's external competitiveness, an encouraging external environment allowed for a stable increase of net exports throughout 2014 and 2015 (Economic and Financial Affairs, 2014).

However, the abovementioned OECD economic survey on Portugal reveals that, although the rebalancing of trade due to stronger exports enabled a current account surplus in 2016, this was partially due to a greater decline in domestic demand relative to output (OECD, 2017). In fact, during a period of economic crisis private consumption is expected to decay to a greater degree than public consumption, rendering a healthier current account balance as compared to the budget balance (Abbas, Bouhga-Hagbe, Fatás, Mauro, & Velloso, 2011).

1.4. A call for a causal ordering analysis

The economic downturn experienced in the years after 2010 was characterized by a substantial decline of private investment. At the same time, consumption declined and domestic demand fell, contributing to the increase of the domestic saving rate. According to the national accounting identity, if national savings have a surplus over domestic investment, the country should be able to finance its investment without borrowing from abroad. Although these facts add to the explanation of the recent current account surplus, the ongoing fiscal consolidation measures are also thought to play a role in the improvement of Portugal's current account performance. Yet, once demand for imports restores its normal levels, the current account balance will, most likely, deteriorate, calling for the need of other structural reforms (European Commission, 2014; Silva, Silveira, & Others, 2017).

In this context, this study investigates if there is a reason for greater focus on fiscal discipline, in Portugal, for the period after the crisis. With debt rising to unsustainable levels of ratios, the appropriateness of Portugal's fiscal policy settings are debatable, particularly if households are Ricardian in their saving behaviour. Diverging from Keynesian theory, the Ricardian Equivalence Hypothesis postulates that the intertemporal allocation of taxes and budget deficits is irrelevant to consumption behaviour. To this end, I pursue an empirical analysis on the Twin Deficits Hypothesis, as the relationship between the current account and fiscal policy changes depending on whether consumers react in a Ricardian or Keynesian fashion. The pertinence of this matter is that based on the direction of causality, or nonexistence thereof, between the fiscal and the external balances, the extent to which

a reduction in the public deficit can ameliorate the external balance differs. Consequently, the policy directives must also differ.

This study builds on existing research that uses Granger causality tests in a multivariate Vector Error Correction specification (VECM) to investigate the direction of causality between the two macroeconomic variables of interest. Furthermore, this analysis also allows for the endogenous determination of regime shifts in the relationship of interest. As pointed out by Kalou and Paleologou (2012), who conduct similar research for the case of Greece, econometrically ascertaining structural breaks leads to a more efficient identification of a causal order, which is crucial for better policy formulation. The final empirical findings provide support against the Twin Deficits Hypothesis and against the Ricardian Equivalence Hypothesis for the case of Portugal.

In the next section I discuss the existing empirical literature related to this topic, by first exposing the diversified theoretical findings and then surveying the several empirical approaches to this topic. In the succeeding section, I review the theory behind the Twin Deficits Hypothesis from which I then draw the alternative testable hypotheses. The sections explaining data, methodology, and econometric concerns follow. Sections 7 and 8 provide a discussion on the empirical results and the consequent policy implications therefrom.

2. Literature Review

2.1. A Panoply of Findings

Although there have been a number of attempts to analyze the twin deficits hypothesis (or its alternative testable hypotheses), there is no consensus regarding whether the budget deficit causes a current account deficit, or vice versa (Baharumshah, Lau, & Khalid, 2006).

One stream of the literature, such as Normandin (1999), Vamvoukas (1999), Salvatore (2006), Trachanas and Katrakilidis (2013), attests in favour of the Keynesian view, according to which the fiscal and current account deficits are positively related and that a budget deficit will either create or amplify an existing current account deficit. A contrasting view, such as Enders and Lee (1990), Kaufmann, Scharler and Winckler (2002) and Kim and Roubini (2008), provides

evidence that there is no causal link between the two deficits, known as the Ricardian Equivalence Hypothesis (REH). Others, such as Khalid and Guan (1999), Fountas and Tsoukis (2004), Kouassi, Mougoué and Kymn (2004), Marinheiro (2008) and Kalou and Paleologou (2012) provide evidence that supports the Current Account Targeting Hypothesis (CATH), in which the two deficits are positively related, but the causality runs from the current account to the government balance instead. Finally, Baharumshah et al. (2006) and Kouassi et al. (2004) also find evidence of a feedback effect between the two deficits, i.e., a bi-directional causality. In fact, Baharumshah et al. (2006) study the twin deficits hypothesis in the ASEAN countries and find all the previously-mentioned types of linkages among the different countries examined; for instance, while the Keynesian view fits Thailand, the CATH fits Indonesia, and both Malaysia and Philippines reveal a bidirectional pattern of causality.

2.2. Empirical Review

Based on the empirical work developed by Perotti (1999) which shows that government debt to GDP is a good predictor for a nonlinear response of consumption to a fiscal consolidation, Nickel and Vansteenkiste (2008) approached the validity of the Ricardian Equivalence by investigating the relationship between the fiscal balance and the current account. They argue this relationship depends on whether consumers are Ricardian or Keynesian. They model the relationship between the two deficits using a dynamic panel threshold model with fixed effects - first differences as instrumental variables - where they let this relationship vary according to the level of the government debt to GDP ratio, as this variable affects private sector expectations. Providing empirical evidence for diverging consumer behavior depending on the level of public debt to GDP ratio, they find that consumers become Ricardian the higher the government debt to GDP ratio is, whereas for low to medium debt levels the Twin Deficits Hypothesis holds.

Stochastic properties

A different approach is adopted in Normandin (1999); he studies the causal relationship between the twin deficits by modeling it with overlapping generations (birth rate) and accounting for the stochastic properties of the budget deficit. The larger the birth rate, the more Keynesian the consumers are expected to be; since it

implies that the tax burden can be more easily shifted to future generations, increasing private consumption and hence, the external deficit. This model implies that consumers are Ricardian when there is a null birth rate (the currently alive consumers reimburse the budget deficit entirely). The more persistent the budget deficit, the larger the response of the current account as it implies that current public deficits are expected to be followed by future deficits (hence, likely future tax reductions); this leads to a rise in current consumption, and hence, imports, deteriorating the current account. The responses of the current account balance to an increase of the budget deficit are estimated through a VAR specification with quarterly data over the period 1950-1992 for US and Canada. Normandin concludes that there is a statistically positive link between the twin deficits for Canada but not for the US. Salvatore (2006) performs a somewhat different analysis estimating a general distributed lag model by means of generalized least squares methods. Building on the Mundell-Fleming theoretical framework, Salvatore (2006) argues that the chain of events behind one deficit causing the second takes time to unfold, and thus, a country's current account is expected to be associated to both contemporaneous and lagged values of government balance. As such, he explains the current account balance by means of contemporaneous and lagged values of budget deficit, the growth of real GNP in the nation and the growth of real GNP in the rest of the world in the current period. He finds a statistically significant positive relationship between the two deficits for the G7 countries during 1973-2005, and that higher domestic growth worsens while higher foreign growth improves the nation's current acount balance. Both of these studies suggest that the twin deficits' behavior is mainly determined by the stochastic properties of the budget deficit. This is, the degree of persistence of the budget deficit affects the robustness of the twin deficits link.

On the same note, Kraay and Ventura (2002) study the intertemporal properties of the current account behaviour. They find that the short run composition of the current account differs from its long run composition, given that countries try to smooth both consumption and domestic investment using foreign assets as a buffer-stock which leads to a gradual rebalance of a country's portfolio from short to long run. Moreover, their findings mean that the link between national savings shocks

(stemming from a fiscal policy change, for instance) and current account behaviour is more pronounced in the long than in the short run.

Kim and Roubini (2008) analyse the twin deficits controlling for the impact of output fluctuations and find that increases in the budget deficit have a positive impact on the external balance in the short run independently of how the deficit originated. They prove that an increase in private saving due to the incurred budget deficit and the decline in domestic investment due to higher interest rates (stemming from government borrowing) offset the decreased government saving in the short run, thus improving the current account balance. This finding shows that a current account surplus may first (in the short-run) be associated with a contemporaneous budget deficit before the twin deficit relationship between them becomes evident over the course of the next couple of years (Salvatore, 2006).

The link between the two deficits deficit is, thus, likely to differ in the short and in the long run, and this is conditional on the long run properties of the series involved.

Dynamics of the Twin Deficits relationship

Within the empirical studies accounting for both short run dynamics and the long run equilibrium between the deficits, most studies rely on a simple bivariate model while others extend it to include more variables. For instance, a study conducted by Baharumshah et al. (2006) extends the model to include two additional variables (exchange rates and interest rates) in their vector autoregressive methodology, as intermediating variables to account for important channels through which the deficits are related.

Resorting to a VECM and Granger causality tests, Vamvoukas (1999) and Marinheiro (2008) test for causality between the two deficits for Greece and Egypt, respectively. Moreover, while Marinheiro (2008) estimates a bivariate model, Vamvoukas (1999) adds inflation as another determinant of government budget deficit and real output to the trade deficit VECM regression. Even though both findings support a positive linkage between the two deficits, the direction of causality is not the same. While Vamvoukas (1999) finds that fiscal deficit causes external

deficit, Marinheiro (2008) provides evidence for a budget deficit caused by a current account deficit.

Akbostanci and Tunç (2001) also use a VECM specification to test the twin deficits for Turkey with a quarterly time series covering the period 1987-2001. In addition to the bivariate model, the authors include an industrial production index and narrow money as a percentage of GDP. They find, in addition to a positive link between the deficits, that budget deficit causes trade deficit, validating the Twin Deficits Hypothesis.

Structural Breaks

Many factors can be responsible for a structural change in the equilibrium relationship (i.e. cointegration) between the two deficits, such as changes in private consumption behavior, in the degree of financial integration or in the net foreign position of a nation (Bagnai, 2006). The few existing studies on the twin deficits hypothesis that incorporate structural breaks apply a Johansen cointegration test that is conditional on pre determined - as opposed to endogenously determined - structural break(s) (Trachanas & Katrakilidis, 2013).

Recognizing the importance of considering structural breaks, Bagnai (2006), Kalou and Paleologou (2012) and Trachanas and Katrakilidis (2013) investigate the links between the two deficits allowing for the presence of, as well as formally testing for, structural breaks. Their analyses prove that by ignoring the potential existence of a significant structural break (digression from simple linear models), one might encounter spurious evidence on the existence of cointegration between the two deficits' time series. Additionally, Trachanas and Katrakilidis (2013) consider the possibility of an asymmetric relationship between the two deficits in their long run equilibrium, i.e., the relationship between current account and budget balances is allowed to differ conditional on whether it is the case of a deficit or a surplus.

Summary

On the whole, though the literature does not concur on one single model to test the twin deficits hypothesis, as Bagnai (2006) outlines, most empirical studies on the twin deficits hypothesis can agree on the following: most macroeconomic models support a causal relationship running from the public to the external account deficit;

the relationship between the two deficits is not static as it may differ between the short and the long run and this, in turn, depends on the properties of the time series involved (eg. Kraay & Ventura (2002); Normandin (1999)); lastly, the long run link is often somewhat weak and conditional on structural breaks.

Hence, recognizing the importance of distinguishing between the short and long run on the effect of a budget deficit on the current account and to properly test for it, this study contributes to the existing literature by focusing on a relatively small open economy and using a recent sample period that includes Portugal's severe financial crisis. In addition, I explicitly test for structural breaks in my specification and include them in my VECM.

3. Theory

3.1. The Twin Deficits Hypothesis

The term 'twin deficits' was coined by Martin Feldstein (1985) to describe the comovement between the US public and external balances during the "Reagan fiscal experiment" in the 1980s. The current account deficit had increased substantially due to the strong appreciation of the dollar and part of its rise was ascribed to the surge of budget deficits.

The relationship between the two deficits can be explored using the national accounting identity, by means of which the national government keeps track of the country's economic activity level, in a particular period. Following the theoretical exposition of Salvatore (2006), Baharumshah et al. (2006) and Algieri (2013), given an open economy, we have that:

$$Y = C + I + G + NX + NFI + NCT \tag{1}$$

where Y = GDP, C = consumption, I = investment, G = government expenditure, NX=net exports of goods and services, NFI = net factor income from abroad and NCT= net current transfers.

Defining current account $CA = NX + NFI + NCT$, the previous becomes:

$$CA = Y - (C + I + G) = S - I \tag{2}$$

where $C + I + G$ is referred to as the domestic absorption and the external balance is equalized to the difference of national saving and investment. One can also discern that an open economy can fund its investments (I) both domestically (S) and

internationally $(-CA)$, as borrowing from outside enables larger investments than those that would be financed merely through national saving (Baharumshah et al., 2006). As Baharumshah et al. (2006) outline, this indicates that policies supporting domestic investment have a negative effect on the external balance, whereas policies aiming at increasing national saving have a positive effect.

We can further express national saving by means of private $S^p = Y - C - T$ and public saving $S^g = T - G$. The latter reflects the government balance BB and reveals a surplus when $T > G$ and a deficit when $T < G$. A current account deficit means $CA < 0$.

$$CA = (S^p - I) + BB \tag{3}$$

Where, assuming saving-investment balance, the surge of a BB deficit increases the CA deficit, if private saving equals investment as the country must borrow from abroad (Cavallo, 2005; Baharumshah et al., 2006). One can rearrange this identity in order to show that a budget deficit $(-BB)$ must equate, as in, be financed by, the surplus of private saving over domestic investment $S^p - I$ and a current account deficit $(-CA)$. Adding the assumption of a flexible exchange rate system (e), and given that both domestic saving and investment depend on the real interest rate (r), one can represent the chain of causation from a BB deficit to a CA deficit for an open economy as:

$$-BB = S^p(r) - I(r) - CA(e), \quad S^p(r) > 0, \quad I(r) < 0 \quad and \quad CA(e) < 0$$

By which an exogenous increase in the BB deficit is financed by an increase in domestic saving, a reduction in domestic investment, and/or an increase in the country's CA deficit (Salvatore, 2006). Ceteris paribus, BB and CA will move in the same direction and by the same amount, like "twins" (Baharumshah et al., 2006; Algieri, 2013). Nevertheless, if changes in the BB are fully offset by changes in S^p, as the REH posits, then BB and CA do not move together.

3.2. The alternative testable hypotheses

With the above theoretical framework in mind, to explore whether a BB deficit is responsible for a CA deficit, I derive my alternative testable hypotheses from the four possible relationships between the two deficits. The policy recommendations will then

differ depending on the direction of (or non-existence of) causality found between the two deficits.

With this purpose, I firstly present the econometric representation of the relationship to study. Having a VECM specification will allow for examination of both short and long run causality, as reviewed in the literature section. Partly following (Kouassi et al., 2004), if the time-series BB_t and CA_t are cointegrated, the VECM representation of identity (3) is the following:

$$\Delta BB_t = \alpha_0 + \sum_{i=1}^{m} \alpha_{2,i}\Delta BB_{t-i} + \sum_{i=1}^{m} \alpha_{3,i}\Delta CA_{t-i} + \sum_{i=1}^{m} \alpha_{4,i}\Delta X_{t-i}$$
$$+ \alpha_1 \left[BB_{t-1} - \{\beta_0 + \beta_1 CA_{t-1} + \beta_2 X_{t-1}\}\right] + \varepsilon_{1t} \qquad (4)$$

$$\Delta CA_t = \delta_0 + \sum_{i=1}^{m} \delta_{2,i}\Delta CA_{t-i} + \sum_{i=1}^{m} \delta_{3,i}\Delta BB_{t-i} + \sum_{i=1}^{m} \delta_{4,i}\Delta X_{t-i}$$
$$+ \delta_1 [CA_{t-1} - \{\gamma_0 + \gamma_1 BB_{t-1} + \gamma_2 X_{t-1}\}] + \varepsilon_{2t} \qquad (5)$$

where the variables are time series; X are a set of controls; m are the optimal lags selected; Δ is the difference operator; α's and δ's are the short run time invariant coefficients; β's and γ's are the long run coefficients included in the long run equation; ε_{1t} and ε_{2t} are serially uncorrelated error terms; α_1 and δ_1 are the speed of adjustment parameters from the short to the long run and precede the disequilibrium error that are inside the squared brackets.

One of the most traditional theoretical explanation for the twin deficits hypothesis is the Mundell-Fleming framework; an open Keynesian economy model with high capital mobility. According to this model, an increase in the budget deficit puts upward pressure on domestic interest rates that, under a flexible exchange rate system, and contingent on the degree of openness, results in capital inflows which appreciates the economy's exchange rate, leading to a deterioration of the current account balance as exports are now less, and imports are more attractive (Kouassi et al., 2004; Salvatore, 2006). The Keynesian absorption theory predicts that an increase in the budget deficit induces expansion of aggregate demand which translates into an increase in imports, ultimately leading to a deficit of the current account. Although the two chains of causation differ, the same conclusion can be applied to both fixed and flexible exchange rate regimes (Akbostanci & Tunç, 2001). Here, the appropriate policy tool to lessen the damage done to the current account is a reduction in budget deficit by means of a tax increase. The decrease in disposable income reduces

consumption of imported goods. Empirically, for this hypothesis to hold, the parameters $\alpha_{3,i}$, α_1 in (4) are not statistically different from 0 and the parameters $\delta_{3,i}$, δ_1 in (5) are statistically different from 0. As mentioned by Kouassi et al. (2004) and Salvatore (2006), the BB deficit short run impact on CA, $\delta_{3,i}$, can be both positive or negative. For a successful adjustment to equilibrium to exist in this case, δ_1 must be negative.[1]

On the other hand, the REH, initially proposed by Barro (1974), predicts the inexistence of any causality between the two deficits; the intertemporal allocation of taxes and budget deficits is irrelevant to consumption behavior. In this framework, as economic agents foresee higher tax liabilities due to the surge of the budget deficit (fiscal expansion), aggregate demand is not affected, and thus a twin deficit can only occur by chance (Barro, 1989; Salvatore, 2006). Changes in a nation's external balance are solely due to shocks to the economy (Kalou & Paleologou, 2012; Kaufmann et al., 2002). For instance, as Cavallo (2005) explains, a "twin divergence" occurs due to impact of output fluctuations on budget and current account deficits that lead them to vary in opposite directions (a surge in an economy's productivity is likely to lead to external deficit as investment increases above savings and at the same time, the output expansion improves the government balance). For the REH to hold, we must have that parameters $\alpha_{3,i}$, α_1 in (4) and $\delta_{3,i}$, δ_1 in (5) are not statistically different from 0.[2]

Thirdly, the CATH predicts a causation that runs, instead, from the current account to the budget deficit in which the decay in the external deficit enlarges the internal deficit. A deterioration in the country's current account means reduced economic growth, which, consequently, leads to a deterioration in the government balance. This is the case of small open economies whose growth depends largely on foreign capital inflows. In the scenario of a small open economy, interest rates are exogenous which explains the current account's impact on the budget deficit whereas in a larger economy, the interest rates are determined by the deficit (Kalou &

[1] Since the parameters of the speed of adjustment illustrate the stability of the long run relationship, they must exhibit negative signs so that convergence holds in the given model. By convergence, one means that the effect of any shock is adjusted over time so that the system restores its equilibrium (Shahzad, Zakaria, Rehman, Ahmed, & Fida, 2016).

[2] However, if there is, in fact, a cointegrating relationship, then at least one of the two error correction parameters must be statistically significant, as in different from 0, and negative (Marinheiro, 2008).

Paleologou, 2012). As the name of this hypothesis suggests, the government's target is to eradicate the external imbalances that negatively impact the domestic output (Summers, 1988; Marinheiro, 2008). To do so, it resorts to a fiscal stimulus (reducing taxes or increasing government spending), making use of the budget deficit as an instrument to achieve it. Another cause for this reverse causality is the impact of a negative exogenous trade shock on the current account as domestic production is replaced by relatively cheaper imports. This negative impact on the economy's domestic output reduces tax revenues which, in turn, deteriorates the government's budget balance. This hypothesis requires that parameters $\alpha_{3,i}$, α_1 in (4) are statistically different from 0 and the parameters $\delta_{3,i}$, δ_1 in (5) are not statistically different from 0. The CA deficit short run impact on BB, $\alpha_{3,i}$, as a deviation from the equilibrium relationship, can be either negative or positive. A successful adjustment to equilibrium, in this case, requires a negative α_1 .

Lastly, a feedback effect between the two deficits can also be found - budget deficit leads to a current account deficit and vice-versa. If this is the case, a mere cut in the budget deficit does not suffice to correct the external imbalance - a more diversified policy tool box is required entailing both interest rates and export promotion policies (given a fixed exchange rate regime). For this to happen parameters $\alpha_{3,i}$, α_1 in (4) and $\delta_{3,i}$, δ_1 in (5) must be statistically different from 0.

5. Data

Starting from the introduction of the euro in Portugal on January 1st, 1999, quarterly data is used covering 1999Q1 – 2017Q2. The data are extracted from the OECD Main Economic Indicators Database, Eurostat, and the Banco de Portugal Statistics. Appendix A.1 outlines all the below-mentioned variables along with their definitions and sources and Appendix A.2 provides their descriptive statistics. All data are seasonally adjusted or expressed in indexes. The variables involved in this study are:

- Current account balance of payments (CA) as the country's international transactions with the rest of the world, defined as a percentage of GDP.
- Government primary balance (BB), as the sum of government balance and interest paid on the government debt, defined as a percentage of GDP.

- Short term interest rate (SIR), that is the rate "associated with Treasury bills, Certificates of Deposit or comparable instruments, each of three month maturity"(OECD, 2015).
- Real effective exchange rate (REER), computed based on relative unit labour costs in the manufacturing sector and it is expressed as an index.
- Trade Openness (Openness), computed as a country's total trade, the sum of exports and imports, divided by the country's GDP.

Figure 3 depicts the two variables of interest, CA, and BB. CA seems to follow an upward trend after the 2008Q4, and BB seems to follow roughly the same trend after 2008Q4 as CA.

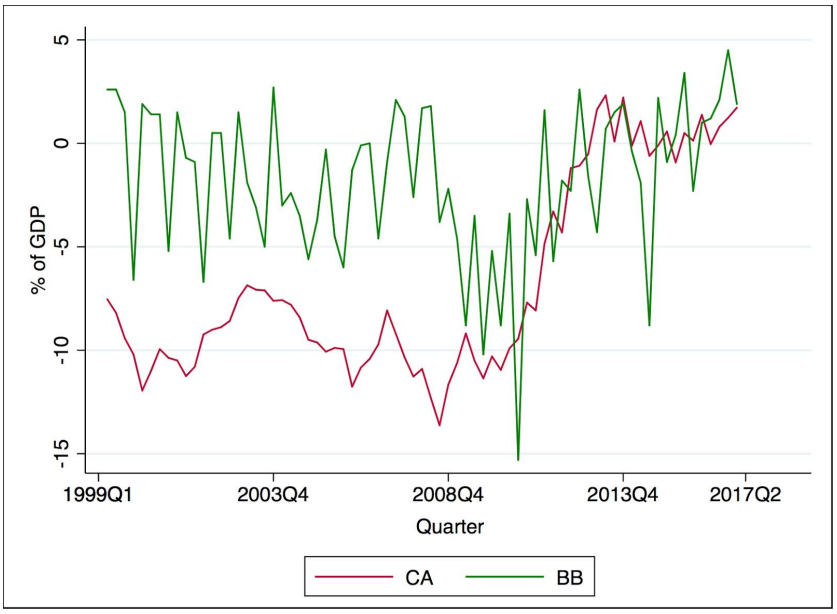


Figure 3. Current Account and Government Budget Balances as % of GDP.

Data choice

Using data of higher frequency, such as quarterly as opposed to annual data, allows for a sharper examination of the relationship in focus. According to Algieri (2013), though most papers on this topic use annual data, analysing disaggregated data should lead to deeper understanding of the interactions among variables, and hence, finer policy directives.

According to Nickel and Vansteenkiste (2008) and Trachanas and Katrakilidis (2013), it is more appropriate to employ the primary budget balance as it proxies discretionary fiscal policy and has the advantage of preventing the potential simultaneity bias (Kim & Roubini, 2008). As the correlation between the government balance and the primary balance is high[3], I opted to employ the primary balance in my main estimations. Given the theoretical background abovementioned, it is important to control for the channels through which the two deficits might be related, as to why the short term interest rate and the real effective exchange rate are included. Given the short sample size in this study that compromises the ability of the vector autoregressive methodology to handle a much larger amount of variables (Baharumshah et al., 2006), I only add these two intermediating variables. Later on I include Openness for a robustness check. Higher degrees of trade openness lessen a country's vulnerability to investment flow reversals by providing more options for shock absorption (Ghosh & Ramakrishnan, 2012). This variable reveals considerable variation since the adoption of the Euro and should relate to both BB and CA. SIR and REER are the Xs in equations (4) and (5) of the previous section. These refer to the Mundell-Fleming framework as they account for different channels of reciprocal action between the public and external deficits. Given Portugal operates within a much larger currency block, the REER is employed. REER reflects a country's aggregate external price competitiveness (Statistics, n.d.). An increase in the REER expresses a real effective appreciation and a decrease in external competitiveness. From the two available indexes, the relative consumer price index and the index of relative unit labor costs in manufacturing, I choose the latter to express REER. The index of relative unit labour costs has been pointed out as the best in measuring international competitiveness, as it combats measurement problems that the relative consumer price index is prone to suffer.

6. Methodology and Model Specification

This section addresses econometric issues. I firstly digress on cointegration and explain the need for investigating the stationarity condition of my variables. The lag

[3] These results are not shown.

selection criterion and a review of different types of unit roots tests and their respective advantages follow. Then, I argue for the Gregory-Hansen cointegration test in addition to the standard tests. I conclude with the resulting model specification and its advantages. Results were obtained using STATA 14.1 and EViews9 econometric package programs.

6.1 Econometric Concerns

Digression on Cointegration

Cointegration means that two time series share a long run equilibrium relationship. Though Johansen (1995) states that this long run relationship exists solely among variables with the same order of integration, the ARDL model, has the advantage of being able to deal with mixed orders of integration, I(0) and I(1), (Harris & Sollis, 2003). Even though the order of integration of variables does not have to be the same in an ARDL model, their order of integration must be below I(2). Therefore, I test for unit roots to ascertain that the series are not I(2) series. If all the variables are stationary, one should opt for the OLS estimation as it is appropriate and efficient, whereas if all variables are nonstationary but of the same integration order I(1) and cointegrated, then one should follow a VECM specification.

Optimal lag lengths

As unit-root and cointegration tests are sensitive to the chosen lag structure, one must previously select the appropriate lag order of the underlying model. As several methods are available for testing which lag order is the most adequate, I will use the Sequential modified LR test (LR) final prediction error (FPE), Akaike's information criterion (AIC), Schwarz's Bayesian information criterion (SBIC), and the Hannan and Quinn information criterion (HQIC) lag-order selection statistics (Lütkepohl, 2005). These criteria have different advantages over each other, so the lag order will be chosen according to what the majority suggest as appropriate. These results are reported in Table 1 and indicate that 2 lags should be included in the underlying VAR model (note that I use the AIC as a tiebreaker). As the main purpose of including lags is to control for serial correlation, post-estimation tests concerning residual autocorrelation will be performed to ensure the correct lag choice. Though not

exhibited, the same procedure is executed individually for each variable to obtain the optimal lag length for unit roots tests.

Table 1. Lag Selection

Lag	*LL*	*LR*	*FPE*	*AIC*	*HQIC*	*SBIC*
0	-654.532		2290.15	19.0879	19.1393	19.2174
1	-410.567	487.93	3.09479	12.4802	12.7371*	13.1278*
2	-387.565	46.004	2.53887*	12.2772*	12.7397	13.4429
3	-379.173	16.784	3.20426	12.4978	13.1657	14.1814
4	-357.506	43.334*	2.78264	12.3335	13.207	14.5352

Note: The lag choice is confirmed by asterisk*. *LR: Sequential modified LR test statistic; FPE: final prediction error; AIC: Akaike's information criterion; HQIC: Hannan & Quinn information criterion; SBIC: Schwarz's Bayesian information criterion*

Unit Root Testing

Macroeconomic time-series variables are likely to follow a unit root process. A stationary process means that the series tends to fluctuate around its mean. A series is strictly stationary if its unconditional distribution is not affected by an arbitrary shift along the time axis. If the series are not stationary, estimating their relationships in levels will be of spurious nature.

As a first test I perform the Augmented Dickey Fuller (ADF) test to investigate the stochastic properties of all the variables, in which rejecting the null hypothesis means the series is stationary. Optimal lags chosen for the ADF tests follow the abovementioned lag choice routine. Table 2 reports the results of the ADF unit root tests; all variables in levels are non-stationary, whereas their first-difference is stationary. Hence, all variables are integrated at order I(1). As a robustness test, I perform the GLS detrended augmented Dickey–Fuller test (GLS–ADF) from Elliott, Rothenberg and Stock (1996), which modifies the series through a generalized least-squares regression and has better performance in small samples in comparison to the ADF test (Waheed et al. 2006). The null hypothesis of a random walk with possible drift is tested against the alternatives of either stationarity on a linear time trend or stationarity around an unknown mean (Baum & Sperling, 2001). Depicted in Table 3 (Appendix B) these tests corroborate the findings in the ADF tests; variables are I(1).

Table 2. ADF unit root tests

	Levels			First-difference			
Variable	*Constant*	*Trend and Constant*	*No trend, no constant*	*Constant*	*Trend and Constant*	*No trend, no constant*	*Integration order*
CA	-0.300 (2)	-1.610 (2)	-1.123 (2)	-5.615 (1)*	-5.707 (1)*	-5.489 (1)*	I(1)
BB	-1.671 (4)	-1.653 (4)	-1.451 (4)	-6.213 (3)*	-6.310 (3)*	-6.250 (3)*	I(1)
REER	-0.950 (1)	-1.748 (1)	-0.217 (1)	-8.495 (0)*	-8.702 (0)*	-8.553 (0)*	I(1)
SIR	-1.398 (2)	-3.264 (3)	-1.317 (2)	-4.388 (1)*	-4.385 (1)*	-4.371 (1)*	I(1)

Note: The test statistics followed by the lag choice for the test (in parentheses);

** denotes rejection of the null at the 1% significance level, ** 5% and *** 10%.*

However, given the period of economic turmoil considered in this analysis, the usual tests might be of lower power if a significant structural change exists (Trachanas & Katrakilidis, 2013). Hence, I additionally apply unit root tests that allow for one or two breaks in the series, namely the Zivot & Andrews (2002) and the Clemente, Montañés, & Reyes (1998) tests.

The Zivot–Andrews test, is an ADF test with structural break with a null hypothesis of unit root with no break against the alternative of a trend-stationary process with a break occurring at an unknown point in time[4] (Zivot & Andrews, 2002). The results presented in Table 4 (Appendix B), reveal that 2 of the variables are I(1) and the other 2, I(0). If a break exists under the null, however, these results might not be valid. Addressing this issue, Clemente et al. (1998) introduce tests for unit roots that allow for a null hypothesis of a unit root with a double structural break. The two models in this test routine, additive outlier (AO) in which changes take place rapidly and innovative outlier (IO) in which changes take place gradually (Baum, 2004), are depicted in Table 5 (Appendix B). While the former considers a break in the slope, the latter allows for a break in both intercept and slope. To choose between the two scenarios the significance of the two dummies for the structural break is checked. Also, if the results lack evidence of a second break in the series, then one should test for a unit root in the presence of a single structural break (Baum, 2004). According to Feridun, Sawhney, and Jalil (2009), in significant evidence of outliers in the time series, the results obtained in ADF and GLS-ADF tests are questionable, since omitting structural breaks likely causes misspecification of the model used in the test. If the double structural breaks indicated by Clemente-Montanes-Reyes tests are statistically significant[5], one should focus on their results instead.

[4] The break occurs at a point where the data provides the strongest evidence against the unit root hypothesis.
[5] at the 5% level, by STATA.

Concerning the variable CA, given that only one of the two breaks is significant in the AO and in the IO model, nothing can be concluded from this test, but given that all the previously executed unit roots tests do not reject a unit root, I will take this variable as I(1). As for BB, both breaks are significant in both models and the t-statistics of the model show that the IO model is more significant in explaining the BB series than the AO model; the BB series is more likely to exhibit rapidly, as opposed to gradually, occurring structural breaks. Additionally, these results mean that even allowing for structural breaks in the 2008Q4 and 2011Q1, the hypothesis of unit root is not rejected in either of the models. The remaining variables follow a similar interpretation. As Table 5 (Appendix B) shows, the test statistics are smaller than the critical value for the variables in levels meaning a non-rejection of the the null hypothesis of unit root.

Since all the tests do not present conflicting results, I can thus establish that the series are not I(2) and are all integrated of the same order I(1) and proceed to test for cointegration between the variables. The same orders of integration provide support towards a traditional cointegration test rather than the ARDL approach to cointegration.

Cointegration Tests

Given the abovementioned unit roots tests allowing for a structural break, one suspects that the cointegrating relationship might itself be subject to a structural change as well. The standard cointegration tests, such as Engle-Granger (1987); and Johansen (Johansen & Juselius, 1990; Johansen 1995), cannot accommodate a possible structural break in the underlying cointegrating relationship as they assume time invariant cointegrating vectors (Ndoricimpa, 2013). Moreover, in the presence of a structural break, these standard cointegration tests might provide erroneous evidence in favor of cointegration (Voronkova, 2004).

As such, to account for the possible structural breaks in the cointegrating relationship, in addition to the Engle-Granger test and the Johansen (1988) trace tests, depicted in Table 6 and 7 respectively, I resort to the Gregory-Hansen (1996) approach to cointegration that extends the above examined unit root tests with structural breaks. This cointegration test allows also for the additional outcome of the

time when the possible structural break occurred. This information can be of valuable use given one analyses if the structural break is related to, for instance, an economic crisis or a specific policy (Glynn, Perera, & Verma, 2007).

The Engle-Granger approach is a residual-based test for cointegration and applies the ADF unit root test on the residuals of the regression in levels, following MacKinnon (1996) critical values. All Engle-Granger, Johansen cointegration test trace statistics and maximum eigenvalue statistics reject the null of no cointegration in favor of one cointegrating vector.

Table 6. Engle-Granger Cointegration test

VAR: BB, CA, REER, SIR

Dependent	*tau-statistic*	*Probability**	*z-statistic*	*Probability**	*Decision*
BB	-9.921109	0.0000	-83.39078	0.0000	Reject the null of no cointegration
CA	-4.272535	0.0480	-29.43628	0.0398	

Note: Automatic lags specifcation based on Schwarz criterion

* MacKinnon (1996) p-values

Table 7. Johansen Cointegration Test

VAR: BB, CA REER, SIR

Rank	*Maximum eigenvalue*	*Critical Value 5%*	*Trace statistic*	*Critical Value 5%*	*Decision*
r=0	41.0712 *	27.07	60.4435*	47.21	1 cointegrating vector
r≤1	14.0511	20.97	19.3723	29.68	

Note: Johansen's maximal eigenvalue and trace test assume an unrestricted constant in the cointegrating equation

** denotes rejection of the null (rank of cointegration=0) at the 5% significance level.*

The optimal lag length is determined in Table 1 and corresponds to a maximum lags of 2.

The Gregory-Hansen cointegration test allows for one endogenously determined break in the cointegrating relationship which, in comparison to other tests imposing an exogenous structural break to the data, makes it more flexible. Its null hypothesis of no cointegration is tested against the alternative of cointegration with a shift in the mean at an unknown point in time[6]. Rejecting the null means that the structural break in the period of analysis that might have occurred due to, for instance, political, or economic factors, has an impact on the joint evolution of the variables in focus. Four models with varying assumptions on the type of structural break can be tested. Following Trachanas and Katrakilidis (2013) I will only test three of them: level shift,

[6] The test estimates cointegrating relationships for all possible break dates in the sample period and the point in which the test statistic is at its minimum is chosen as the break date (Rao, Bhaskara Rao, & Kumar, 2009).

level shift with a trend, and lastly, full structural break (regime shift with change in intercept, slope coefficients and trend).

Table 8. Gregory-Hansen Test for Cointegration with Regime Shifts

	Model			
	Level break, no trend	*Level break and trend*	*Change in regime and trend*	*Decision*
ADF	-5.37*	-5.47*	-6.32*	Rejection of the null of no cointegration
Breakpoint	2011Q4	2011Q4	2011Q1	

Note: ADF denotes the ADF minimum test statistic for a unit root across all possible break points; and breakpoint is the time at which the structural break occurs.
The optimal lag length is selected by the Akaike Information Criterion (AIC).
** denotes rejection of the null of no cointegration at the 5% significance level.*

The Gregory-Hansen test rejects the null of no cointegration between the variables CA, BB, REER, and SIR (Table 8). Specifically, the ADF minimum test statistics reject the null of no cointegration for all the models (level shift, level shift with a trend, and regime shift with a trend) and suggests a breakpoint in 2011Q4 for the first two models and in 2011Q1 for the third model. Both breakpoints coincide with the period where Portugal was suffering a severe economic and debt crisis, after the government bailed out two national banks. The period between 2011-2014 is referred to as the Great Recession in Portugal.

According to these findings, the relevant time series reach a long run equilibrium relationship despite the short run deviations therefrom. Note that by equilibrium I intend to express that their relationship holds, on average, over a period of considerable length.[7] Yet with that being said, the direction of causality remains unknown.[8]

6.2. Specification: Error Correction Model

As confirmed by Bagnai (2006), it is important to allow the relationship between the two deficits to differ between the short and the long run. Simply regressing my two dependent variables, CA and BB, on their own past values, present and past values of the hypothesized causal variable and the two controls will prevent me from capturing the causal ordering I wish to assess. It is also important from an econometric point of view to control for the properties of the time series involved, such as the high degree of persistence of BB (Normandin, 1999; Salvatore, 2006).[9] A

[7] I.e., I do not refer to market clearing conditions.

[8] The existence of cointegration implies that granger causality exists in at least one direction (Engle & Granger, 1987; Granger, 1986).

[9] High persistence means that past values of the variable are likely to explain its present values.

simple specification in levels is prone to lead to biased estimates because it imposes the assumption of an instantaneous relationship between the outcome and explanatory variables. Furthermore, given that the time series are I(1) as well as cointegrated, an Error Correction representation (VECM) is the most adequate specification Equations (4) and (5) (Engle & Granger, 1987; Granger, 1986).

With this specification I am able to impose structure on the variables' relations while controlling for the likely high persistence of the outcome and/or causal variable. In addition, the long-term behavior of the endogenous variables is restricted to converge to their cointegrating relationship, while still allowing for a wide range of short-term dynamics. The deviations from the long-run equilibrium are corrected gradually through a series of partial short-run adjustments.

Granger-Causality & Testable Hypotheses

Engle and Granger (1987) posit that if the variables are cointegrated then a uni or bidirectional causality must exist between these variables. The VECM enables the assessment of the direction of causality among variables via both short and long run Granger causality testing (Shahzad, Zakaria, Rehman, Ahmed, & Fida, 2016).

The concept of Granger-causality entails identifying which of the two main variables of interest precedes the other, i.e., rather whether BB happens before CA than BB causes (in the most literal sense) CA (Algieri, 2013). The cointegrating relation does not express causality per se, but the BB and CA deviations and subsequent adjustments to the long run equilibrium, expressed through the significance of the error correction terms (ECT), do. As this term stems from the cointegrating relationship, it comprises all the information of their existing long run equilibrium, and hence, the direction of their temporal causality (Shahzad et al., 2016). Therefore, the long run causality, referred to as strong Granger causality, is given by the significance of the lagged ECT in each model (Kalou & Paleologou, 2012).

7. Results & Discussion

Table 9 and Table 10 (Appendix B) report the first stage results of the two step Engle-Granger executed in STATA. The tables outline the static, long-run regression of the cointegrated time-series subject to regime shifts. This method allows me to include, in the predicted long run relationship, the breakpoints suggested by the Gregory-Hansen test. Depending on the model, dummy variables are interacted with the intercept, a time trend and the slope coefficients, as depicted in the tables. Although causality cannot be categorically determined by looking at this simpler setting as it only demonstrates the equilibrium relation existing between the variables, it gives a sense of the interdependence between the two variables. In both tables there is a notable positive association between public and external balances. When the dependent variable is CA (Table 9), BB is significant at the 1% level in the two first columns, whereas when the dependent variable is BB (Table 10), CA is significant at the 1% and 5% levels for the three examined models. These results corroborate a positive link between the two balances, and hence that the two deficits are positively related. But, as previously outlined, one must examine the VECM results in order to assess Granger-causality.

To estimate the VECM and assess the short run dynamics, I use EViews to estimate the model with the maximum likelihood method introduced by Johansen (1988, 1991, 1995). Table 11 reports the results of the VECM. The lagged ECT coefficients from equations (4) and (5) are shown in the first row.

Table 11. Vector Error Correction Model Results

	Primary Budget Balance (ΔBB)			Current Account Balance (ΔCA)		
Variables	*Long Run*	*Short Run*	*Crisis*	*Long Run*	*Short Run*	*Crisis*
ECT(-1)	- 1.123993*			- 0.025394		
	(0.19401)			(0.045)		
ΔBB (-1)		- 0.042416			- 0.07047	
		(0.135954)			(0.048583)	
ΔCA (-1)		- 0.686447***			- 0.26819**	
		(0.350546)			(0.125268)	
ΔSIR (-1)		0.645707			- 0.632707***	
		(1.014656)			(0.362588)	
ΔREER (-1)		- 0.238645			- 0.073455	
		(0.322075)			(0.115094)	
Constant		- 0.845754***			- 0.022602	
		(0.477869)			0.170767	
DUM_2011Q1			2.147680			2.294825*
			(2.073168)			(0.740848)
DUM_2011Q4			0.735075			- 2.068094*
			(2.150455)			(0.768466)
Adjusted R-Squared		0.551133			0.106141	
F-statistic		13.27832			2.187446	
Prob (F-statistic)		0.000000			0.106141	
Post-estimation Residuals tests						
Normality test		3.884693 (*p*-value=0.143367)			2.156472 (*p*-value=0.340195)	
Breusch-Pagan-Godfrey		6.845483 (*p*-value=0.7399)			9.524407(*p*-value=0.4832)	
ARCH test		2.001661(*p*-value=0.3676)			1.309302 (*p*-value=0.5196)	
BG LM test		2.951310 (*p*-value=0.2286)			0.121609 (*p*-value=0.9410)	

Note: The standard errors are in parentheses below the coefficients;
BG stands for Breusch-Godfrey Serial Correlation LM Test and the observed R-squared followed by the Chi-square probability;
The ARCH test displays the observed R-squared followed by the Chi-square probability;
* denotes statistical significance at the 1% level, ** 5% level, *** 10% level;
DUM_2011Q4 means that the dummy takes the value 1 after that year and quarter.

7.1. Interpretation of Error Correction Terms (ECT)

One way of looking at the VECM of equations (4) and (5) is to think that the dependent variable, BB or CA, reacts to the disequilibrium error (represented inside brackets) through the adjustment coefficient, respectively, α_1 and δ_1, to return to equilibrium. These terms, α_1 and δ_1, correspond to ECT(-1) in the above table. They correct the speed at which the dependent variable, namely BB or CA, adjusts to the long run equilibrium. ECTs, therefore, illustrate the stability of the long run relationship and as such, must be negative so that convergence, in a given model, exists. In this way, to restore the equilibrium, the system adjusts itself over time to the effect of an exogenous shock (Shahzad et al., 2016).

Given the statistical significance at the 1% level and the negative sign of the ECT in the first column, the results indicate that there is a long run Granger-causality relationship, through the ECT, from CA, SIR, and REER to BB. Focusing on the

results of the second column, the impact of BB on CA is not in line with the twin deficits' theory predictions as both the lagged difference of BB and the ECT are not statistically different from 0. The single unilateral causality in this VECM means that the adjustment to the deviations from the long-run equilibrium is made by the variable BB. As explained by Marinheiro (2008), while CA, the long run exogenous variable, does not adjust at all, BB is calibrating its route so that the variables share the same relationship in the long run. Given that the ECT estimated coefficient of the first column is -1.12, the system corrects previous period disequilibrium at a speed of 112%, quarterly. This coefficient implies that the disequilibrium is corrected very quickly before one period (quarter) terminates.

Both endogenously determined structural breaks in this analysis are significant in the VECM of CA, at the level of 1%. Whereas the dummy referring to the first quarter of 2011 has a positive impact on the behaviour of CA, the dummy referring to the fourth quarter has a negative impact of similar magnitude. Their predictive power of the behaviour of BB is not statistically significant.

7.2. Post estimation tests

Residual Diagnostics

If the estimation errors do not follow a normal distribution, the parameter estimates of the model are still consistent, however they are not efficient[10]. The Jarque-Bera test, presented at the bottom of Table 11, does not reject the null hypothesis that the errors are normally distributed. The Breusch-Godfrey LM test for serial correlation of the residuals does not reject the null hypothesis of no autocorrelation with 2 lags of the underlying VAR of the VECM[11]. In addition, given that macroeconomics time-series are susceptible to heteroscedasticity, I also test for autoregressive conditional heteroskedasticity (ARCH) of the VECM, with a null hypothesis of no ARCH effect in the model (which is desirable)[12]. The

[10] An efficient estimator is one with very small variance, as compared to other estimators of its type, whereas a consistent estimator tends to the true parameter value as the sample size increases.

[11] Note that although the optimal lag length for the underlying VAR is 2, due to first differencing when formulating the VECM, one lag is lost.

[12] Though having ARCH effects does not hamper inference of the model, not considering ARCH effects can lead to losses in efficiency of the estimators.

Breusch-Pagan-Godfrey test for heteroskedasticity is also reported. The results, displayed at the bottom of Table 11, show that the the errors are homoscedastic.

In conclusion, the residual diagnostics tests show no issue with the two VECM estimations.

Stability diagnostics

Although the negative and significant value of the ECT in the BB equation indicates there is a stable adjustment from the short to the long-run equilibrium, I perform further testing on the dynamic stability of the estimated VECMs. The presence of instability in the final results could lead to erroneous policy directives (Algieri, 2013).

Given a K-variable model with r cointegrating relationships, the companion matrix must display K–r unit eigenvalues. For the model to be stable, the moduli of the remaining r eigenvalues should be strictly less than unity (StataCorp, 2007). Given the estimated four variable VECM subject to one cointegrating vector, we must have three unit eigenvalues and the remaining ones less than unity. As shown in Table 13, the model meets the requirements for stability. The VECM specification imposes three unit moduli, while the remaining eigenvalues are less than one. As an alternative test for the parameter constancy of the VECM estimates, Figure 4 (Appendix B) reports the computed CUMSUM[13] of squares test. As the blue line stays within the red lines, the null hypothesis of parameter stability is not rejected at the significance level of 5%.

Table 13. Eigenvalue stability condition

Eigenvalue	*Modulus*
1	1
1	1
1	1
0.546452	0.546452
-0.504596	0.504596
-0.028532 - 0.289807i	0.291208
-0.028532 + 0.289807i	0.291209
-0.007537	0.007537

[13] Cumulative sum.

Robustness

The variable Openness is included in the VECM to determine whether the direction of the long run Granger-causality remains the same. Tests for unit root and cointegration were performed to ensure that Openness can be included in the VECM. Table 12 (Appendix B) shows that although Openness is not a significant predictor of either CA or BB in the short run, in the BB column the lagged ECT coefficient is still statistically significant and negative, as well as not statistically different from 0 in the CA equation. This supports the previous findings.

Following the suggestion of Kalou and Paleologou (2012), as an additional robustness check I perform supplementary Granger-causality tests. The short run Granger-causality is explored by simply observing the significance of the lagged differences via a Wald test, and this stands for the "weak" Granger causality. Table 14 presents the Wald test, and the respective F-statistics on the one lagged difference of each variable in the two equations of interest. Focusing on the relationship between the two deficits in the short-run, the hypothesis of non-Granger causality is rejected at the significance level of 5%, revealing that CA Granger-causes BB. The statistics of the second row of Table 14 fail to reject the null hypothesis of non-Granger causality, meaning that BB does not Granger-cause CA. Concerning the equation of CA, in the short run, the hypothesis of non-Granger causality is only rejected for the case of SIR, but not, as one could also expect, for the case of REER. Hence, at the significance level of 10%, SIR Granger-causes CA deficits[14] in the short run. I also test the joint significance of the ECT and the lagged differences of each variable, the "strong" Granger causality, via an F-test. As displayed, the existence of a causal relationship running from CA to BB at the significance level of 1% is supported. Consistent with Kraay and Ventura (2002), the wald tests on the lagged difference of CA reveal a stronger link between BB and CA in the long than in the short run. Furthermore, as for the channels of reciprocal action between CA and BB, the results in Table 14 support a long run relationship running from BB to SIR, and from BB to REER, as theorized.

[14] The negative sign of the estimated coefficient in Table 13 means that increases in the short-term interest rate deteriorates the current account balance.

Table 14. Granger causality tests

	Short Run Effects F-stat				ECT F-stat	Joint Short and Long Run F-stat			
Independent variables	*BB*	*CA*	*SIR*	*REER*	*ECT*	*BB*	*CA*	*SIR*	REER
Dependent variables									
BB	-	3.834634**	0.404980	0.549023	- 5.793486*	-	16.93554*	16.88349*	17.33940*
CA	2.103962	-	3.044944***	0.407322	- 0.563529	1.423255	-	1.651293	0.344010
SIR	0.032289	0.933483	-	0.309351	- 1.743117***	3.185261**	2.636682***	-	1.740518
REER	0.241870	0.000950	1.281148	-	- 2.032252**	3.485078**	2.211076	2.657376***	-

Note: * denotes statistical significance at the 1% level, ** 5% level, *** 10% level.

7.3. Discussion

Having confirmed that the VECMs pass all the diagnostic tests, the final results support the CATH, in which current account deficit Granger-causes budget deficit in the long run in Portugal, which is not consistent with the Twin Deficits hypothesis. These findings contradict those of Trachanas and Katrakilidis (2013), who posit that the Twin Deficits Hypothesis holds in the case of Portugal. However, these authors do not perform a VECM analysis to ascertain the direction of causality, as they only estimate the cointegrating long run relationship between current account and budget balance. To this extent, our conclusions actually match, as I also find evidence in favor of a long run equilibrium relationship between the two. Moreover, their analysis covers the period before the global financial crisis and although they perform the same Gregory-Hansen cointegration tests I have performed, they do not include the determined time shifts in their final estimation.

Similar to what Kalou and Paleologou (2012) concluded for the case of Greece, the statistical evidence in favor of CATH may be because Portugal is also a "debtor country". In fact, as Eurostat (2017) reports, Portugal's government debt-to-GDP ratio at the end of the third quarter of 2016 was the second highest among EU member states after Greece.[15] Owing to this, a great share of Portugal's income is absorbed by debt and interest payments, which worsens the current account balance.

As the Šuliková and Gazda (2016) literature review demonstrates the REH and the Mundell-Fleming framework are found to hold among developed countries, although less so for the latter when more recent data are used. As the CATH and bi-directional causal relationship between the two deficits are predominantly

[15] The three highest ratios of government debt to GDP at the end of the third quarter of 2016: Greece (176.9%), Portugal (133.4%) and Italy (132.7%) (Eurostat, 2017).

corroborated among developing countries, it may or may not come as a surprise that the CATH holds for the case of Portugal.

8. Policy implications

Although a positive association between Portugal's twin deficits is found, the direction of (Granger-)causality is the opposite to what the Twin Deficits theory suggests. The CATH predicts that a decay of the CA has a negative impact on the BB (Summers, 1988).

This unidirectional causality running from CA to BB suggests that directing efforts at reducing the country's budget deficit will not necessarily affect its current account balance. Due to the Stability and Growth Pact in which a country's budget deficit to GDP ratio must fall below 3%, restrictive fiscal policies are necessary in the case of government budget imbalances. Nonetheless, indefinitely increasing taxes (or cutting government expenditure) in a recession context is prone to exacerbate an already existing economic contraction (Algieri, 2013).

Aware of this fact, the current Portuguese policymakers argue that a looser fiscal policy will improve domestic demand, which has fallen drastically since the Troika's austerity directives. Yet, the current Government's expansionary measures are likely to have only short term success. The government should prioritize economic growth policies that are sustainable in the long term. Additionally, the policymakers' choice of expansionary policies should be based on their respective fiscal multipliers. As an example, reflating public servants' wages may be politically popular, but the multiplier to demand/GDP growth is not high for its type of fiscal spending. The government should also bear in mind that the feasibility of fiscal policy for economic stabilization purposes depends on the evolution of the government debt to GDP ratio.

Moreover, the findings of this paper suggest that Portuguese policymakers should be mindful of the interlinkages between the CA and the BB in their efforts to reduce Portugal's public debt. Given that a deterioration in the external balance is likely to dampen budget consolidation efforts, Portuguese policymakers should focus on improving the current account balance. To do so, increasing the economy's real competitiveness is imperative. Given that a depreciation of the currency's nominal value is not feasible, the focus should be placed on export promotion measures and an

"internal devaluation" policy (Algieri, 2013). These policies entail avoiding rises in domestic wages and prices, increasing productivity levels as well as waging quality enhancements in the tradable goods sector. In the short run, the focus should be promoting external competitiveness. That said, given Portugal is a small open economy, changes in the external balance can only influence the government budget balance up to a certain degree (Kalou & Paleologou, 2012). Portugal's longer term growth prospects could also be enhanced by investing more in technological development.

Altogether, these findings call for a more coherent package of policy measures, entailing both reduction of the public debt along with structural reforms aimed at improving productivity to boost the country's external competitiveness. These are commensurate with the policy directives identified by Nickel and Tudyka (2014) who argue that policymakers in a highly indebted economy should proceed with extra caution when resorting to fiscal stimuli for expansionary purposes, as external imbalances are not likely to be solved solely in this way.

9. Conclusion

This paper has examined the relationship between the current account balance and the government budget deficit for the case of Portugal, during the period 1999Q1-2017Q2. The data analysis is based on cointegration and Granger-causality testing, modelling a vector error correction of the two variables of interest - Portugal's current account and government budget balances. This methodology investigates the direction of causation between the public and external balances which, ultimately, is of substantial importance for the practice of fiscal policy given Portugal's high public debt level and recent history of large current account deficits. In addition to the standard cointegration tests, this paper tests for cointegration in the presence of structural breaks. This study extends the existing literature by using higher frequency data covering a recent period comprising the global financial crisis of 2008-2009 and Portugal's Great Recession. Further it endogenously determines structural breaks existing in the adjustment path towards the long run equilibrium. This study contributes further to the Twin Deficits discussion in the context of a small open economy.

After controlling for intermediate effects in the chain of causation between public and external balances, this study finds a significant impact of the current account balance on the government budget balance that is consistent with the Current Account Targeting Hypothesis. Furthermore, the results confirm a stable adjustment path from the short to the long run equilibrium between the two.

For policymakers, these findings suggest that greater focus should be placed on increasing the appeal of domestic products, by means of technological progress, quality, and productivity improvements, given that currency devaluation is not an available policy tool in Portugal's case. The overarching message is that while fiscal discipline is a necessary policy focus, it is not sufficient on its own to restore Portugal's fiscal position and put the broader economy on a sustainable path.

APPENDIX A.

Appendix A.1: Variables Definitions, Sources

Variable	**Description**	**Measurement**	**Type of Variable**	**Data Source**
CA	Current Account Balance	A country's international transactions with the rest of the world as a percentage of GDP.	Ratio (%)	Eurostat
BB	Primary Government Balance	Sum of government balance and interest paid on the government debt as a percentage of the GDP	Ratio (%)	Banco de Portugal Statistics
REER	Real Effective Exchange Rate	Based on relative unit labour costs in the manufacturing sector	Index (2010=100)	OECD Main Economic Indicators Database
SIR	Short Term Interest Rate	Rate associated with Treasury bills, Certificates of Deposit or comparable instruments, each of three month maturity	Ratio (%)	OECD Main Economic Indicators Database
Openness	Trade Openness	Defined as the sum of Imports and Exports divided by GDP	Ratio (%)	OECD Main Economic Indicators Database
DUM_2011Q1 DUM_2011Q4	Structural Dummies	Take value 1 after the breakpoint (1st quarter and 4th quarter of 2011, respectively)	Binary Variable	-

Appendix A.2: Descriptive Statistics

Variable	**Mean**	**Min**	**Max**	**Std. Dev.**	**Sample Period**
CA	-6.676163	-13.6274	2.321522	4.750441	1999Q1 - 2017Q1
BB	-1.741096	-15.3	4.5	3.716698	1999Q1 - 2017Q1
REER	97.58768	89.79115	104.9705	4.689271	1999Q1 - 2017Q2
SIR	2.029048	-0.3299667	5.024167	1.674301	1999Q1 - 2017Q2

APPENDIX B.

Table 3. DF-GLS unit root tests

	Levels		First-difference		
Variable	*Trend*	*No trend*	*Trend*	*No trend*	*Integration order*
CA	Unit Root (2)	Unit Root (2)	Unit Root (1)*	Unit Root (1)*	I(1)
BB	Unit Root (4)	Unit Root (4)	Unit Root (3)*	Unit Root (3)*	I(1)
REER	Unit Root (1)	Unit Root (1)	Unit Root (0)*	Unit Root (0)*	I(1)
SIR	Unit Root (2)	Unit Root (2)	Unit Root (1)*	Unit Root (1)*	I(1)

Note: The null hypothesis followed by the lag choice for the test (in parentheses);

** denotes rejection of the null at the 1% significance level, ** 5% and *** 10%.*

Table 4. Zivot-Andrews unit root tests inclusive of one break in the intercept

Series in levels		
Variable	*Minimum t-statistics*	*Breakpoint*
CA	-4.441 (1)	2011Q3
BB	-4.748 (1)***	2012Q2
REER	-3.455 (0)	2002Q1
SIR	-4.591 (1)***	2005Q4

Note: The lags for the differences (in parentheses) are selected based on AIC;

** denotes rejection of the null of a unit root at the 1% significance level, ** 5%, *** 10%.*

Critical values: 1%: -5.34; 5%: -4.80; 10%: -4.58.

Table 5. Clemente-Montañés-Reyes unit root test with double mean shift

	Additive Outlier (AO)				Innovation Outlier (IO)			
Variable	*t-stat*	*Break 1*	*Break 2*	*Integration order*	*t-stat*	*Break 1*	*Break 2*	*Integration order*
CA	-4.703 (2)	2005Q3	2011Q4*		-4.929 (2)	2004Q1	2011Q1*	
ΔCA	-11.390 (1)*	2010Q2*	2012Q4	I(1)	-11.386 (1)*	2010Q3*	2013Q1*	I(1)
BB	-2.937 (4)	2008Q4*	2011Q2*		-4.096 (4)	2008Q4*	2011Q1*	
ΔBB	-9.646 (3)*	2010Q2	2011Q1	I(1)	-11.809(3)*	2011Q2*	2014Q2	I(1)
REER	-5.232 (1)	2002Q3*	2010Q4*		-4.644 (1)	2001Q4*	2011Q1*	
ΔREER	-7.756 (1)*	2009Q3*	2012Q3*	I(1)	-10.514 (1)*	2009Q4*	2012Q4*	I(1)
SIR	-4.503 (2)	2009Q4*	2013Q1*		-5.365 (2)	2006Q2	2008Q2*	
ΔSIR	-6.791 (1)*	2005Q1	2008Q3*	I(1)	-8.240 (1)*	2000Q2*	2008Q4	I(1)

Note: The t statistics followed by the lag choice for the test that is computed the same way as for the ADF test (in parentheses);

The min. t statistics calculated is compared to the 5% critical value of -5.490 for two breaks; a larger minimum t statistics implies a rejection of the null of unit root

** denotes rejection of the null of a unit root at the 5% significance level as well as the significance level of the structural breakpoints*

Table 9. Cointegrating Equations subject to regime shifts, DV=CA

	Model		
Dependent Variable CA	*Level break, no trend 2011Q4*	*Level break and trend 2011Q4*	*Change in regime&trend 2011Q1*
Intercept	0.3485193 (6.333)	-0.9352394 (6.646)	-18.13982 (6.782)*
D x Intercept	6.472416 (0.892)*	6.904556 (1.107)	16.30519 (16.579)
Trend		-0.0118483 (0.017)	-0.0699299 (0.018)*
D x Trend			-0.0861421 (0.088)
BB	0.1341567 (0.057)**	0.1301169 (0.058)*	0.0550099 (0.061)
D x BB			0.0098475 (0.115)
REER	-0.0703445 (0.062)	-0.0529371 (0.067)	0.1236708 (0.069)***
D x REER			0.0122758 (0.183)
SIR	-0.8650406 (0.187)*	-0.9180207 (0.204)*	-0.7067337 (0.177)*
D x SIR			-4.841108 (1.214)*

Note: The standard errors are in parentheses after the coefficients; * denotes significance at the 1% level; ** at 5%; *** at 10%; *the year and quarter of each model's structural break, is indicated in parentheses in the second row. D2011Q4 means that the dummy takes the value 1 after that year and quarter.*

Table 10. Cointegrating Equations subject to regime shifts, DV=BB

	Model		
Dependent Variable BB	*Level break, no trend 2011Q4*	*Level break and trend 2011Q4*	*Change in regime&trend 2011Q1*
Intercept	14.01214 (12.502)	13.87531 (13.55762)	4.805952 (13.972)
D x Intercept	-1.252403 (2.1416)	-1.205205 (2.7659)	24.25703 (38.755)
Trend		-0.0010805 (0.03962)	-0.0699299 (0.018)*
D x Trend			0.2081596 (0.2197)
CA	0.6839683 (0.22211)*	0.6829694 (0.22674)*	0.625972 (0.3161)**
D x CA			-0.3234975 (0.60184)
REER	-0.1437333 (0.1248)	-0.1420388 (0.14024)	-0.0624174 (0.13542)
D x REER			-0.3980542 (0.42684)
SIR	1.582373 (0.38549)	1.577102 (0.43379)*	1.75506 (0.39774)*
D x SIR			0.1243369 (4.0894)

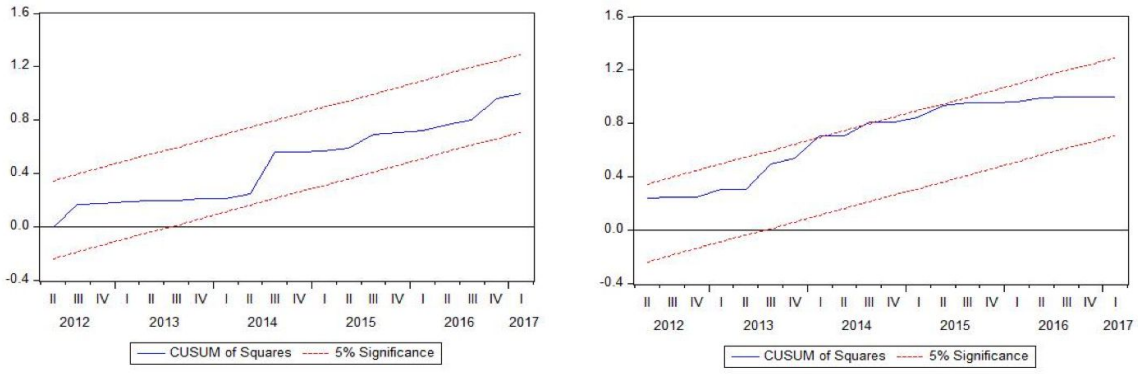
Note: The standard errors are in parentheses after the coefficients; * denotes significance at the 1% level; ** at 5%; *** at 10%; *the year and quarter of each model's structural break, is indicated in parentheses in the second row. D2011Q4 means that the dummy takes the value 1 after that year and quarter.*

Table 12. Vector Error Correction Model Results

	Primary Budget Balance (ΔBB)			Current Account Balance (ΔCA)		
Variables	*Long Run*	*Short Run*	*Crisis*	*Long Run*	*Short Run*	*Crisis*
ECT(-1)	- 1.082052*			- 0.016696		
	(0.186921)			(0.034959)		
ΔBB (-1)		- 0.071189			- 0.066125	
		(0.132251)			(0.047914)	
ΔCA (-1)		- 0.478725			- 0.298985**	
		(0.359868)			(0.130379)	
ΔSIR (-1)		0.328517			- 0.538694	
		(1.075859)			(0.389780)	
ΔREER (-1)		- 0.423808			- 0.049634	
		(0.328499)			(0.119014)	
ΔOpenness (-1)		0.339350			- 0.064392	
		(0.243787)			(0.088323)	
Constant		- 2.013027*			0.032024	
		(0.543403)			0.196873	
DUM_2011Q1			3.476450***			2.300182*
			(2.068613)			(0.749450)
DUM_2011Q4			2.755013			- 2.181015*
			(2.224513)			(0.805932)
Adjusted R-Squared		0.559707			0.098779	
F-statistic		12.12314			1.959048	
Prob (F-statistic)		0.000000			0.066809	
Post-estimation Residuals tests						
Normality test	4.131199 (*p*-value = 0.126742)			1.739055 (*p*-value = 0.419149)		
Breusch-Pagan-Godfrey	8.699863 (*p*-value=0.7283)			10.98704 (*p*-value=0.5300)		
ARCH test	1.312570 (*p*-value=0.5188)			0.596181 (*p*-value=0.7422)		
BG LM test	3.979762 (*p*-value=0.1367)			0.413924 (*p*-value=0.8131)		

Note: The standard errors are in parentheses below the coefficients;
BG stands for Breusch-Godfrey Serial Correlation LM Test and the observed R-squared followed by the Chi-square probability;
The ARCH test displays the observed R-squared followed by the Chi-square probability;
* denotes statistical significance at the 1% level, ** 5% level, *** 10% level;
DUM_2011Q4 means that the dummy takes the value 1 after that year and quarter.

Figure 4. CUMSUM of Squares. On the left, Dependent variable=BB; on the right Dependent variable=CA



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