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The "Twin Deficits" Problem in Eurozone

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Abstract

This thesis aims to determine the causality between current account deficits and budget deficits in Greece, Portugal, Italy and Spain during 1999-2015, which is the time period after the introduction of Euro. The econometric analysis begins with Granger causality tests of the relationship between current account and budget deficits. VAR modeling and innovation accounting is then used to analyze the dynamic interactions between the current account deficits, budget deficits, the real exchange rate and the real interest rate. The results suggest that there is no systematic causal relationship between current account deficits and budget deficits. The effect of real interest rates shocks on budget deficits is low and the effect of real exchange rates shocks on current account is also low.

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1. Introduction

The financial Crisis of Eurozone, which started almost simultaneously with the international Financial Crisis in 2008, was characterized by a large accumulation of public debt in several of Southern countries of Eurozone. This huge increase in public debt was considered by many economists and politicians as the main reason of the Financial Crisis in the Southern countries. The Southern countries of Eurozone were accused to be responsible of their financial problems. Moreover, the Eurozone was characterized by internal "economical imbalances" mostly in terms of current account deficits. More specifically, the Northern countries (Germany and Netherlands) had surpluses on their current account balances in contrast to the Southern countries (Greece, Portugal, Spain and Italy) which had serious deficits on their current account.

The problem of peripheral imbalances is consisted of two parts: the current account deficits and the budget (fiscal) deficits in the Southern economies and the current and budget accounts surpluses in the Northern economies. The issue of persistent coexistence of both current account and budget deficits is called the "twin deficits" problem (Miller and Russek, 1989). There is an ongoing controversy about the interpretation of the causality of the "twin deficits" and the way that the Euro affects the current and budget accounts. Some economists argue that the current account deficits lead to budget deficits (Nikiforos et al., 2015). This hypothesis is usually combined with the assumption that there are differences in terms of price and labor cost competitiveness between the North and the South (Groll and Van Roye, 2011). The other hypothesis is that fiscal deficits lead to current account deficits. More specifically, increased fiscal debt is translated to increased capital inflows which lead to current account deficits (Sanchez and Varoudakis, 2013).

As a contribution to the existing literature, this study estimates the causality between current account deficits and budget deficits about the cases of Greece, Portugal, Italy and Spain. In addition to that, it is investigated the way that the Euro contributes in the creation of the "twin deficits" problem. According to a theory, the effects of Euro can be seen through the fluctuations of real effective exchange rates, which show up in the changes of prices and labor costs and thus, competitiveness (Groll and Van Roye, 2011).

In contrast to previous study (Sanchez and Varoudakis, 2013) which uses annual panel data and it analyses countries together as groups, quarter times series data are used in this study and the cases of Greece, Italy, Spain and Portugal are analyzed separately.

In order to test econometrically the different theories, this study tests the causal relationship between current account and budget deficits. It firstly uses Granger causality tests in order to test this issue. Then, VAR modeling and innovation accounting is used to analyze the dynamic interactions between the current account deficits, budget deficits, the real exchange rate based on prices and labor costs and the real long-term interest rate of government bonds, following previous study (Sanchez and Varoudakis, 2013).

The results suggest that there is no systematic causal relationship between current account and budget deficits. They also imply that the effect of real interest rates on budget deficit is marginal as well as the effect of real exchange rates on current account deficit.

Section 2 reviews the literature on theories and empirical studies about these issues. Section 3 presents some basic theoretical concepts. In section 4 there is a brief presentation of the empirical method which is followed. Section 5 describes the data. Section 6 presents the results of the empirical analysis. Sections 7 summarizes the results and Section 8 concludes.

2. Literature Review

There are plenty of studies which are relevant to the issue of "twin deficits" (as a global economic phenomenon), and moreover, to "twin deficits" as the major characteristic of the peripheral imbalances in European Monetary Union (EMU) .

There is a controversy between the different theoretical interpretations which refer to the causal relationship between the two (budget and current account) deficits. There are two main interpretations: the first one argues that budget deficit causes current deficit and the second one which argues that current account deficit leads to budget deficit.

From a global perspective, there are authors who argue that budget deficits are exogenously determined and current account deficits are caused by budget deficits (Abell, 1990 ; Volcker, 1984).

One of the most common interpretations of "twin deficits" issue regarding Southern European countries is that these countries produced high budget deficits because of huge tax evasion problems and state structural problems (Schneider, 2011). According to this interpretation, the fiscal deficits are these which cause current account deficits. A similar interpretation suggests that the low borrowing cost of the time period after the introduction of euro was the main reason of the creation of fiscal deficits and, because of that, of the current account deficits (Milios and Sotiropoulos, 2010 ; Sanchez and Varoudakis, 2013 ; Holinski et al., 2012).

Except of these opinions which support the view that budget deficits cause current account deficits, there are also other economical arguments about "twin deficits" which imply that current account deficits could also be responsible for the creation of budget deficits inside global economy (Darrat, 1988; Summers, 1988 ; Reisen, 1998).

In the case of Eurozone's imbalances, there are studies which support the view of a causality that runs from current account deficits to budget deficits (Nikiforos et al., 2015 ; Kalou and Paleologou, 2012 ; Katrakilidis and Trachanas, 2011). In general, these current account imbalances are attributed mostly to divergent levels of labor cost and inflation. In other words, most of these studies focus on price and unit-labor cost competitiveness issues (Brancaccio, 2012 ; Groll and Van Roye, 2011). Most of these studies mention the role of real exchange rates as the factor which shows the price and the labor cost competitiveness gap between the countries (Carton and Hervé, 2012 ; Arghyrou et al., 2008).

Constantine (2014) argues that, except of the price and labor cost competitiveness issues, there are also deeper competitiveness issues which are related to the productivity and to the structure of European economies. This approach follows a more classical economic interpretation, which argues that the trade imbalances between countries are caused by the different levels of productivity combined with the trade between the same sectors of different regions and countries (Seretis and Tsaliki, 2012). Some of the studies, which support the view that current account deficits led to

budget deficits, consider Euro itself as a cause of these trade imbalances (Nikiforos et al., 2015 ; Krugman, 2013).

There are also some other theoretical interpretations regarding "twin deficits" hypothesis. Baharumshah et al. (2006) argue that there is a two-way causal relationship between current and budget accounts. According to Ricardian Equivalence Principle, there is no causal relationship between the current account and budget deficits (Thornton, 1990 ; Barro, 1974). Kim and Roubini (2008) suggest that budget deficits can cause current account surpluses in the case of US economy.

There are some basic econometric methods in the research literature which have been used in order to test the "twin deficits" hypothesis. One popular method in investigating the "twin deficits" hypothesis is Granger causality test (Baharumshah et al., 2006 ; Nikiforos et al., 2015). Other popular methods, which follow the cointegration approach, are Vector Error Correction Models (VECM) (Nikiforos et al., 2015 ; Kalou and Paleologou, 2012) and Autoregressive distributed lags (ARDL) cointegration (Pesaran and Shin, 1998 ; Katrakilidis and Trachanas, 2011). In addition to these methods, VAR model and Innovation Accounting are also used extensively in order to determine the causal relationship between current account and budget deficits (Sanchez and Varoudakis, 2013 ; Kim and Roubini, 2008, Baharumshah et al., 2006).

3. Theoretical Framework

3.1 National Accounts

This section presents some basic concepts of national accounts and balance of payments and which are related to this study's analysis. In national accounts total GDP is expressed as:

$$Y = C + I + G + X - M \quad (1)$$

where Y =Total Income, C = internal consumption I = internal investment

and $X - M = NX$ is the *net exports* or *current account balance*. The relationship $X > M$ expresses that the country's economy exports more than it imports. This means that there is a *current account surplus*. When this relationship $X < M$ holds, this means that there is a *current account deficit*. When a country has current account deficits, it is called a *net lender* country to foreigners and when a country has a current account

surpluses is *net borrower* from foreigners. In order to define the effect of the current account balance, we also have to decompose national savings:

$$\text{To total private savings : } S^P = Y - C - T \quad \text{where T is total taxes.} \quad (2)$$

$$\text{And to total public savings : } S^G = T - G. \quad (3)$$

$$\text{Therefore, total national savings are } S = S^P + S^G = Y - C - G = I + NX \quad (4)$$

If we rearrange the terms of equation (4), we get this new equation:

$$NX = S^P - I - (G - T) \quad (5)$$

In a closed economy, savings should be always equal to investment, thus $I = S$.

However, in an open economy, this is not always the case. According to equation (5), if NX increases, there might be a government deficit (if $S^P - I$ stays fixed). If this is the case, then we argue that there are "twin deficits" (current account deficits which are followed by fiscal deficits or vice versa).

3.2 Balance of Payments

In order to show the mechanism which links current account deficits to budget deficits and, in turn, to government debt, this subsection describes the framework of Balance of Payments (BoP). Balance of Payments (BoP) show the sum of financial and trade transactions that take place between a country and the rest of the world. BoP is consisted of two parts: *current account* and *capital account*. The capital account can be positive or negative. When capital account is positive, there are *capital inflows* into the economy. In contrast, when capital account is negative, there are *capital outflows* abroad the economy. By definition, it must hold that

$$\text{BoP} = \text{Current Account} + \text{Capital Account} = 0$$

Thus, when there is a current account deficit, there must be an equal (to current account deficit) positive capital account and when there is a current account surplus, there must be an equal (to current account surplus) negative capital account.

Therefore, when there is a current account deficit, it is necessarily followed by capital inflows. These capital inflows might be financial assets like government bonds.

In the case of current account deficit changes exogenously in equation (5), the result is likely to be a budget deficit ($G > T$). This happens through "the automatic and

discretionary mechanisms which respond endogenously to the shocks of current account" (Constantine, 2014). Darrat (1988) mentions the fact that when a domestic productive sector of an economy has been harmed by large trade deficits, then government spending programs are increased in order to enhance these sectors and to compensate their trade losses. These increased government expenditures cause budget deficits and the economy becomes a net borrower. In the case of current account surplus, the economy becomes a net lender (Constantine, 2014).

3.3 The Role of Real Exchange Rate in a Currency Union

This subsection describes the mechanism through different regions, which have a common currency, can face trade imbalances between them. Mundell (1961) describes the problems that are caused by the introduction of a common currency between different economic regions. He argues that the introduction of a common currency may cause current account imbalances between the different regions, if the different regions are under conditions of "rigid wage and price levels" (Mundell, 1961). More analytically, the shift of demand from economy A (or group of economies) to the B economy (or group of economies) causes a surplus in the current account (CA) of economy B and a deficit in the current account of economy A. According to Mundell (1961), a higher rate of inflation of economy B could solve this CA imbalance issue. In addition to the previous theoretical analysis, Mundell (1961) mentions that a currency union cannot be optimal if the assumptions of perfect capital and labor mobility don't hold.

Argyrou et al. (2008) argue that, in case of Eurozone's countries, the deterioration of their price and unit labour cost competitiveness can be seen through the changes of real exchange rates (RER) of the different countries. More specifically, a appreciation of RER of country A means that there is deterioration of price or unit labour cost competitiveness. On the other way, a depreciation of RER of country B means that there is improvement of price or unit labour cost competitiveness (Argyrou et al., 2008).

4. Method

Granger Causality Test

Before starting with the empirical analysis, there should be a definition of some basic theoretical concepts of the methods that are implemented. Granger causality tests are

based on the hypothesis that "the future does not cause the past" (Lin, 2008). More precisely, assume that there are two variables X and Y. If X Granger causes Y, then X is an useful predictor of Y (Watson and Stock, 2015). In order to test the null hypothesis that Y does not Granger cause X using 1 lag length:

$$X_t = a_0 + a_1X_{t-1} + a_2Y_{t-1} + e_{xt} \quad (5.1)$$

In order to test the null hypothesis that X does not Granger cause Y using 1 lag length:

$$Y_t = b_0 + b_1Y_{t-1} + b_2X_{t-1} + e_{yt} \quad (5.2)$$

The null hypothesis holds when the coefficient of a_2 or b_2 is zero (Watson and Stock, 2015). If the null hypothesis holds, this means that X does not predict Y or X does not Granger cause Y.

VAR model and Innovation Accounting

A reduced form of VAR model (Sims, 1980), with two variables X_t and Y_t , is consisted of the following equations:

$$X_t = a_0 + a_1X_{t-1} + a_2Y_{t-1} + e_{xt}$$

$$Y_t = b_0 + b_1Y_{t-1} + b_2X_{t-1} + e_{yt}$$

Innovation accounting consists of two econometric tools *impulse responses* and *forecast error variance decomposition*. Impulse responses show "the response of the current and future values of the variables to an one-unit increase of the value of the error term of one variable inside a VAR model" (Stock and Watson, 2001). Because of the fact that all the other error terms should be equal to zero, the error terms should also be uncorrelated across equations (Stock and Watson, 2001).

Forecast error variance decomposition (FEVD) shows " the percentage of variance of the error made in forecasting a variable due to a specific shock at a given horizon" (Stock and Watson, 2001). Both impulse responses and FEVDs are used extensively, because they provide more information than the coefficients of VAR regressions that are usually not reported (Stock and Watson, 2001).

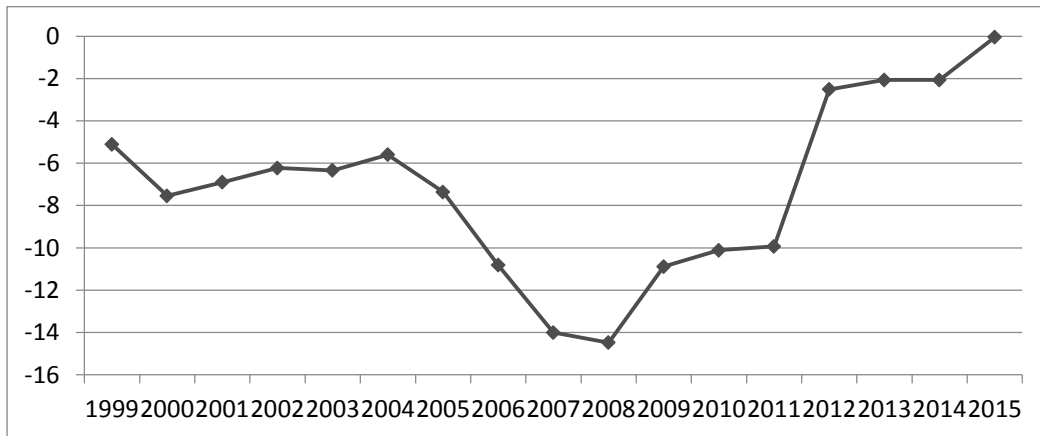
5. Data Description

Current Account Imbalances

The study's analysis begins by looking at the current account imbalances which are presented in Figures 1.1-1.6. Germany and Netherlands are also included in this analysis in order to show the economic divergence between Northern and Southern countries. Starting with Greece (Figure 1.1), we see that the current account deficit is exacerbated two years after the introduction of Euro (2004-2011). There is a strong improvement after the implementation of the austerity measures during the last years (Constantine, 2014). We observe that the same trend is also followed by the rest of Southern countries (Italy, Spain, Portugal). This change can be explained by the contractionary fiscal policies that have been implemented during the years 2010-2015. These fiscal policies were able to reduce excessive imports and to improve current accounts of these countries (Constantine, 2014).

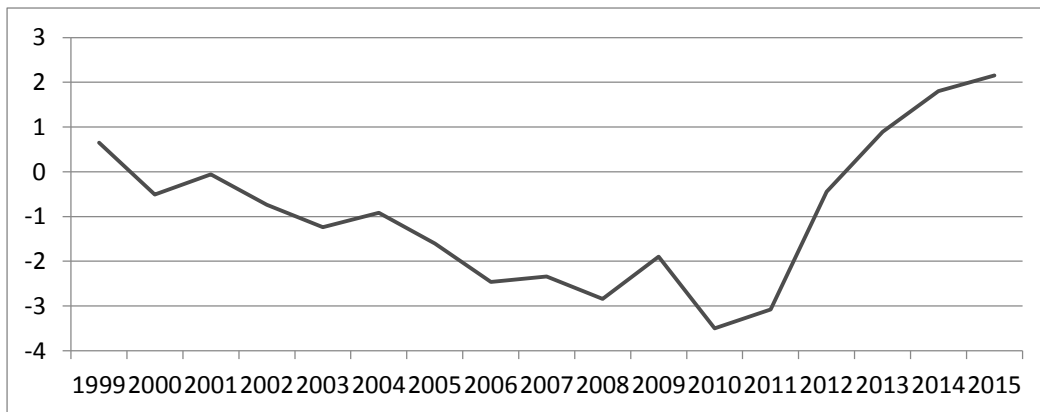
On the other hand, Germany and Netherlands have surpluses in their current accounts during all these years (2002-2015) (Krugman, 2013). Especially, Germany has a steady increase of its current account surplus even after the financial Crisis (2008). Krugman (2013) attributes German current account surpluses to the "highly competitive labour cost" of Germany. In comparison to the Southern countries, Germany and Netherlands seem to have a competitive advantage, which can be attributed in a price and labour competitiveness advantage (Argyrou et al., 2008) or to deeper competitiveness gaps, which are related to the different levels of productivity between North and South (Constantine, 2014).

Figure 1.1: Current Account (% GDP)-Greece-(1999-2015)



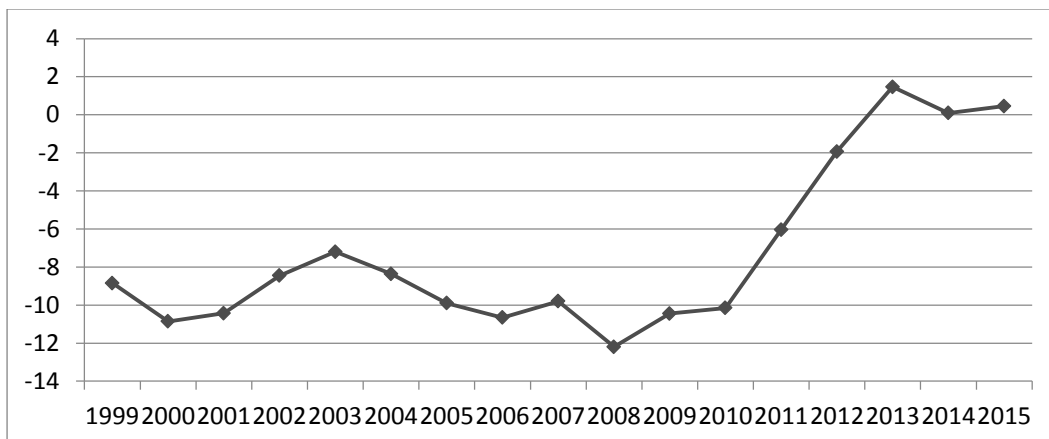
Source: World Development Indicators database, World Bank

Figure 1.2: Current Account (% GDP)-Italy-(1999-2015)



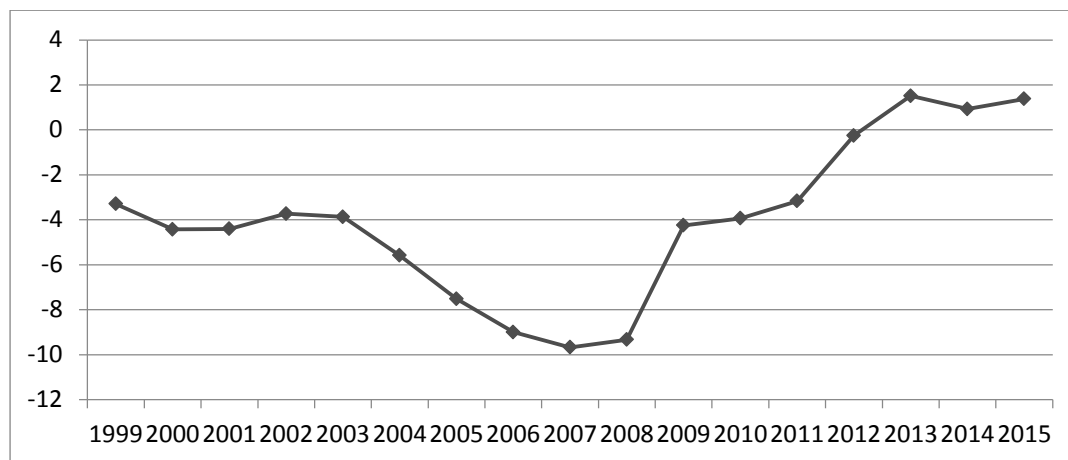
Source: World Development Indicators database, World Bank

Figure 1.3: Current Account (% GDP)-Portugal-(1999-2015)



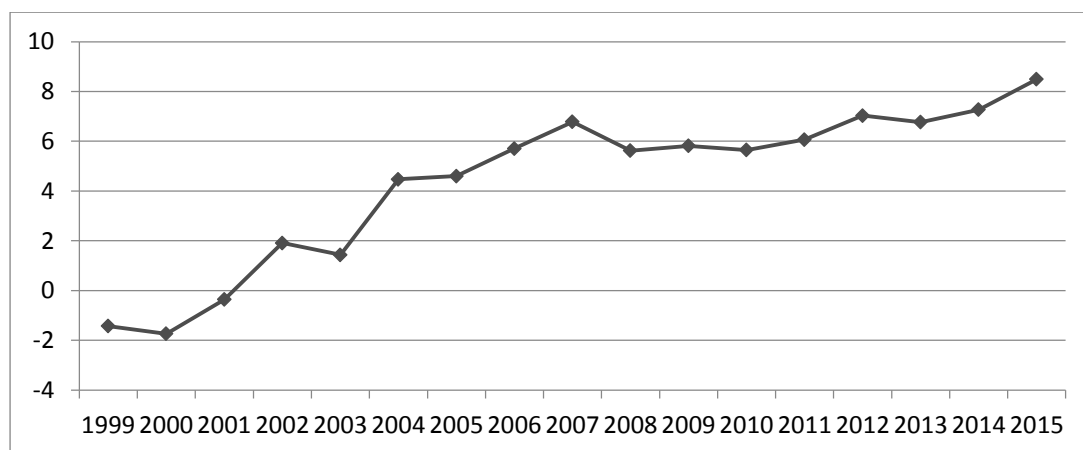
Source: World Development Indicators database, World Bank

Figure 1.4: Current Account (% GDP)-Spain-(1999-2015)



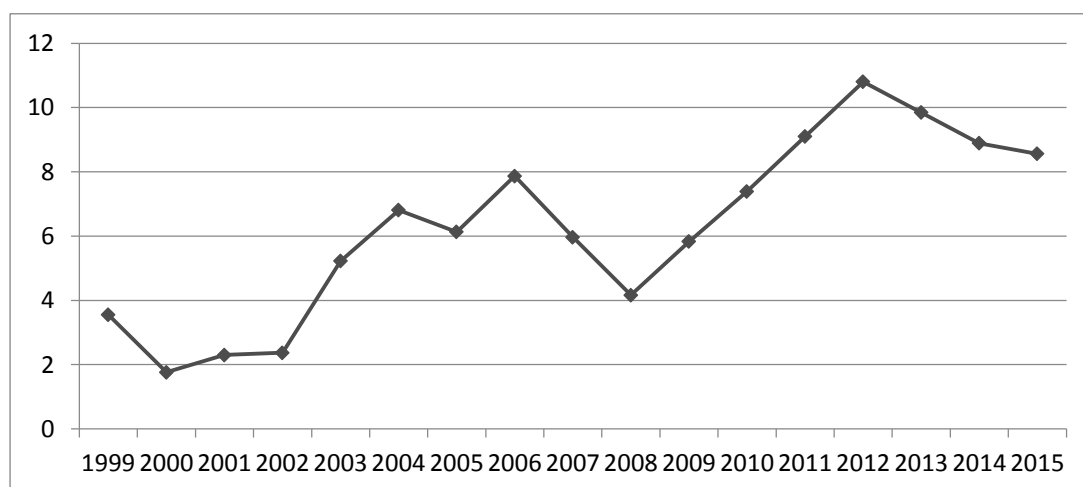
Source: World Development Indicators database, World Bank

Figure 1.5: Current Account (% GDP)-Germany-(1999-2015)



Source: World Development Indicators database, World Bank

Figure 1.6: Current Account (% GDP)-Netherlands-(1999-2015)

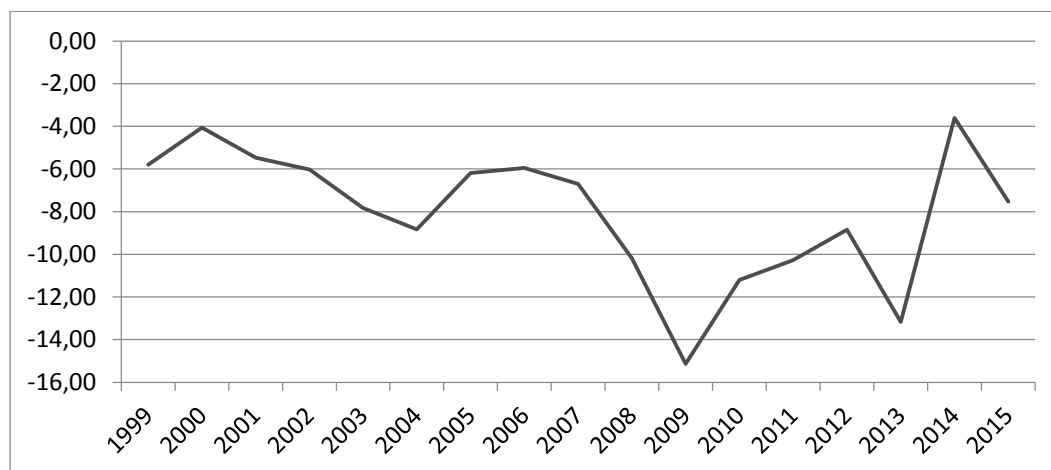


Source: World Development Indicators database , World Bank

Budget Deficit Problem

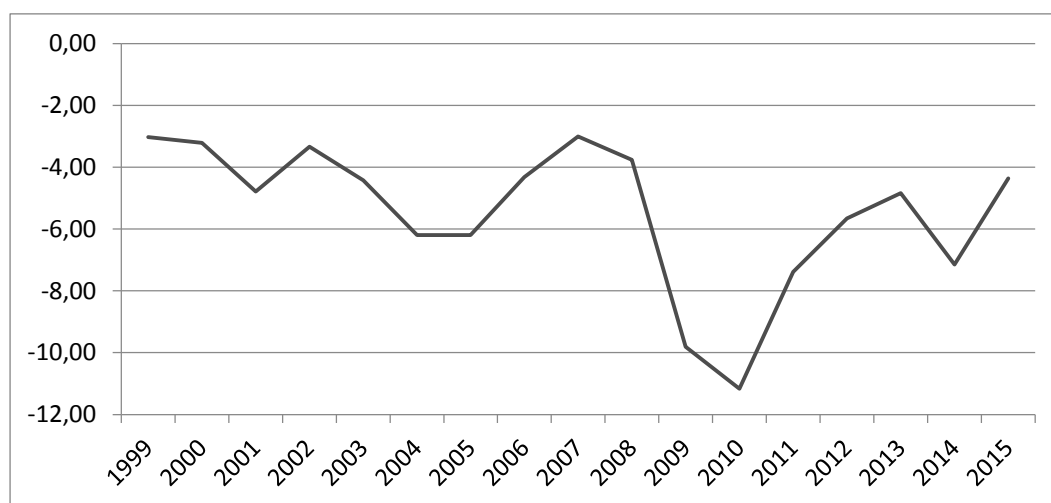
The figures below show the trend of budget deficits of countries which are studied. Greece, Italy and Portugal have high budget deficits during the whole time period. Greece, Italy and Portugal have high budget deficits during the whole time period. Spain initially has a surplus in its budget account, but there is a high deterioration of its budget account after 2007. On the other hand, Germany and Netherlands have both surpluses and deficits in their budget accounts during the whole time period, but in general they do not face high budget deficits to the extent that Southern countries face. Furthermore, there is an improvement for most of the countries in their budget accounts during the last years. This improvement can be explained by the strict fiscal policies that were implemented especially in the Southern countries (Constantine, 2014).

Figure 2.1: General Government Budget Deficit (% of GDP)-Greece-(1999-2015)



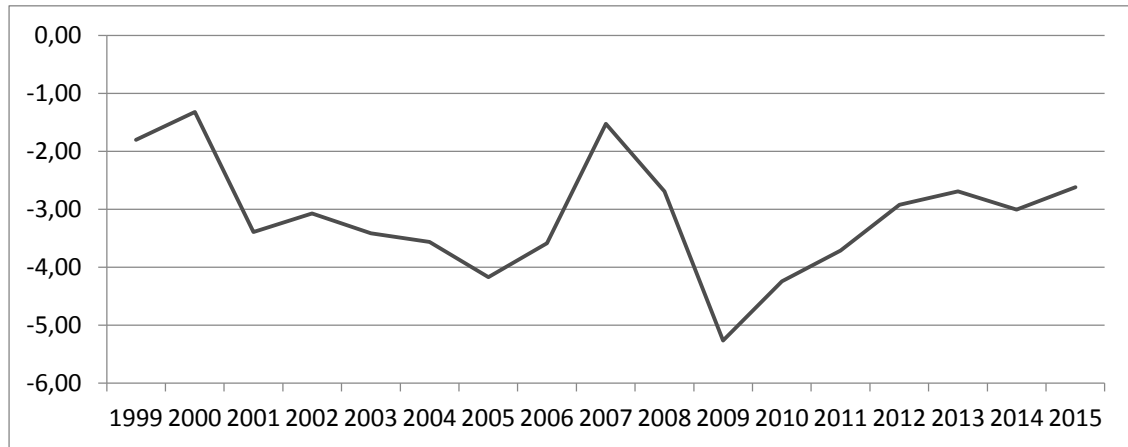
Source: *International Financial Statistics (IFS) database, IMF*

Figure 2.2: General Government Budget Deficit (% of GDP)-Portugal-(1999-2015)



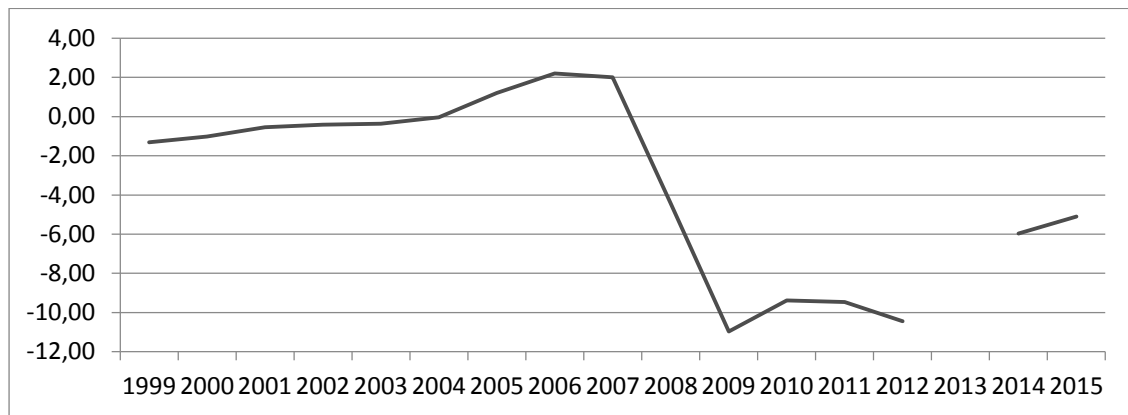
Source: *International Financial Statistics (IFS) database, IMF*

Figure 2.3: General Government Budget Deficit (% of GDP)-Italy-(1999-2015)



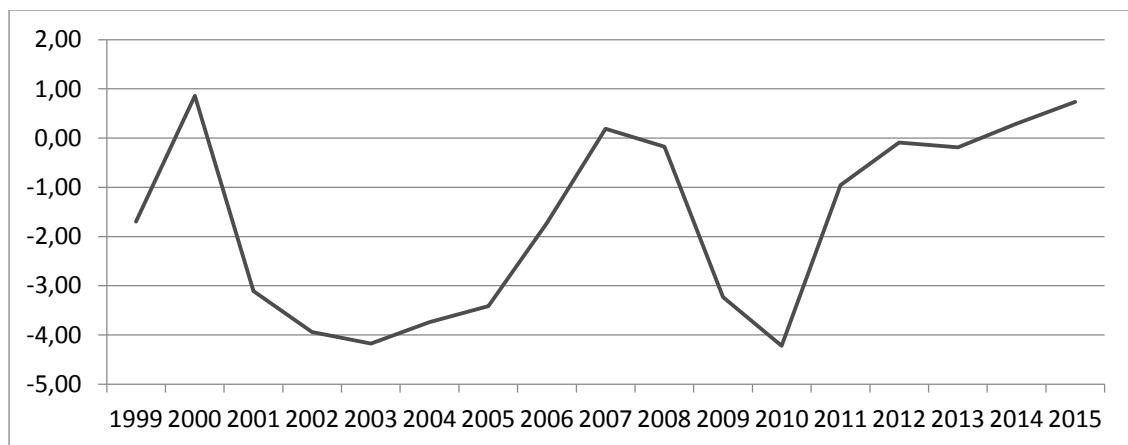
Source: International Financial Statistics (IFS) database, IMF

Figure 2.4: General Government Budget Deficit (% of GDP)-Spain-(1999-2015)



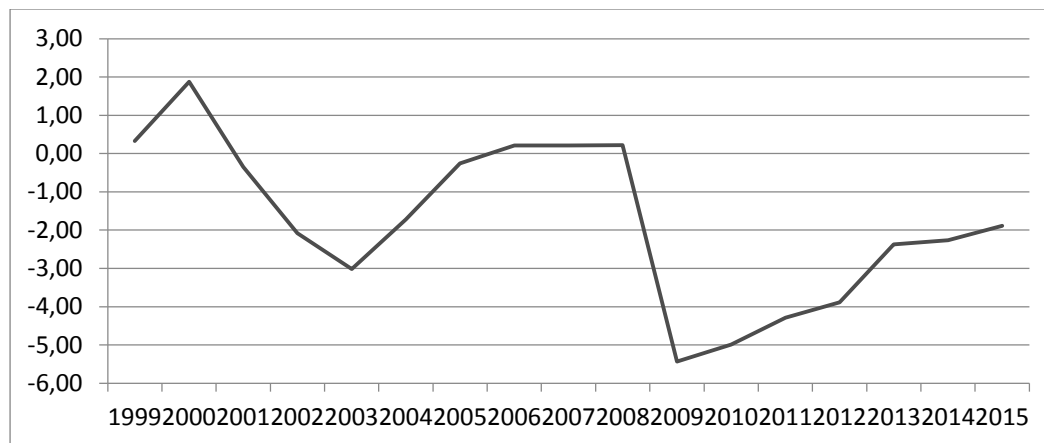
Source: International Financial Statistics (IFS) database, IMF

Figure 2.5: General Government Budget Deficit (% of GDP)-Germany-(1999-2015)



Source: International Financial Statistics (IFS) database, IMF

Figure 2.6: General Government Budget Deficit (% of GDP)-Netherlands-(1999-2015)



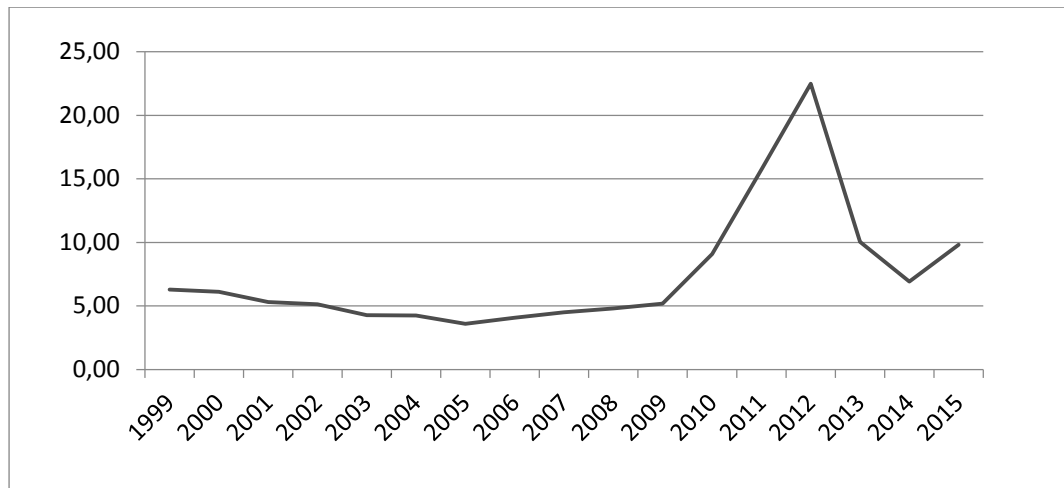
Source: *International Financial Statistics (IFS) database, IMF*

Long-Term Real Interest Rates of Government Bonds

Long-Term Real Interest Rates refer to "the average daily secondary market yield on 10-year fixed-rate government bonds" (IMF, 2017). A very important characteristic of real interest rates of government bonds is the convergence of real interest rates of all countries to the same level after the introduction of Euro. This is one of the most important arguments of the creation of high budget deficits during this time period. More precisely, the low borrowing cost is the key determinant of the high budget deficits of the Southern countries (Nikiforos et al., 2015).

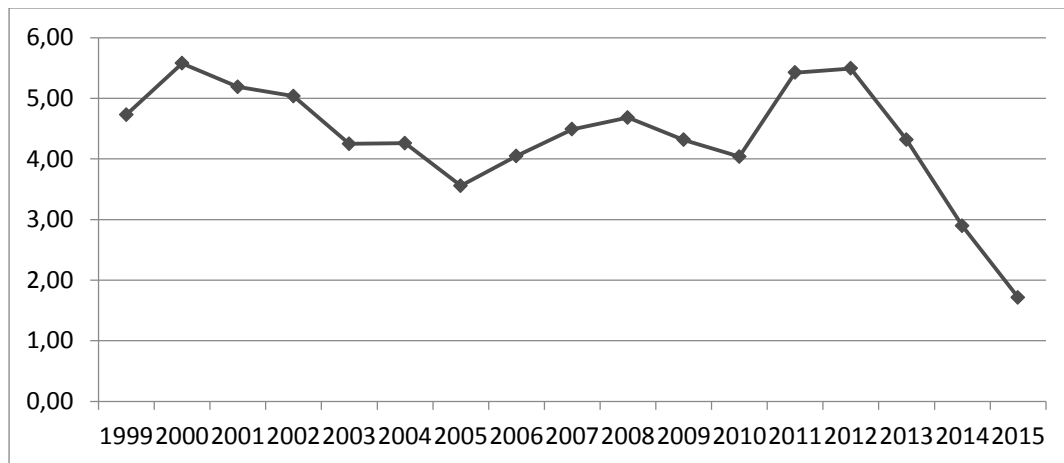
Real interest rates of Greece, Portugal and Spain face a huge increase after the beginning of the financial Crisis (Figures 3.1-3.4). This fact easily explains the dynamics of the government debt of these countries. In contrast to the Southern countries, Germany and Netherlands follow a different path (Figures 3.5-3.6). More specifically, Germany and Netherlands follow a steady decreasing of their interest rates. The different trend of government interest rates between Northern (Germany and Netherlands) and Southern (Greece, Italy, Portugal and Spain) countries is another important feature of the economic imbalances in Eurozone.

Figure 3.1: Long-Term Interest Rates (Gov. Bonds)-Greece-(1999-2015)



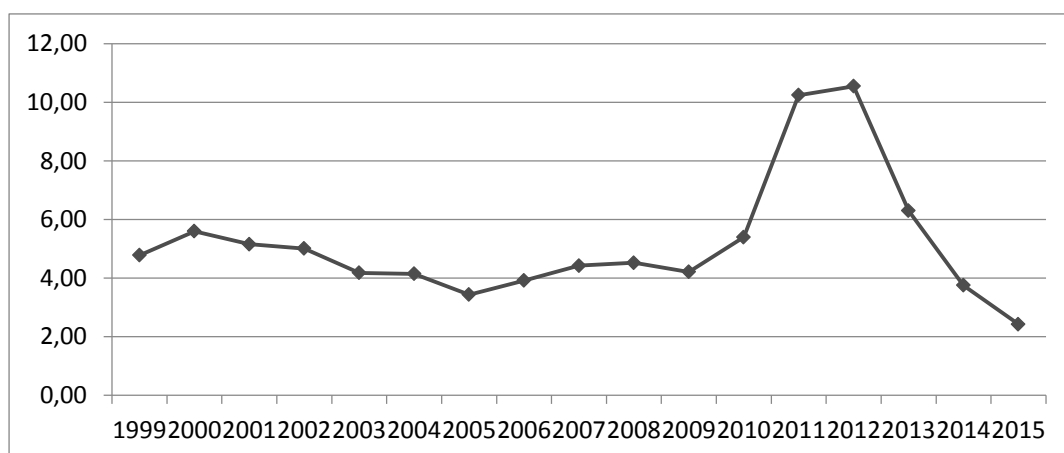
Source: International Financial Statistics (IFS) database, IMF

Figure 3.2: Long-Term Interest Rates (Gov. Bonds)-Italy-(1999-2015)



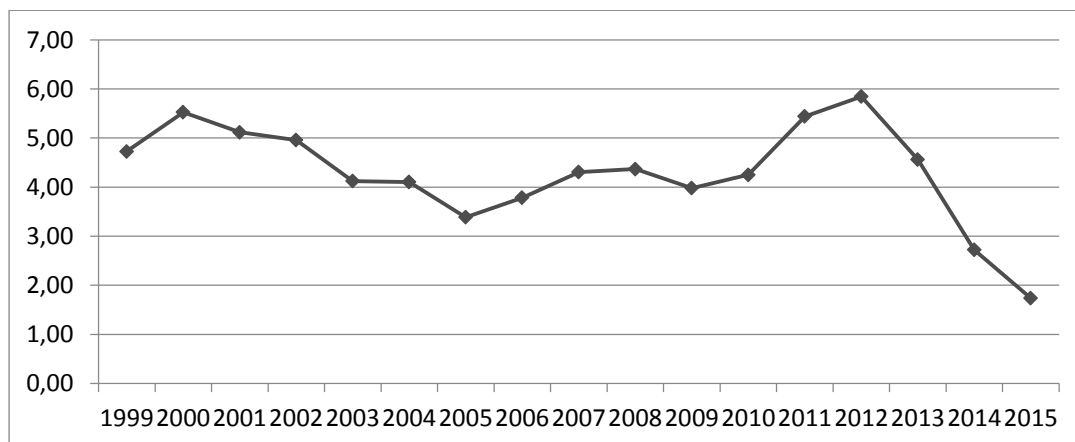
Source: International Financial Statistics (IFS) database, IMF

Figure 3.3: Long-Term Interest Rates (Gov. Bonds)-Portugal-(1999-2015)



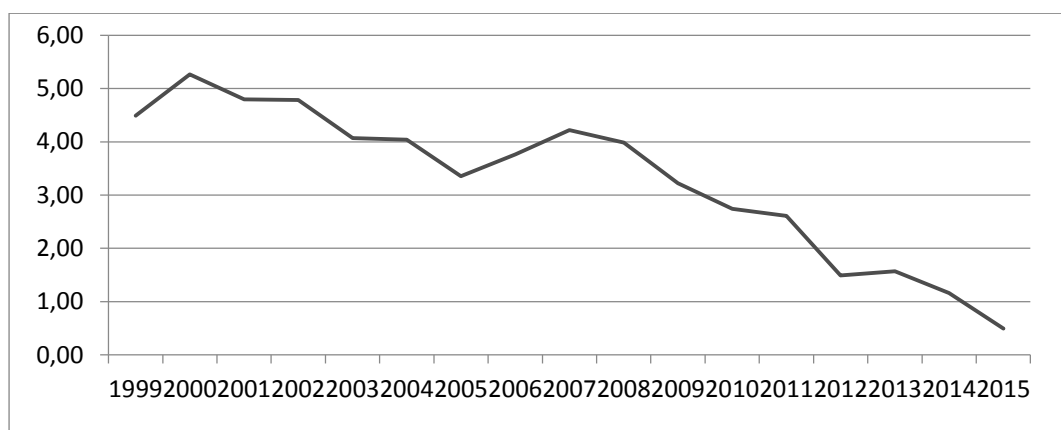
Source: International Financial Statistics (IFS) database, IMF

Figure 3.4: Long-Term Interest Rates (Gov. Bonds)-Spain-(1999-2015)



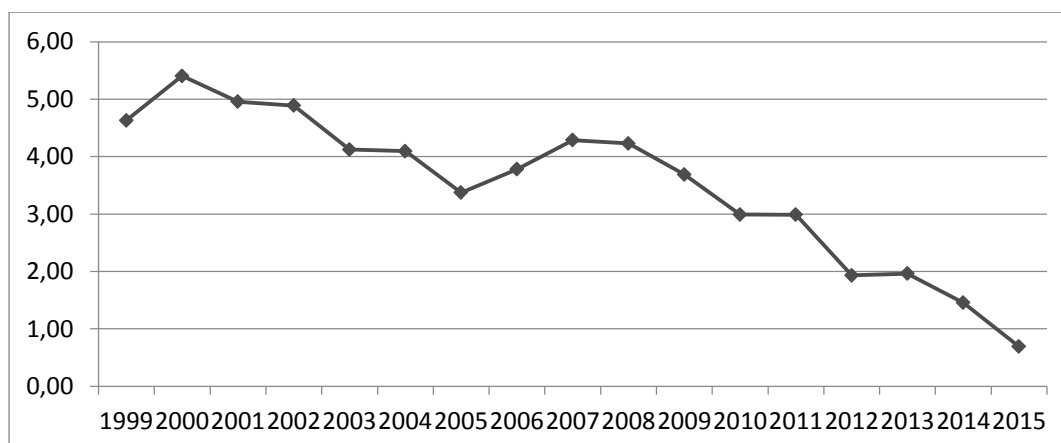
Source: International Financial Statistics (IFS) database, IMF

Figure 3.5: Long-Term Interest Rates (Gov. Bonds)-Germany-(1999-2015)



Source: International Financial Statistics (IFS) database, IMF

Figure 3.6: Long-Term Interest Rates (Gov. Bonds)-Netherlands-(1999-2015)



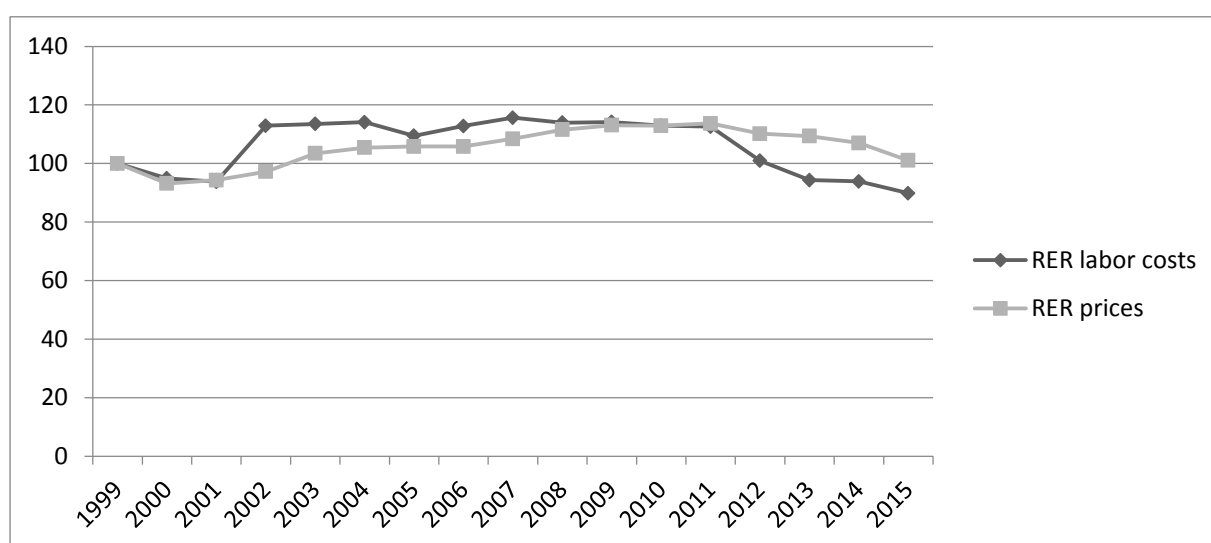
Source: International Financial Statistics (IFS) database, IMF

Real Exchange Rates (based on Prices and Labor Costs)

According to International Financial Statistics definition (IMF, 2017), "a nominal effective exchange rate index represents the ratio of an index of a currency's period-average exchange rate to a weighted geometric average of exchange rates for the currencies of selected countries and the euro area". In addition to that, "a real exchange rate index is an adjusted nominal effective exchange rate index for relative movements in national prices or cost indicators of the home country" (IMF, 2017). The weights of real exchange rates based on relative consumer prices are calculated in accordance with the country's trade in both manufactured and primary goods with its partner and competitor countries (IMF, 2017).

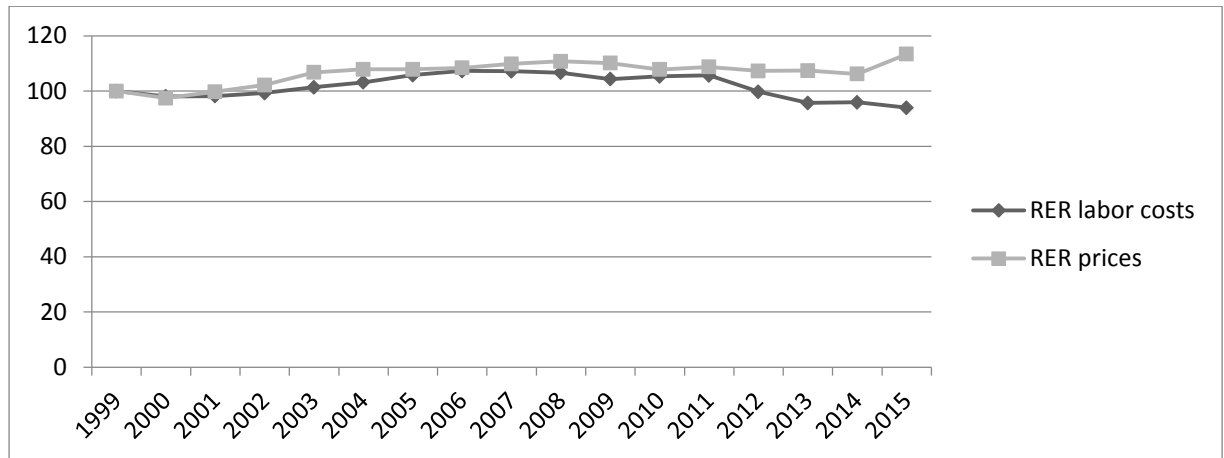
In the figures below, we see the change of real exchange rates (based on prices and unit-labor cost) during the years (1999-2015). There is an appreciation of real exchange rates (both based on prices and labor costs) for all Southern countries and their levels are higher than Germany's and Netherlands'. Again during the years of implementation of austerity measures, there is a depreciation of real exchange rates of Southern countries. During the same time period, there is also depreciation of real exchange rates of Germany and Netherlands. Thus, what we observe is that there was an exacerbation of price and labor cost competitiveness in Southern countries and an improvement of Germany's and Netherlands' price and labor cost competitiveness.

Figure 4.1: Real Exchange Rates (based on prices and labor costs)-(1999=100)-Greece-(1999-2015)



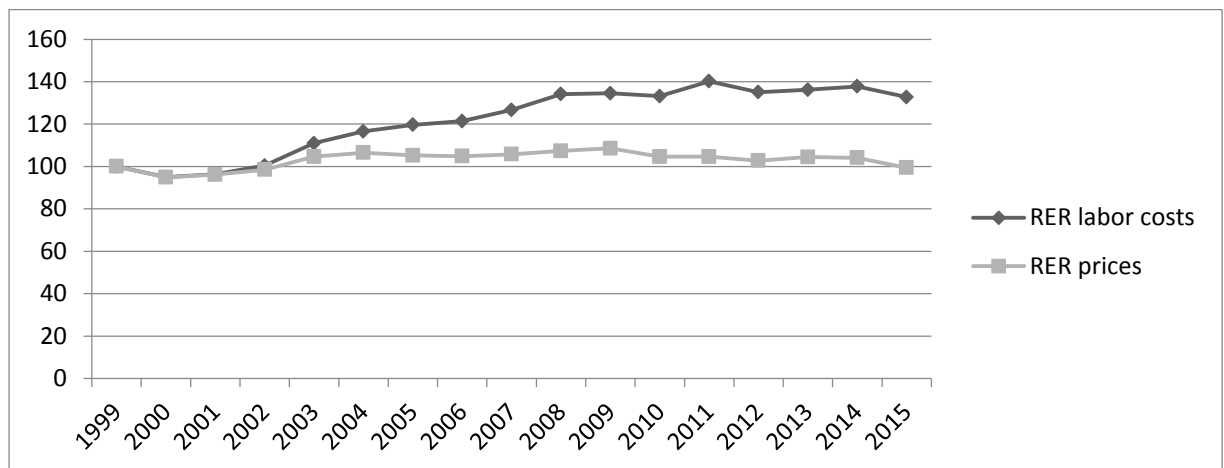
Source: *International Financial Statistics (IFS) database, IMF*

Figure 4.2: Real Exchange Rates (based on prices and labor costs)-(1999=100)-Portugal-(1999-2015)



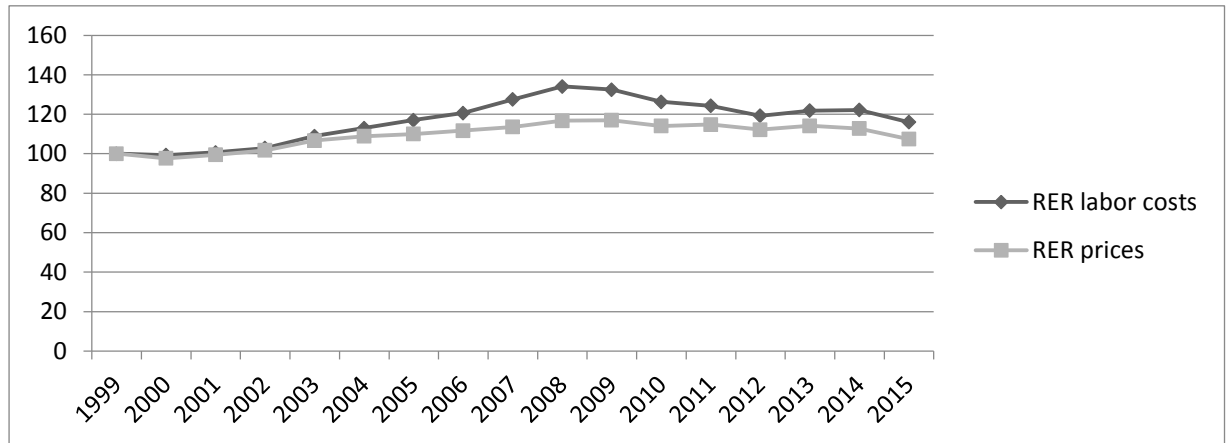
Source: International Financial Statistics (IFS) database, IMF

Figure 4.3: Real Exchange Rates (based on prices)-(1999=100)-Italy-(1999-2015)



Source: International Financial Statistics (IFS) database, IMF

Figure 4.4: Real Exchange Rates (based on prices)-(1999=100)-Spain-(1999-2015)



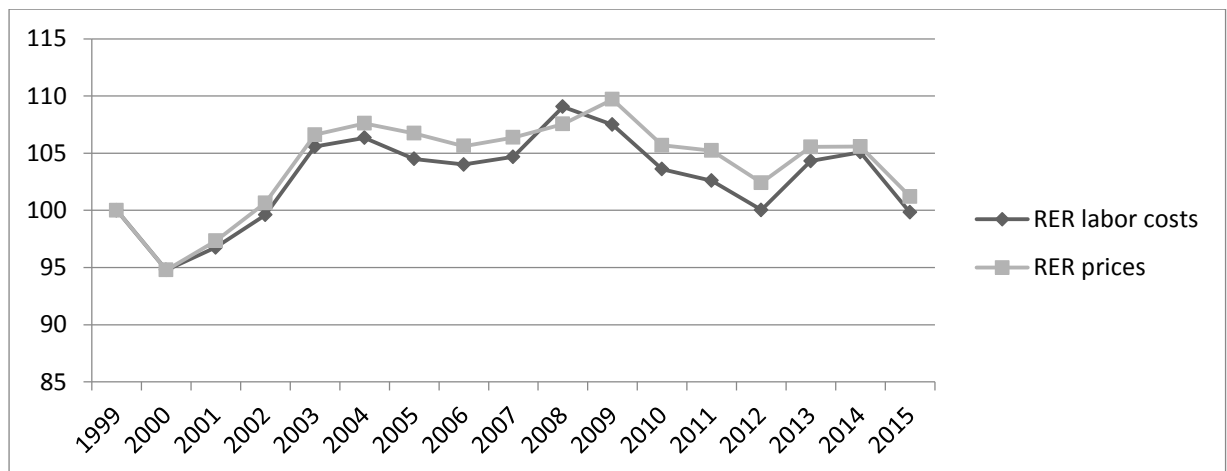
Source: International Financial Statistics (IFS) database, IMF

Figure 4.5: Real Exchange Rates (based on prices and labor costs)-(1999=100)-Germany-(1999-2015)



Source: International Financial Statistics (IFS) database, IMF

Figure 4.6: Real Exchange Rates (based on prices)-(1999=100)-Netherlands-(1999-2015)



Source: International Financial Statistics (IFS) database, IMF

6. Empirical Analysis

The main variables, to which the Granger causality test is applied, are budget account (BD) and current account (CD). Our data refer to Greece, Italy, Spain and Portugal. Budget account data are derived from OECD database and current account data are derived from IMF database. Both current account and budget account are measured in Euro. Our data refer to the time period 1999Q1-2015Q4. In the case of Greece the time period starts from 2002Q1 because of data availability. We use quarterly data which are seasonally adjusted. The list of variables of the VAR model includes CD (current account), BD (budget account), IR (real interest rates of government bonds), REX (real exchange rates based on prices) and REXL (real exchange rates based on labor cost). IR, REX, REXL are derived from IMF database.

6.1 Granger Causality Test

The econometric analysis begins by conducting Granger-Causality tests similar to Nikiforos et al. (2015) in order to estimate the causal relationship between CD and BD. Granger causality tests refer to time period, 1999Q1-2015Q4. In order to capture unsystematic seasonality, 2 to 5 lags are used.

The results about Greece in the table 1.1 show that using 2 and 3 lags, CD and BD do not Granger cause each other. However, in the models with 4 and 5 lags, we can reject the null hypothesis that CD does not Granger cause BD.

Table 1.1: Greece-(2002Q1-2015Q4)

Lags	Null Hypothesis	χ^2 statistic	Prob. > χ^2
2	BD does not Granger cause CD	2.706	0.259
	CD does not Granger cause BD	2.959	0.228
3	BD does not Granger cause CD	3.874	0.275
	CD does not Granger cause BD	3.222	0.359
4	BD does not Granger cause CD	4.253	0.373
	CD does not Granger cause BD	9.446	0.051
5	BD does not Granger cause CD	3.579	0.612
	CD does not Granger cause BD	24.493	0.000

Table 1.2, which presents Portugal's results, shows that CD and BD do not Granger cause each other irrespectively of the number of lags.

Table 1.2: Portugal-(1999Q1-2015Q4)

Lags	Null Hypothesis	χ^2 statistic	Prob. $> \chi^2$
2	BD does not Granger cause CD	5.470	0.065
	CD does not Granger cause BD	4.428	0.109
3	BD does not Granger cause CD	5.364	0.147
	CD does not Granger cause BD	4.621	0.202
4	BD does not Granger cause CD	6.648	0.156
	CD does not Granger cause BD	5.093	0.278
5	BD does not Granger cause CD	5.966	0.310
	CD does not Granger cause BD	8.302	0.140

In the case of Italy in table 1.3, in the models with 2 and 3 lags we can reject that CD does not Granger cause BD. However, the model with 4 lags shows no causal relationship between CD and BD and model with 5 lags shows that we can reject the null hypothesis that BD does not Grange cause CD. Thus, we can argue that the results are unstable.

Table 1.3: Italy-(1999Q1-2015Q4)

Lags	Null Hypothesis	χ^2 statistic	Prob. $> \chi^2$
2	BD does not Granger cause CD	3.720	0.156
	CD does not Granger cause BD	8.842	0.012
3	BD does not Granger cause CD	4.867	0.182
	CD does not Granger cause BD	13.139	0.004
4	BD does not Granger cause CD	7.752	0.101
	CD does not Granger cause BD	7.726	0.106
5	BD does not Granger cause CD	15.347	0.009
	CD does not Granger cause BD	8.655	0.124

Table 1.4 refers to Spain and it clearly shows causality both-way between the variables.

Table 1.4: Spain-(1999Q1-2015Q4)

Lags	Null Hypothesis	χ^2 statistic	Prob. $> \chi^2$
2	BD does not Granger cause CD	12.585	0.002
	CD does not Granger cause BD	11.182	0.004
3	BD does not Granger cause CD	17.592	0.001
	CD does not Granger cause BD	15.075	0.002
4	BD does not Granger cause CD	19.27	0.001
	CD does not Granger cause BD	28.378	0.000
5	BD does not Granger cause CD	21.392	0.001
	CD does not Granger cause BD	17.084	0.004

Since the results are unstable for all countries, the contemporaneous correlation of the residuals of the models is tested. The contemporaneous correlation of the residuals should be close to zero in order not to be problematic. 2 lags are used since they are sufficient. Since there is a strong policy change after 2010 with the implementation of strict fiscal policies, the sample is divided in two time periods, 1999Q1-2009Q4 and 2010Q1-2015Q4. We observe in the tables below that there is a negative contemporaneous correlation of the residuals for Italy and for Spain (24,2% and 21,8% respectively) in time period 1999Q1-2009Q4. The contemporaneous correlation of the residuals of Greece is negative and very low (7,7%) for the same time period. The contemporaneous correlation of the residuals of Portugal is also very low and positive (6,3%) in time period 1999Q1-2009Q4.

In the time period 2010Q1-2015Q4, the contemporaneous correlation of the residuals is higher in all countries except of Spain (which is an "odd" result). Specifically, the contemporaneous correlation of the residuals is negative and 25,2% in the case of Greece, negative and 37,5% in the case of Portugal, negative and 30,2% in the case of Italy and negative and 1,8% (closer to zero) in the case of Spain. This change in the results in this second time period is justified by the lower number of observations of the second period.

Table 2: Contemporaneous Correlation of Residuals

		BD_GR	BD_POR	BD_IT	BD_SP
CD_GR	1999-2009	-0.077			
	2010-2015	0.252			

CD_POR	1999-2009		0.063		
	2010-2015		-0.375		
CD_IT	1999-2009			-0.242	
	2010-2015			-0.302	
CD_SP	1999-2009				-0.218
	2010-2015				-0.018

In general, there are some strong indications that there is quite large contemporaneous correlation of the residuals, especially in the time period 2010Q1-2015Q4. This contemporaneous correlation of the residuals can obviously affect the results of the tests.

6.2 VAR analysis

As it is already described, since 2010 there is implementation of contractionary fiscal policies in all the Southern countries (Constantine, 2014). The large difference in the correlation of the residuals between the two time periods (1999Q1-2009Q4 and 2010Q1-2015Q4) is also indication that there is a structural break in the data and thus, the sample is divided in two different time periods: 1999Q1-2009Q4 (first time period) and 2010Q1-2015Q4 (second time period). In case of Greece and Portugal for the first time period, all the values of current account and budget deficits are negative, so they are converted to positive values and they are logged following the standard in the VAR modeling literature (Kim and Roubini, 2008). In the cases of the other countries and time periods, the data cannot be logged, since there are both positive and negative values. Because of that, Current Account and Budget Account as a percentage of GDP are used.

A recursive ordering of the variables is used in order to identify the VAR model and to remove the contemporaneous correlation of the residuals. The selected ordering is IR-REX-CD-BD. Alternatively, IR-REXL-CD-BD are used. REX and REXL are used in different specifications in order to test the effect of these variables separately, similarly to previous studies (Varoudakis and Sanchez, 2013). The ordering of the last two variables (CD-BD, BD-CD) is changed to test the way that the causality runs between them. IR is put as the first ordered variable, since we assume that it is most likely not to be affected by the fiscal policies of the countries within a quarter. As we see in the figures 3.1-3.6, during the first years after the introduction of Euro the real

interest rates of all the countries converged to almost the same level, independently of their following policies. Moreover, we assume that real exchange rates are also not affected by fiscal policies within a quarter. Thus, four different specifications are used for every country in each time period. The results of specifications which use REXL are presented in Appendix.

Since the observations in both time periods are few and in order to maintain certain number of degrees of freedom, 2 lags are used for the time period 1999Q1-2009Q4 and 1 lag for the time period 2010Q1-2015Q4. A 20 quarters horizon is used for the analysis of impulse responses and FEVDs for the period 1999Q1-2009Q4 and a 10 quarters horizon is used for the period 2010Q1-2015Q4.

Analysis of Period 1999Q1-2009Q4

Greece

The analysis begins reporting the impulse responses results (Fig. 6.1 and 6.2) for the first time period (2002Q1-2009Q4) about Greece. The panels of the figures show in their headings that the first variable is the shock variable and the second variable is the response variable. The upper right and low left panels show that in response to a shock that increases budget deficit, current account deficit decreases and in response to a shock that increases current account deficit, budget deficit increases. These results are in accordance with the theory which argues that current account deficits drive budget deficits.

The upper left panel shows that in response to a shock that increases real interest rates, budget deficit increases. This result contradicts to the hypothesis that low real interest rates increase budget deficits (Nikiforos et al., 2015). The low left panel shows that in response to a shock that increases real exchange rates, current account deficit increases. In accordance to the theory (Arghyrou et al., 2008), this result shows that an appreciation of the real exchange rates deteriorates the current account. The impulse responses return to zero in 10 quarters in all specifications and they are the same independently of the different orderings. In the third and the fourth specifications (Fig.6A, 6B), the results are similar to the first and the second specifications (Fig. 6.1 and 6.2).

Figure 6.1: Impulse Responses: Greece-(2002Q1-2009Q4)-IR-REX-CD-BD

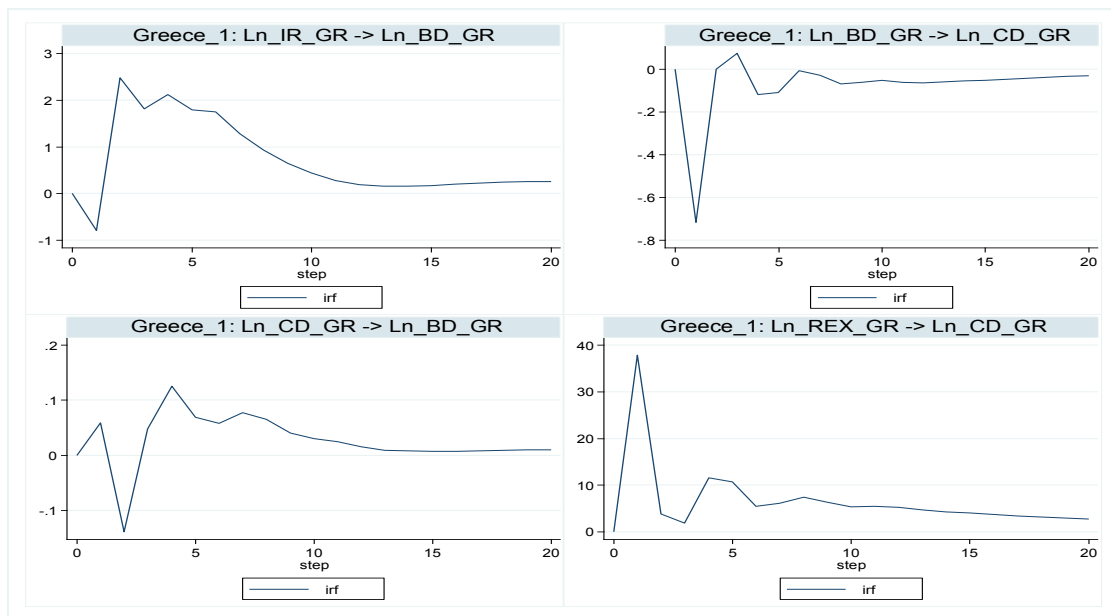
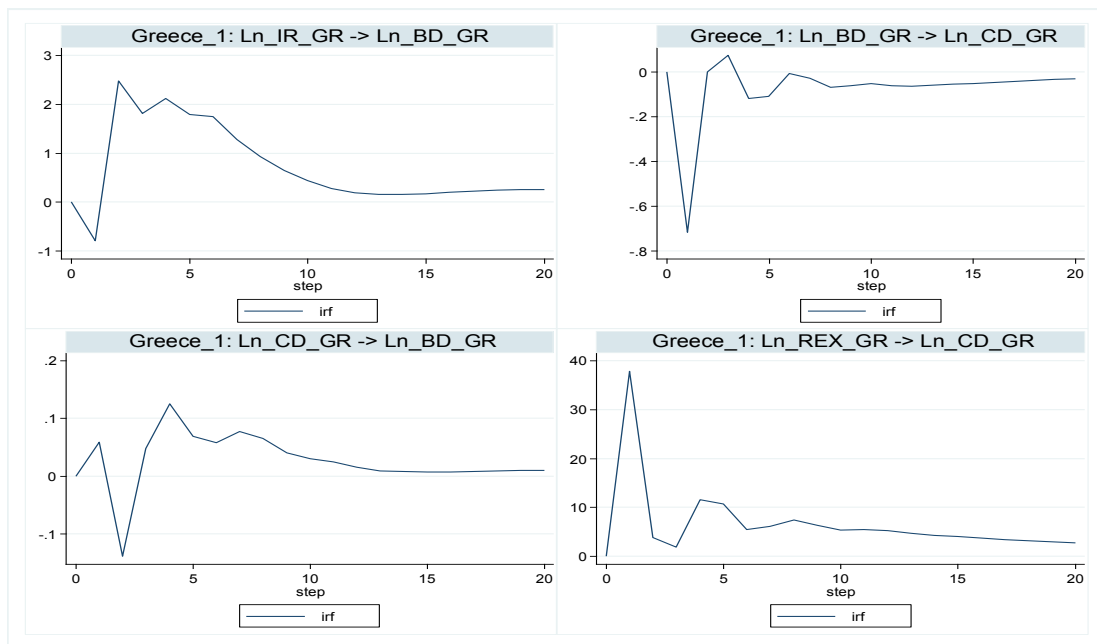


Figure 6.2: Impulse Responses: Greece-(2002Q1-2009Q4)-IR-REX-BD-CD



Tables 3.1 and 3.2 report the results of variance decompositions (FEVD) of Greece for all specifications for the first period (2002Q1-2009Q4). Table 3.1 shows that the effect of budget deficit shock on current account deficit and the effect of current account deficit on budget deficit are low (less than 20%), but the effect of budget deficit shock on current account deficit is marginally higher than the effect of current

account deficit shock on budget deficit. Table 3.2 shows a 30,50% effect of budget deficit on current account deficit and a 3% effect of current account deficit on budget deficit.

Table 3A shows that there is an 26,01% impact of current account deficit shock on budget deficit. Table 3B shows an 27,65% impact of budget deficit shock on current account deficit. Obviously, the ordering of CD and BD variables plays a significant role on the results (especially in the results of Tables 3A and 3B) because it gives us totally different results about the causal relationship between current account deficit and budget deficit.

Tables 3.1 and 3.2 show that the effect of real exchange rate (based on prices) shock causes a 15,08% of variance on the error term of current account deficit at a horizon of 20 quarters. Moreover, they show that the effect of real interest rates shock on budget deficit is relatively low (22,54% at 20 quarters horizon). Tables 3A and 3B present similar results. The results don't indicate that real exchange rates (both based on prices and labor costs) play a major role in affecting current account deficits. Real interest rates don't seem to strongly affect budget deficits either.

Table 3.1: FEVD (percent of variation in BD and in CD)-GREECE-(2002Q1-2009Q4)-IR-REX-CD-BD

Horizon		IR	EX	CD	BD
15 quarters	CD	14,54%	14,69%	52,81%	17,96%
	BD	22,65%	11,43%	8,01%	57,91%
20 quarters	CD	14,45%	15,08%	52,38%	18,09%
	BD	22,54%	11,86%	7,96%	57,65%

Table 3.2:FEVD (percent of variation in BD and in CD)-GREECE-(2002Q1-2009Q4)-IR-REX-BD-CD

Horizon		IR	EX	BD	CD
15 quarters	BD	22,65%	11,43%	62,85%	3,07%
20 quarters	CD	14,54%	14,69%	30,52%	40,25%
	BD	22,54%	11,86%	62,53%	3,07%
	CD	14,45%	15,08%	30,50%	39,97%

In case of Portugal, Figures 6.3 and 6.4 show that the impulse responses results are similar to the results related to Greece. There is one exception in the upper right panel which shows that in response to a shock that increase budget deficit, current account deficit increases too. These results are similar to the results of third and fourth specifications (Fig. 6C and 6D).

The upper left panels in the Figures below show that in response to a shock that increases real interest rates, budget deficit increases (similarly to Greece's results). The low right panels show that in response to a shock that increases real exchange rates, current account deficit increases. Figures 6C and 6D give quite different results, because the different ordering of CD-BD gives different results about the effect of real exchange rates shock on current account deficit and the effect of real interest rates on budget deficit.

However, we conclude that the appreciation of real exchange rates based on prices and labor costs has a negative impact on current account and that an increase of current account deficit causes an increase of budget deficit and vice versa. Low interest rates don't seem to increase budget deficits.

Figure 6.3: Impulse Responses: Portugal-(1999Q1-2009Q4)-IR-REX-CD-BD

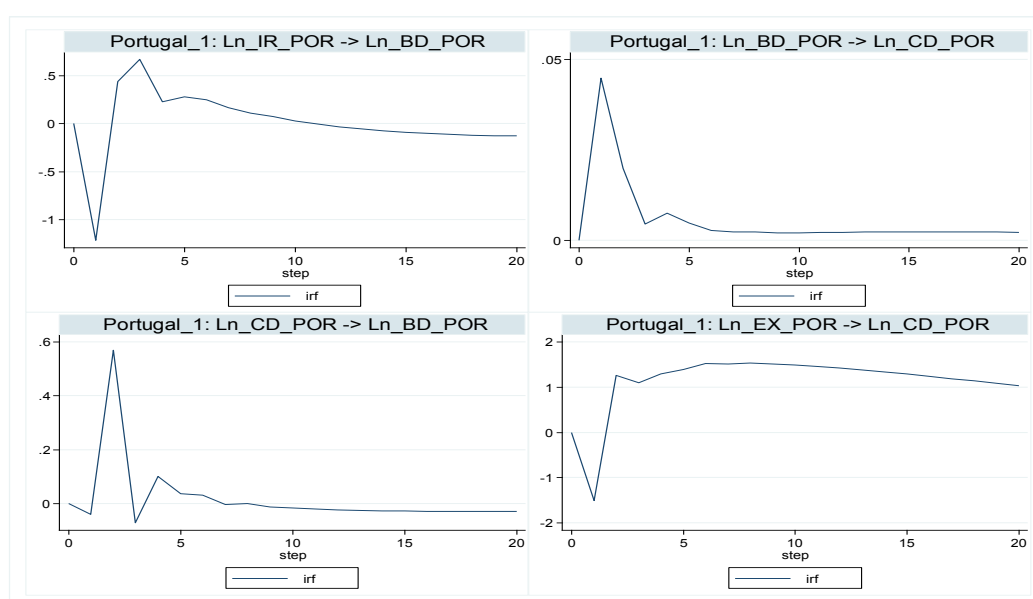
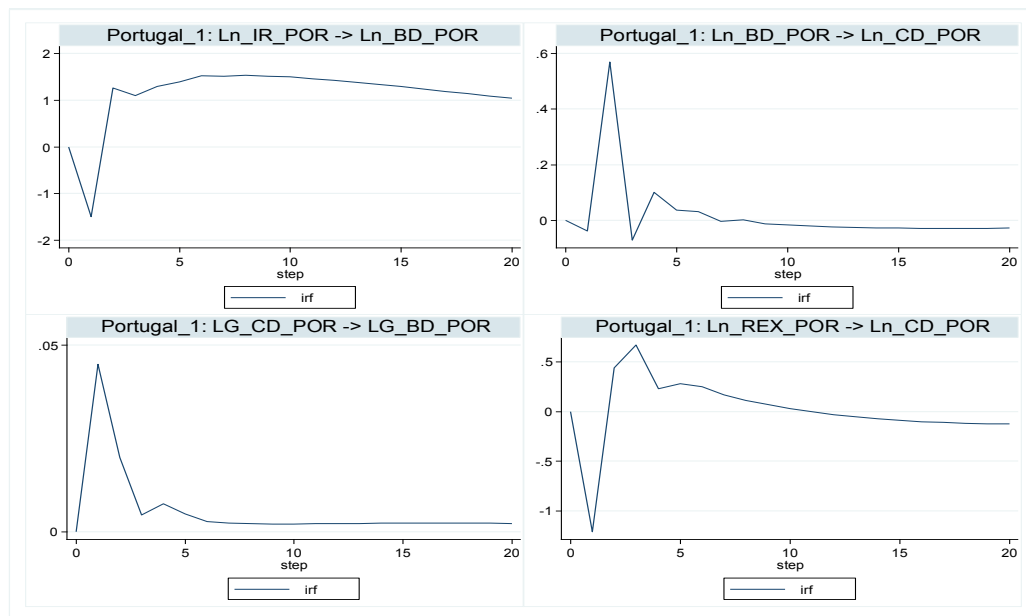


Figure 6.4: Impulse Responses: Portugal-(1999Q1-2009Q4)-IR-REX-BD-CD



Tables 3.3 and 3.4 show that the effect of both current account and budget deficits shocks on budget and current account deficits respectively is very low (less than 20%). We conclude that in the case of Portugal the variance of current account deficit and budget deficit seems to be explained by their own shocks and that the results don't imply causal relationship between current account deficit and budget deficit.

The contribution of real interest rates shocks to budget deficit is small (under 20% in all specifications at 20 horizon). The only exception is in the Table 3D, which shows a 56,17% contribution of real interest rates shocks to budget deficit variance. This is a huge difference in comparison to the other results and it is difficult to be interpreted. The effect of real exchange rates shock on current account deficit is very low in all specifications. In general, real interest rates don't seem to affect budget account and the appreciation of real exchange rates doesn't have large effect on current account.

Table 3.3:FEVD (percent of variation in BD and in CD)-PORTUGAL-(1999Q1-2009Q4)-IR-REX-CD-BD

Horizon		IR	EX	CD	BD
15 quarters	CD	5,52%	2,85%	88,76%	2,87%
	BD	10,21%	5,18%	2,07%	82,54%
20 quarters	CD	5,67%	3,41%	88,04%	2,88%
	BD	10,29%	5,38%	2,09%	82,25%

Table 3.4:FEVD (percent of variation in BD and in CD)-PORTUGAL-(1999Q1-2009Q4)-IR-REX-BD-CD

Horizon		IR	EX	BD	CD
15 quarters	BD	16,61%	1,50%	81,88%	0,01%
	CD	87,46%	0,18%	10,25%	2,11%
20 quarters	BD	18,92%	1,40%	79,60%	0,01%
	CD	88,07%	0,17%	9,77%	2,00%

The low right and left panels in Figures 6.5 and 6.6 about Spain show that in response to a shock that increases current account, budget account reacts unstably. However, in response to a shock that increases budget account, current account decreases. This last result clearly opposes to the theory which argues that a budget deficit leads to current account deficit.

Upper left panel shows that a shock which increases real interest rates causes a decrease of budget account. Furthermore, upper right panel indicates that an appreciation of real exchange rates leads to increase of current account. These results imply that low real interest rates can increase budget deficit. They also imply that an appreciation of real exchange rates doesn't affect negatively on current account. This result opposes to the theory (Argyrou et al., 2008). In the Figures 6G and 6H the results are almost identical.

Figure 6.5: Impulse Responses: Spain (1999Q1-2009Q4)-IR-REX-CD-BD

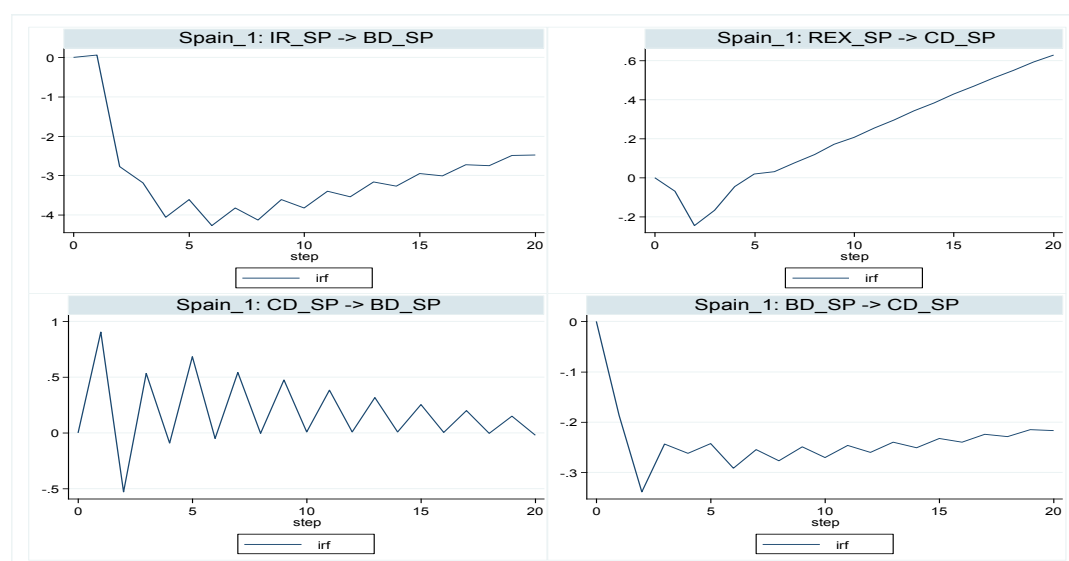
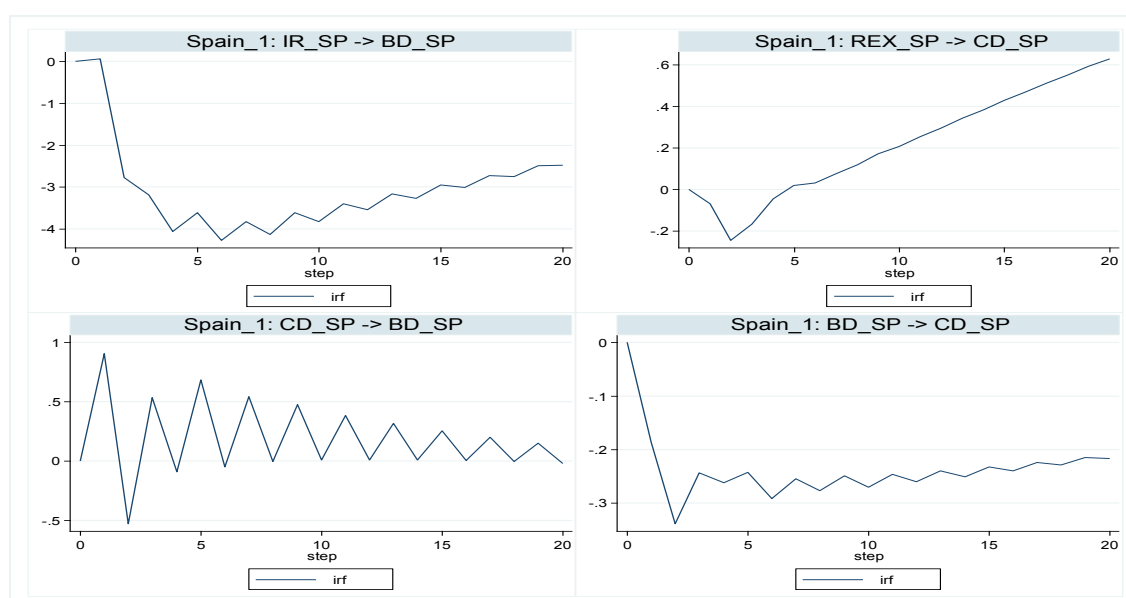


Figure 6.6: Impulse Responses: Spain (1999Q1-2009Q4)-IR-REX-BD-CD



The results of FEVD in the Tables 3.5 and 3.6 show that there is an interesting result related to the causal relationship between current account and budget account, since the effect of budget account on current account is 43,23% and 41,98% in the first and second specifications respectively. These results indicate that budget account drives current account.

The effect of real interest rates on budget account is 24,01% in the first and second specifications. The effect of real exchange rates shock on current account is very low (10,88% in the first and second specifications).

Table 3.5:FEVD (percent of variation in BD and in CD)-SPAIN-(1999Q1-2009Q4)-IR-REX-CD-BD

Horizon		IR	EX	CD	BD
15 quarters	CD	38,21%	5,10%	10,12%	46,58%
	BD	25,99%	23,45%	7,76%	42,80%
20 quarters	CD	38,52%	10,88%	7,37%	43,23%
	BD	24,01%	32,66%	6,25%	37,08%

Table 3.6:FEVD (percent of variation in BD and in CD)-SPAIN-(1999Q1-2009Q4)-IR-REX-BD-CD

Horizon		IR	EX	BD	CD
15 quarters	BD	25,99%	23,45%	45,51%	5,05%
	CD	38,21%	5,10%	45,68%	11,01%
20 quarters	BD	24,01%	32,66%	39,20%	4,13%
	CD	38,52%	10,88%	41,98%	8,62%

Figures 6.7 and 6.8 in the low right and left panels show that in response to a shock that increases current account, budget account decreases and vice versa. These results seem to contradict with all common theoretical interpretations.

There is no clear image about the effect of real interest rates on budget account (upper left panel), because a shock that increases real interest rates affects both positively and negatively on budget account. Upper right panel shows that in response to a shock that increases real exchange rates, current account decreases. This result follows the common theory which predicts this effect. Figures 6E and 6F show almost identical results.

Figure 6.7: Impulse Responses: Italy-(1999Q1-2009Q4)-IR-REX-CD-BD

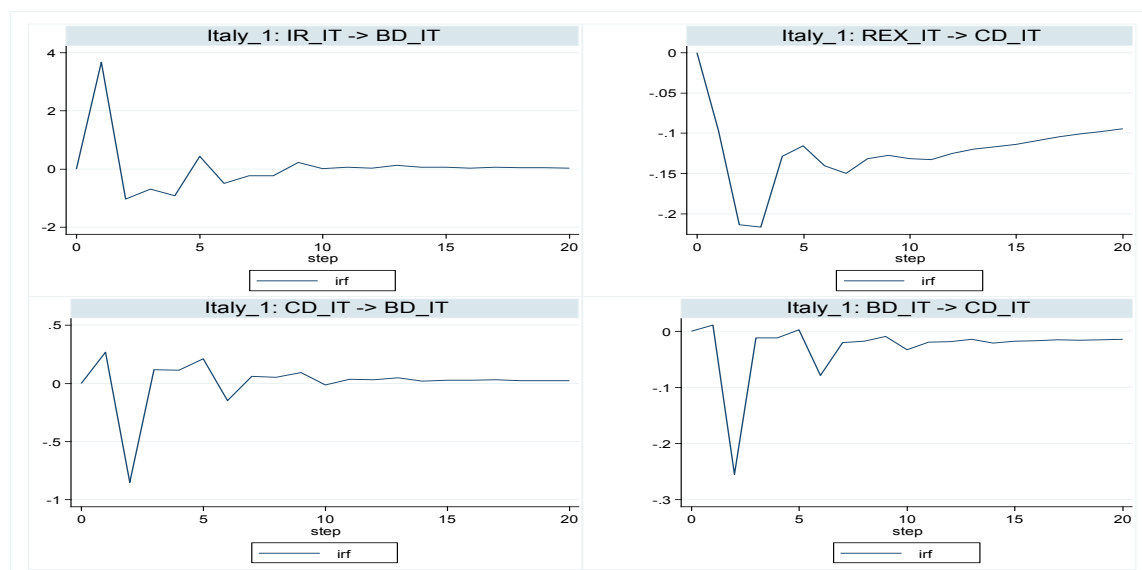
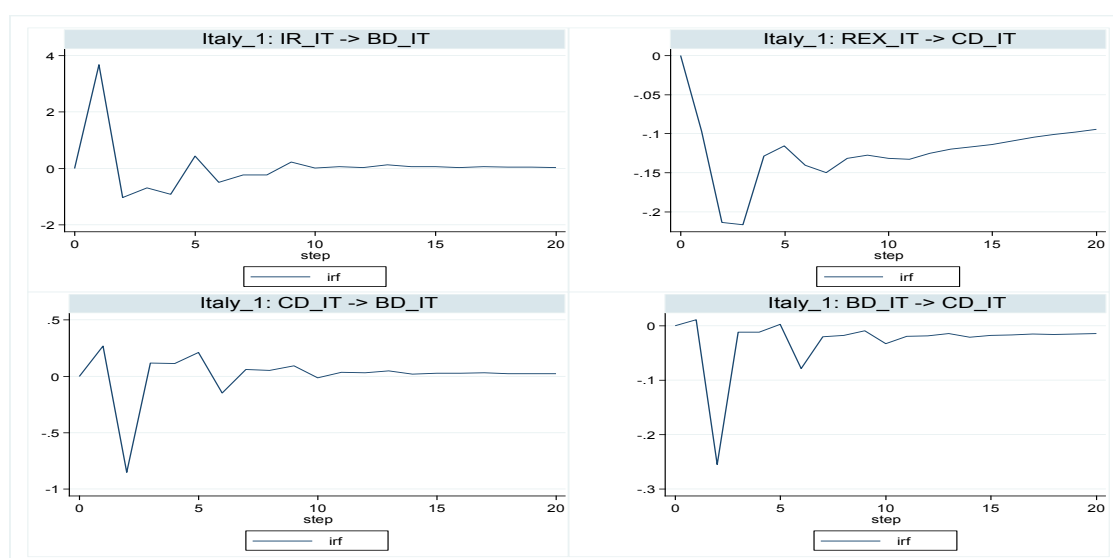


Figure 6.8: Impulse Responses: Italy-(1999Q1-2009Q4)-IR-REX-BD-CD



Tables 3.7 and 3.8 show that the effect of current account on budget account and the effect of budget account on current account is lower than 20%. These results show that current account and budget account are actually explained by their own shocks and that there is no causal relationship between them.

The results show a weak effect of real interest rates shocks on budget account (13,04% in the first and second specifications). The effect of real exchange rates shock on current account is also low (14,97%) in the first and second specifications, but it is higher (27,83%) in the third and fourth specifications (Tab. 3G and 3H).

Table 3.7:FEVD (percent of variation in BD and in CD)-ITALY-(1999Q1-2009Q4)-IR-REX-CD-BD

Horizon		IR	EX	CD	BD
15 quarters	CD	12,14%	12,93%	57,61%	17,33%
	BD	13,01%	5,49%	10,07%	71,42%
20 quarters	CD	12,71%	14,97%	55,48%	16,84%
	BD	13,04%	5,64%	10,07%	71,24%

Table 3.8:FEVD (percent of variation in BD and in CD)-ITALY-(1999Q1-2009Q4)-IR-REX-BD-CD

Horizon		IR	EX	BD	CD
15 quarters	BD	13,01%	5,49%	72,18%	9,32%
	CD	12,14%	12,93%	18,55%	56,39%
20 quarters	BD	13,04%	5,64%	71,99%	9,33%
	CD	12,71%	14,97%	17,88%	54,44%

Analysis of Period 2010Q1-2015Q4

In the Figures 6.9 and 6.10 low left and right panels show that in response to a shock that increases current account, budget account increases and in response to a shock that increases budget account, current account decreases. The result of low left panel is in accordance with the theory which supports that a current account deficit can cause a budget deficit, but the result of low right panel doesn't seem to follow a certain theoretical interpretation.

The upper left panel shows that in response to a shock that increases real interest rates, budget account initially decreases (below zero) and later it increases (over zero). Upper right panel shows that an appreciation of real exchange rates, increases current account deficit. The results of this second period are similar to these in the first period with only exception the effect of real interest rates shock on budget account.

Figure 6.9: Impulse Responses: Greece-(2010Q1-2015Q4)-IR-REX-CD-BD

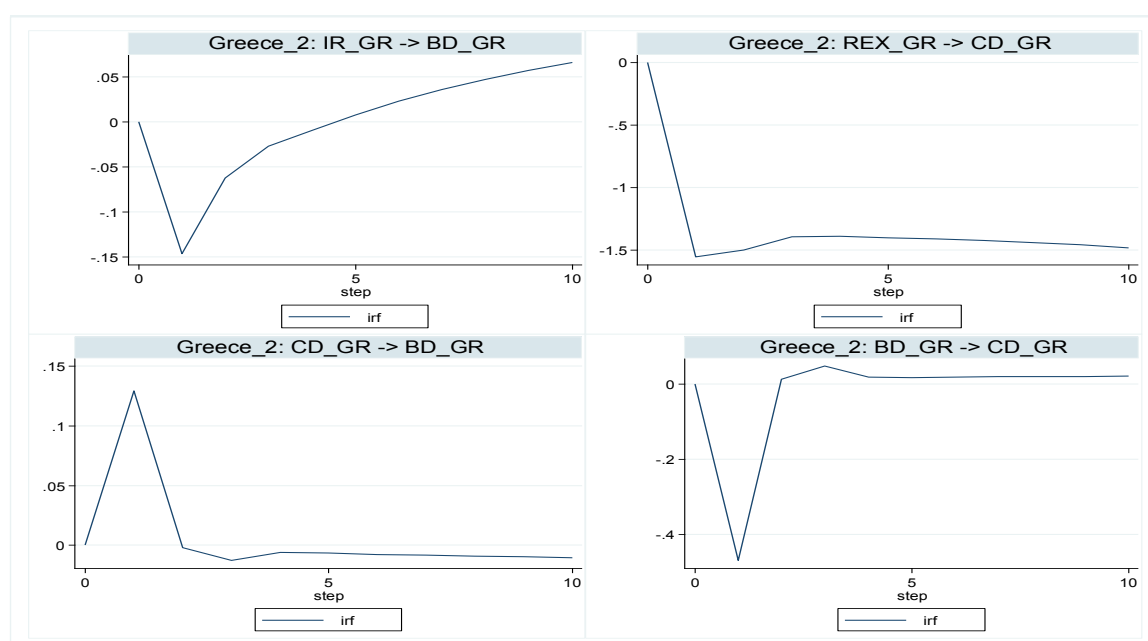
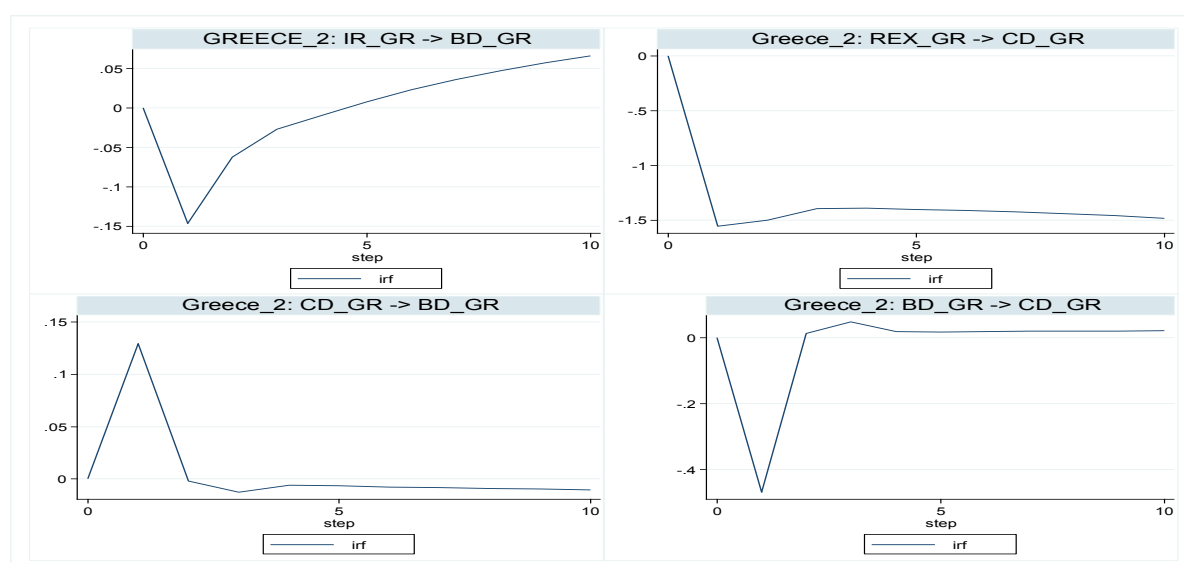


Figure 6.10: Impulse Responses: Greece-(2010Q1-2015Q4)-IR-REX-BD-CD



Tables 3.9 and 3.10 show that budget account tends to be more exogenous than current account, however, the effects of current account and budget account shocks on budget account and current account respectively are low (less than 20%). Thus, we conclude from these results that budget account and current account are explained by their own shocks.

Moreover, the results show that the effect of a shock on real interest rates causes a 0,44% variance of the error term of budget account at a horizon of 10 quarters. The effect of real interest rates shock on budget account seems to be extremely low. The effect of real exchange rates shock on current account is 27,50%. Thus, the effect of real exchange rates based on prices has a relatively large impact on current account in the second period.

Table 3.9:FEVD (percent of variation in BD and in CD)-GREECE-(2010Q1-2015Q4)-IR-REX-CD-BD

Horizon		IR	EX	CD	BD
5 quarters	BD	0,44%	2,52%	7,13%	89,91%
	CD	0,13%	13,81%	69,08%	15,81%
10 quarters	BD	0,44%	5,38%	6,94%	87,25%
	CD	1,29%	27,20%	58,14%	13,37%

Table 3.10:FEVD (percent of variation in BD and in CD)-GREECE-(2010Q1-2015Q4)-IR-REX-BD-CD

Horizon		IR	EX	BD	CD
5 quarters	BD	0,44%	0,25%	95,70%	1,34%
	CD	0,13%	13,81%	21,16%	63,72%
10 quarters	BD	0,44%	5,38%	92,86%	1,32%
	CD	1,29%	27,20%	17,80%	53,71%

Low left and right panels in the Figures 6.11 and 6.12 indicate that in response to a shock that leads to increase of current account, budget account increases. However, in response to a shock that increases budget account, current account decreases. Figures 6K and 6L show that the effect of current account shock on budget account and the effect of budget account shock on current account are unstable, since in response to a shock that increases current and budget accounts, budget and current accounts initially decrease and then increase respectively. The results of the first and second specifications seem to follow the argument that current account drives budget account.

Upper left panel shows that in response to a shock that increases real interest rates, budget account increases. Upper right panel shows that an appreciation of real exchange rates decreases current account. The results are similar in all the specifications.

Figure 6.11: Impulse Responses: Portugal-(2010Q1-2015Q4)-IR-REX-CD-BD

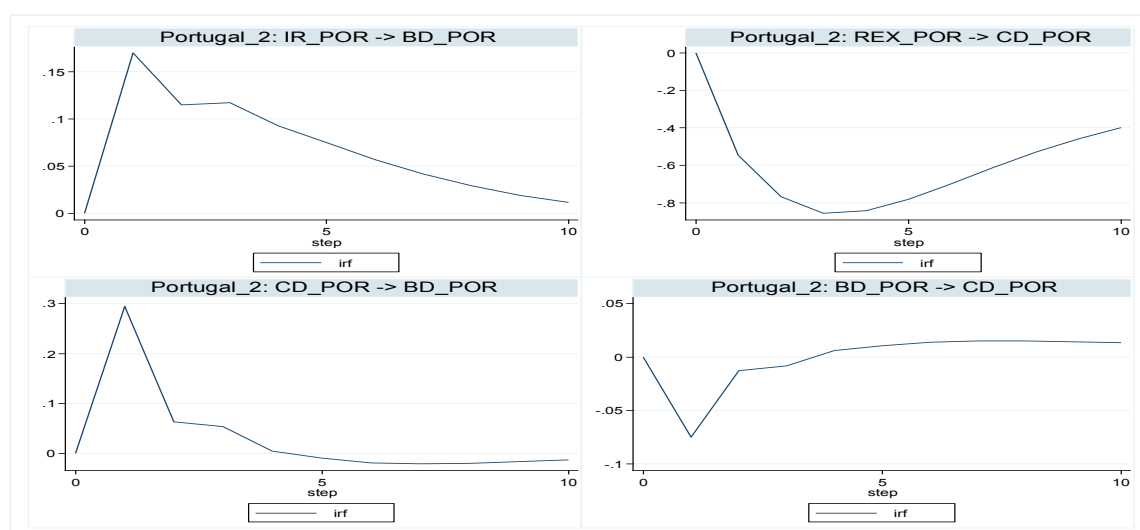
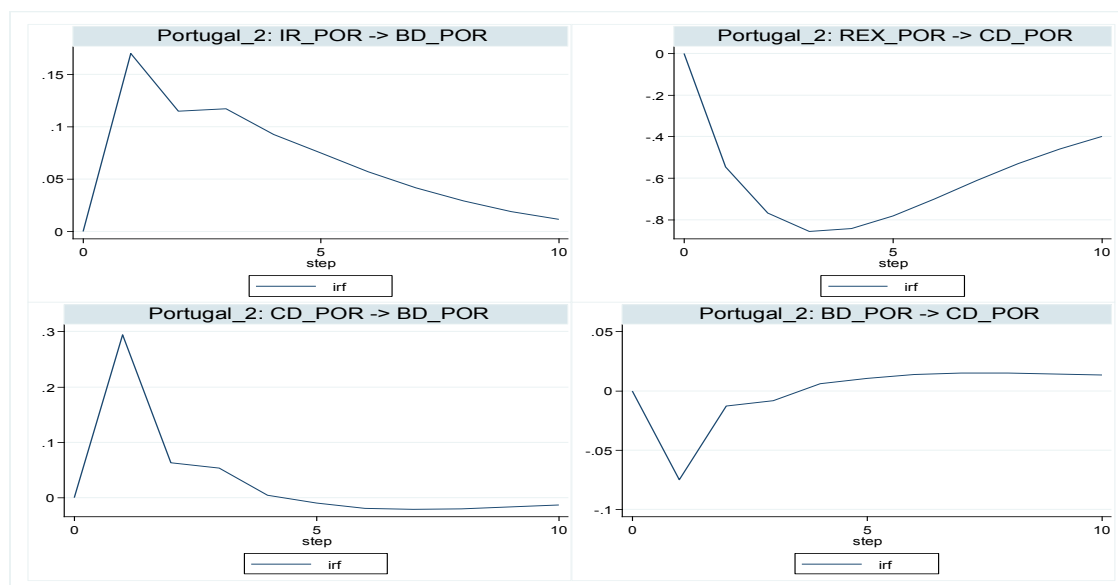


Figure 6.12: Impulse Responses: Portugal-(2010Q1-2015Q4)-IR-REX-BD-CD



Tables 3.11 and 3.12 show that the effects of current account and budget account shocks on budget account and current account respectively are low (less than 25%). Thus, current account and budget account are explained by their own shocks.

The effect of real interest rates shock on budget account is 3,89%. The effect of real exchange rates shock on current account is also low (15,72%). The results of third and fourth specifications are similar to these results.

Table 3.11:FEVD (percent of variation in BD and in CD)-PORTUGAL-(2010Q1-2015Q4)-IR-REX-CD-BD

Horizon		IR	EX	CD	BD
5 quarters	CD	5,84%	12,11%	81,65%	0,39%
	BD	3,02%	4,91%	24,17%	67,91%
10 quarters	CD	9,31%	15,72%	74,56%	0,41%
	BD	3,89%	6,06%	23,65%	66,40%

Table 3.12:FEVD (percent of variation in BD and in CD)-PORTUGAL-(2010Q1-2015Q4)-IR-REX-BD-CD

Horizon		IR	EX	BD	CD
5 quarters	BD	3,01%	4,91%	88,94%	3,14%
	CD	5,84%	12,11%	20,93%	61,85%
10 quarters	BD	3,89%	6,06%	86,93%	3,12%
	CD	9,31%	15,72%	18,48%	56,49%

Figures 6.13 and 6.14 show that impulse responses are highly unstable and they imply that there is no systematic causal relationship between the variables. The only important indication which is presented in upper right panel is that an appreciation of real exchange rates decreases current account (Fig. 6.13, 6M, 6N).

Figure 6.13: Impulse Responses: Spain-(2010Q1-2015Q4)-IR-REX-CD-BD

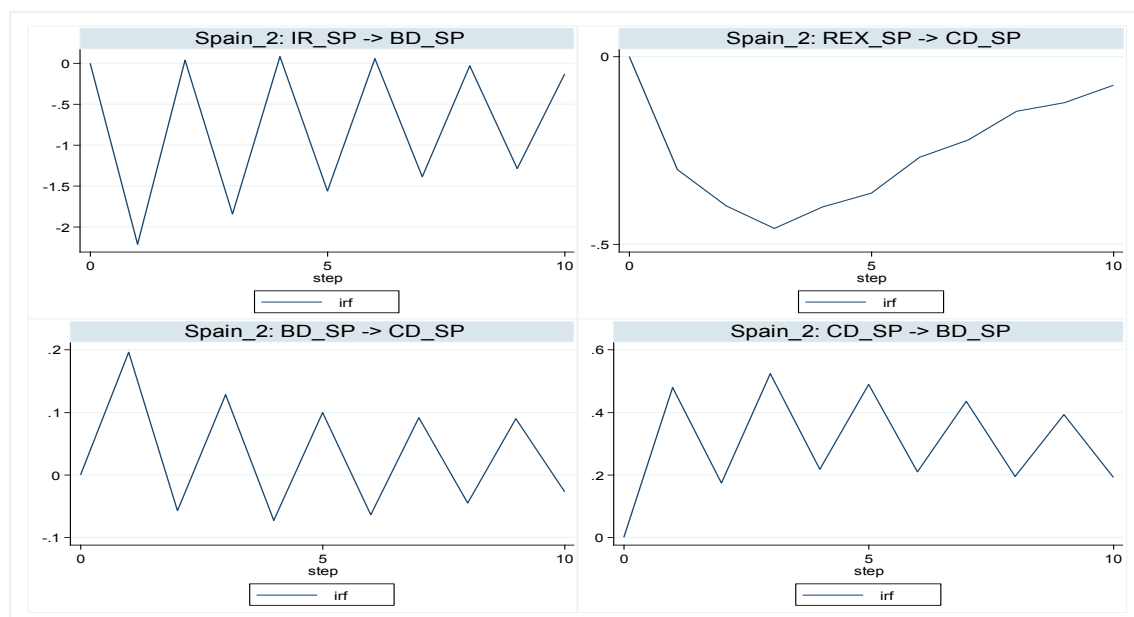
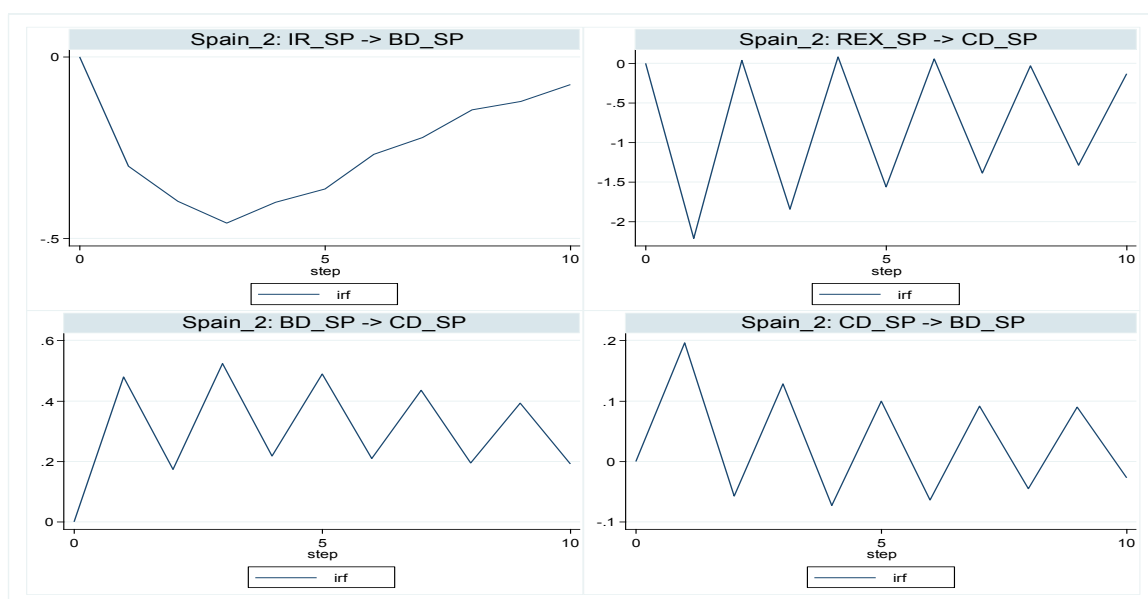


Figure 6.14: Impulse Responses: Spain-(2010Q1-2015Q4)-IR-REX-BD-CD



Tables 3.13 and 3.14 show that the contribution of current account and budget account to budget account and current account respectively is very low (less than 20%). The results show that the effect of real interest rates shock on budget account is very low (less than 15%). The effect of REX shock on current account seems to be large (38,73% in Table 3.14 and 24,17% in Tables 3M and 3N). This result implies that real exchange rates might fluctuate exogenously even when there is a fiscal policy change.

Table 3.13:FEVD (percent of variation in BD and in CD)-SPAIN-(2010Q1-2015Q4)-IR-REX-CD-BD

Horizon		IR	EX	CD	BD
5 quarters	CD	1,47%	8,95%	88,46%	4,12%
	BD	11,89%	0,37%	12,40%	75,34%
10 quarters	CD	7,40%	10,63%	76,94%	5,04%
	BD	13,62%	0,32%	13,88%	72,19%

Table 3.14:FEVD (percent of variation in BD and in CD)-SPAIN-(2010Q1-2015Q4)-IR-REX-BD-CD

Horizon		IR	EX	BD	CD
5 quarters	BD	1,27%	3,06%	93,65%	2,03%
	CD	0,23%	36,21%	13,69%	49,87%
10 quarters	BD	1,56%	20,17%	76,03%	2,25%
	CD	0,20%	38,73%	16,16%	44,95%

Figures 6.15 and 6.16 show in the low left and right panels that the effect of current account and budget account shocks on budget account and current account respectively is not interpretable, since the different ordering of CD-BD gives totally different results.

Upper left panels show that in response to a shock that increases real interest rates, budget account decreases. At this point it should be mentioned that an increase of real interest rates is expected to increase the budget deficit of general government since real interest rates are highly increased in the time period 2010- 2015¹. Upper right panel shows that an appreciation of real exchange rates, increases current account deficit. Figures 6O and 6P present similar results.

¹ Budget account of general government also includes the interest payments of government bonds.

Figure 6.15: Impulse Responses: Italy-(2010Q1-2015Q4)-IR-REX-CD-BD

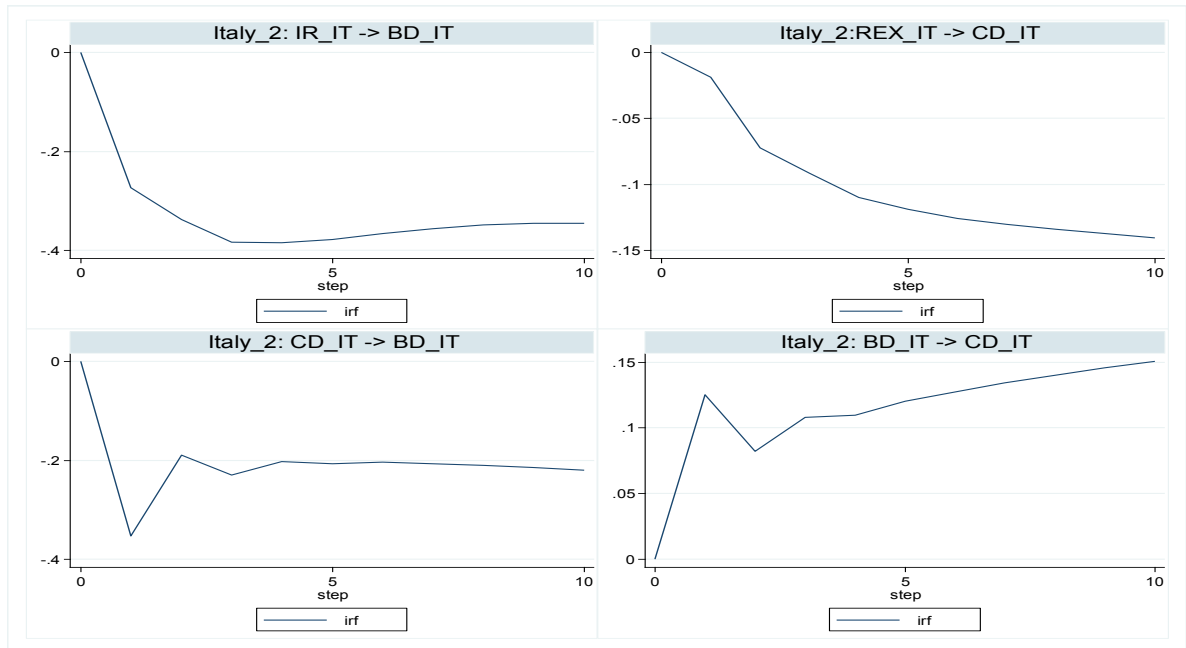
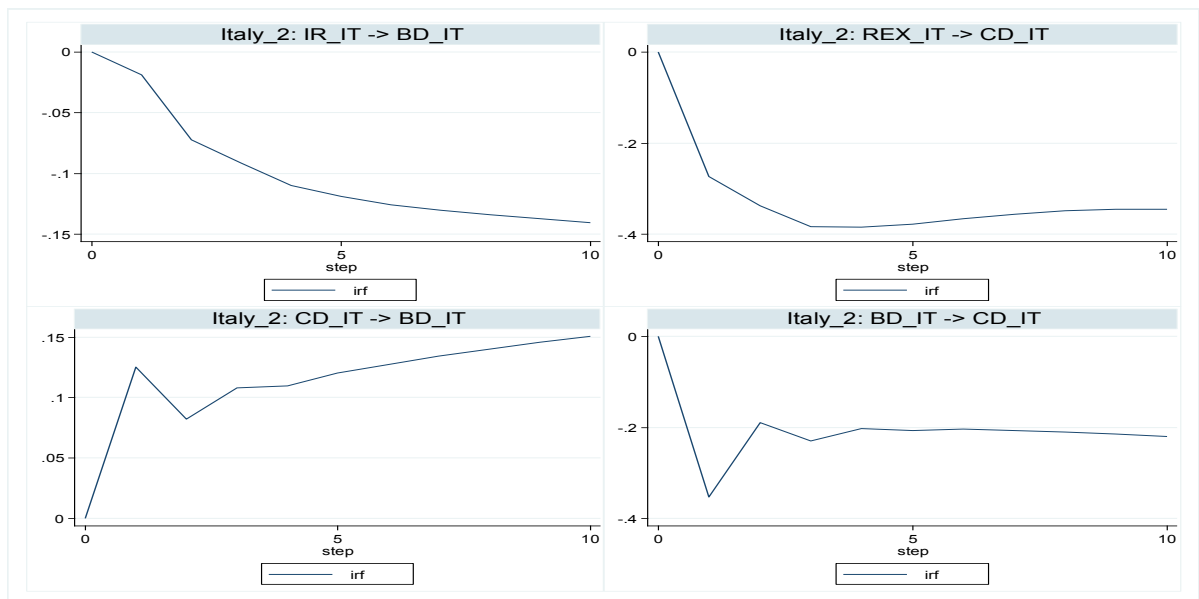


Figure 6.16: Impulse Responses: Italy (2010Q1-2015Q4)-IR-REX-BD-CD



Tables 3.15 and 3.16 show that the effect of current account shock on budget account and the effect of budget account shock on current account changes according to the ordering of CD-BD variables. Because of that, the effect is not interpretable. The effect of real interest rates shock on budget account is extremely low (less than 5%)

and the effect of real exchange rates shock on current account is also very low (less than 15% in all specifications). Tables 3O and 3P show similar results.

Table 3.15:FEVD (percent of variation in BD and in CD)-ITALY-(2010Q1-2015Q4)-IR-REX-CD-BD

Horizon		IR	EX	CD	BD
5 quarters	CD	2,66%	7,24%	89,28%	0,81%
	BD	1,70%	2,39%	60,54%	35,37%
10 quarters	CD	2,60%	9,55%	85,59%	2,27%
	BD	1,72%	13,93%	49,30%	35,05%

Table 3.16:FEVD (percent of variation in BD and in CD)-ITALY-(2010Q1-2015Q4)-IR-REX-BD-CD

Horizon		IR	EX	BD	CD
5 quarters	BD	2,60%	3,68%	92,74%	0,99%
	CD	1,37%	5,24%	59,84%	33,55%
10 quarters	BD	2,73%	3,91%	90,56%	2,80%
	CD	1,80%	6,79%	54,75%	36,66%

7. Summary of the Results

Impulse responses' results indicate about Greece that a current account deficit clearly leads to a budget deficit. In the cases of Portugal and Italy, the results show that a current account deficit leads to a budget deficit and vice versa. Most of the impulse responses' results about Spain imply that there is no systematic causal relationship between current account and budget account. The only exception about Spain is in the first period and this result supports that budget deficit causes a current account surplus. This is definitely an "odd" result.

The FEVD results imply about the causal relationship between current account and budget account in the case of Greece in the first period that budget account has a causal impact on current account. In addition to that, Spain's results in the first period show that budget account has a causal effect on current account. Except of the above indications, in general the results don't suggest a systematic causal relationship between current account and budget account.

In general, there is no strong evidence that the hypothesis that an increase of real interest rates causes an increase of budget account, holds (Nikiforos et al., 2015), since many results suggest the opposite effect. There are only some indications in the first period about Greece that real interest rates might have a causal effect on budget account. There are also some strong indications in the case of Spain that real interest rates have a causal effect on budget account in the first time period. Nevertheless, the effect of real interest rates on budget account seems to be low.

The effect of real exchange rates on current account is negative. Thus, the results clearly show that an appreciation of real exchange rates leads to a deterioration of current account. Italy's FEVD results in the first period indicate that there is a large effect of real exchange rates on current account (27,83%) in the third and fourth specifications. There are similar results about Greece and Spain in the second period. However, in general the effect of real exchange rates on current account seems to be low.

We should mention that the ordering of current account and budget account appears to be important only in some cases like FEVD results of Greece in the first period and FEVD and impulse responses results of Italy in the second period.

8. Conclusions

This study focuses on the "twin deficit" issue and it tries to estimate the causality between current account deficit and budget deficit of Greece, Portugal, Italy and Spain during the time period 1999-2015. The analysis begins by observing the fluctuations and changes of some important stylized facts during the time period 1999-2015. The first conclusion is that there is definitely a divergence between Southern countries (Greece, Portugal, Italy and Spain) and Northern countries (Germany and Netherlands) in Eurozone. In order to test the "twin deficits" about Southern countries, two different methods are used, Granger-causality tests and VAR modeling. Granger-causality test refers to the whole time period 1999-2015.

The preliminary results of Granger-causality tests don't give us a clear image of the causal relationship between current account deficit and budget deficit. VAR modeling uses innovation accounting for the analysis which contains two empirical tools, Impulse Responses and Forecast Error Variance Decomposition. In order to avoid the

"unstable" results of Granger-Causality tests, the sample is divided into two different time periods: 1999-2009 and 2010-2015.

The results of VAR model analysis suggest that there is no systematic causal relationship between current account deficit and budget deficit. There are only some indications in some particular cases (Greece and Spain in the first time period) that budget deficit probably has a significant causal impact to current account deficit.

Except of this main finding, we find that the effect of real interest rates of government bonds on budget deficit is weak. We also find that the appreciation of real exchange rates (either based on prices or labor cost) on current account is negative, but low.

In conclusion, there is no evidence which supports that current account deficit causes budget deficit or vice versa. Moreover, in contrast to previous study (Sanchez and Varoudakis, 2013), there is no evidence that low real interest rates cause higher budget deficits. Finally, there is no evidence that the different levels of price and labor cost competitiveness between Southern and Northern countries cause the increase of current account deficits. This result also differs from the result of previous study (Arghyrou et al., 2008).

One potential drawback of this analysis is the difficulty of decomposing the current account deficit. There are many factors that intervene between the relationship of current account and budget account. These factors seem to vary over time and are dependent to fiscal policies and to macroeconomic policies in general. However, these factors are difficult to be detected in an empirical analysis. The complexity of the "twin deficits" prevents us from excluding safe conclusions about which of the two variables drives the other. Also, it is difficult to estimate the factors which led to the exacerbation of "twin deficits" after the introduction of Euro.

We know that austerity measures can decrease current account deficits, but "in the cost of higher unemployment and indebtedness", since austerity policies decrease GDP and they increase public debt as a percentage of GDP (Constantine, 2014). Thus, policy implications have to also be considered by a humanitarian perspective.

Since study's followed methodology has some serious limitations especially about the estimation of causality between current account deficits and budget deficits, further research could be valuable.

APPENDIX

Forecast Error Variance Decomposition Results

Table 3A:FEVD (percent of variation in BD and in CD)-GREECE-(2002Q1-2009Q4)-IR-REXL-CD-BD

Horizon		IR	EX	CD	BD
15 quarters	CD	8,81%	9,52%	73,56%	8,11%
	BD	18,78%	7,27%	26,01%	47,94%
20 quarters	CD	8,81%	9,52%	73,55%	8,12%
	BD	18,78%	7,27%	26,01%	47,94%

Table 3B:FEVD (percent of variation in BD and in CD)-GREECE-(2002Q1-2009Q4)-IR-REXL-BD-CD

Horizon		IR	EX	BD	CD
15 quarters	BD	18,78%	7,27%	66,44%	7,51%
	CD	8,81%	9,52%	27,65%	54,02%
20 quarters	BD	18,78%	7,27%	66,44%	7,51%
	CD	8,80%	9,52%	27,65%	54,02%

Table 3C:FEVD (percent of variation in BD and in CD)-PORTUGAL-(1999Q1-2009Q4)-IR-REXL-CD-BD

Horizon		IR	EX	CD	BD
15 quarters	CD	11,05%	12,78%	71,50%	4,67%
	BD	9,89%	1,88%	2,98%	85,24%
20 quarters	CD	13,86%	12,43%	69,12%	4,59%
	BD	9,95%	1,88%	2,98%	85,19%

Table 3D:FEVD (percent of variation in BD and in CD)-PORTUGAL-(1999Q1-2009Q4)-IR-REXL-BD-CD

Horizon		IR	EX	BD	CD
15 quarters	BD	55,96%	0,06%	43,98%	0%
	CD	78,27%	0,02%	19,86%	1,85%
20 quarters	BD	56,17%	0,06%	43,76%	0%
	CD	78,26%	0,02%	19,87%	1,85%

Table 3E:FEVD (percent of variation in BD and in CD)-SPAIN-(1999Q1-2009Q4)-IR-REXL-CD-BD

Horizon		IR	EX	CD	BD
15 quarters	CD	47,78%	2,46%	16,57%	33,19%
	BD	31,99%	10,00%	22,93%	35,07%
20 quarters	CD	51,04%	5,30%	14,21%	29,45%
	BD	29,50%	14,83%	21,46%	34,21%

Table 3F:FEVD (percent of variation in BD and in CD)-SPAIN-(1999Q1-2009Q4)-IR-REXL-BD-CD

Horizon		IR	EX	BD	CD
15 quarters	BD	32,00%	10,00%	52,52%	5,49%
	CD	47,78%	2,46%	42,54%	7,22%
20 quarters	BD	29,50%	14,83%	50,58%	5,09%
	CD	51,04%	5,30%	37,67%	5,99%

Table 3G:FEVD (percent of variation in BD and in CD)-ITALY-(1999Q1-2009Q4)-IR-REXL-CD-BD

Horizon		IR	EX	BD	CD
15 quarters	CD	11,92%	24,23%	51,33%	12,52%
	BD	15,17%	3,22%	15,07%	66,54%
20 quarters	CD	12,10%	27,83%	48,27%	11,79%
	BD	15,18%	3,74%	14,98%	66,10%

Table 3H:FEVD (percent of variation in BD and in CD)-ITALY-(1999Q1-2009Q4)-IR-REXL-BD-CD

Horizon		IR	EX	BD	CD
15 quarters	BD	15,17	3,22%	66,82%	14,79%
	CD	11,92%	24,23%	15,05%	48,80%
20 quarters	BD	15,18	3,74%	66,38%	14,70%
	CD	12,10%	27,83%	14,17%	45,90%

Table 3I:FEVD (percent of variation in BD and in CD)-GREECE-(2010Q1-2015Q4)-IR-REXL-CD-BD

Horizon		IR	EX	CD	BD
5 quarters	CD	3,41%	12,35%	75,35%	8,90%
	BD	0,24%	1,80%	8,21%	89,76%
10 quarters	CD	6,27%	16,07%	69,36%	8,31%
	BD	0,40%	2,81%	8,16%	88,63%

Table 3J:FEVD (percent of variation in BD and in CD)-GREECE-(2010Q1-2015Q4)-IR-REXL-BD-CD

Horizon		IR	EX	BD	CD
5 quarters	BD	0,24%	1,80%	96,37%	1,59%
	CD	3,41%	12,35%	15,97%	68,28%
10 quarters	BD	0,40%	2,81%	95,17%	1,62%
	CD	6,27%	16,07%	14,91%	62,76%

Table 3K:FEVD (percent of variation in BD and in CD)-PORTUGAL-(2010Q1-2015Q4)-IR-REXL-CD-BD

Horizon		IR	EX	CD	BD
5 quarters	CD	5,84%	12,11%	88,94%	3,14%
	BD	3,02%	4,91%	20,20%	61,85%
10 quarters	CD	39,20%	12,51%	47,61%	0,69%
	BD	13,35%	19,45%	16,42%	68,29%

Table 3L:FEVD (percent of variation in BD and in CD)-PORTUGAL-(2010Q1-2015Q4)-IR-REXL-BD-CD

Horizon		IR	EX	BD	CD
5 quarters	BD	3,02%	4,91%	88,94%	3,14%
	CD	5,84%	12,11%	20,20%	61,85%
10 quarters	BD	13,35%	1,95%	82,35%	2,35%
	CD	39,20%	12,51%	6,54%	41,75%

Table 3M:FEVD (percent of variation in BD and in CD)-SPAIN-(2010Q1-2015Q4)-IR-REXL-CD-BD

Horizon		IR	EX	CD	BD
5 quarters	CD	2,06%	17,74%	74,88%	5,33%
	BD	9,58%	2,69%	8,91%	78,82%
10 quarters	CD	9,67%	24,17%	60,05%	6,11%
	BD	12,17%	3,36%	8,98%	75,49%

Table 3N:FEVD (percent of variation in BD and in CD)-SPAIN-(2010Q1-2015Q4)-IR-REXL-BD-CD

Horizon		IR	EX	BD	CD
5 quarters	BD	9,58%	2,69%	81,82%	5,91%
	CD	2,06%	17,74%	16,17%	64,03%
10 quarters	BD	12,17%	3,36%	76,85%	7,62%
	CD	9,67%	24,17%	15,00%	51,15%

Table 3O:FEVD (percent of variation in BD and in CD)-ITALY-(2010Q1-2015Q4)-IR-REXL-CD-BD

Horizon		IR	EX	CD	BD
5 quarters	CD	0,91%	0,95%	96,76%	1,38%
	BD	3,71%	3,51%	70,00%	22,72%
10 quarters	CD	1,06%	1,16%	96,04%	1,74%
	BD	3,61%	3,62%	70,74%	22,03%

Table 3P:FEVD (percent of variation in BD and in CD)-ITALY-(2010Q1-2015Q4)-IR-REXL-BD-CD

Horizon		IR	EX	BD	CD
5 quarters	BD	3,71%	19,02%	75,62%	1,65%
	CD	15,63%	3,62%	71,54%	23,28%
10 quarters	BD	3,44%	30,48%	64,28%	1,80%
	CD	1,59%	5,82%	70,24%	22,35%

Impulse Responses

Figure 6A:Impulse Responses: Greece- (2002Q1-2009Q4)-IR-REXL-CD-BD

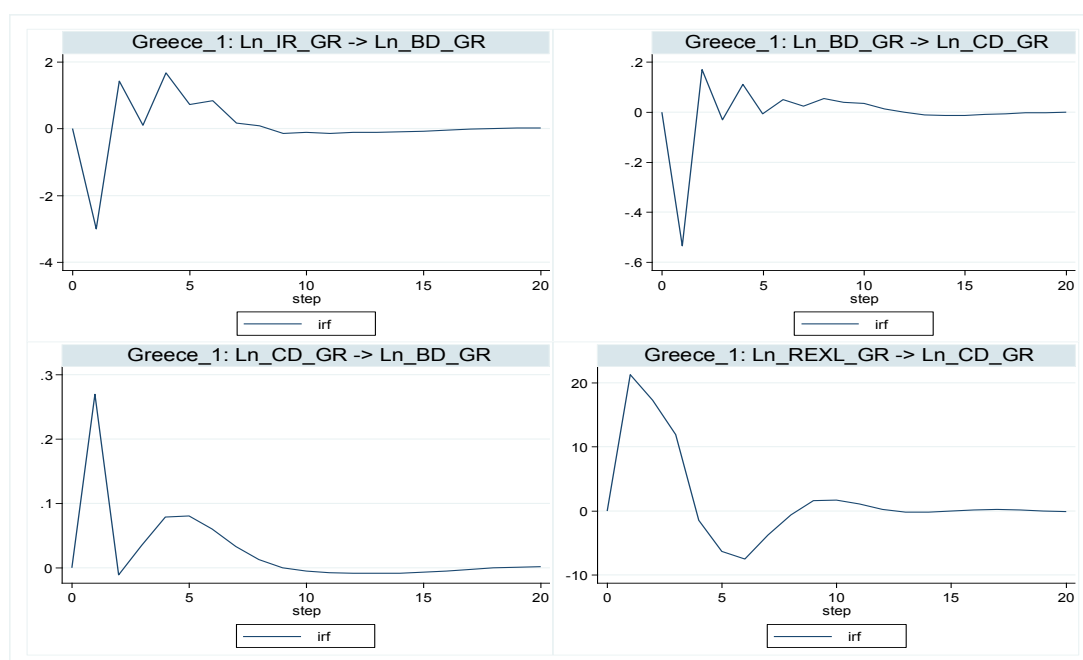


Figure 6B: Impulse Responses: Greece-(2002Q1-2009Q4)-IR-REXL-BD-CD

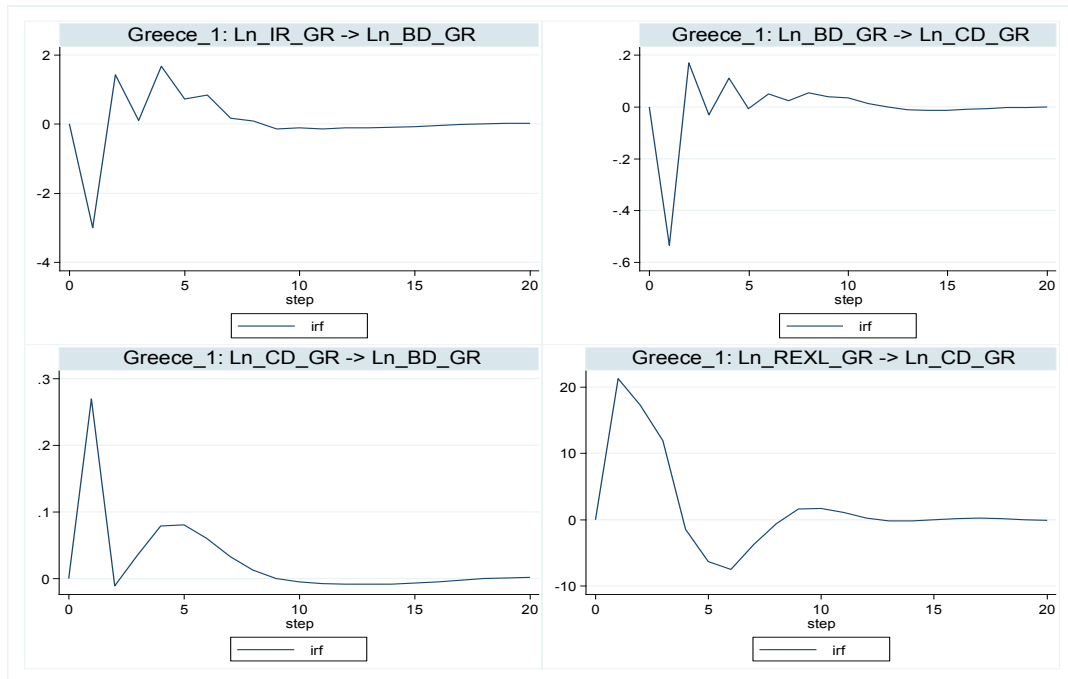


Figure 6C: Impulse Responses: Portugal-(1999Q1-2009Q4)-IR-REXL-CD-BD

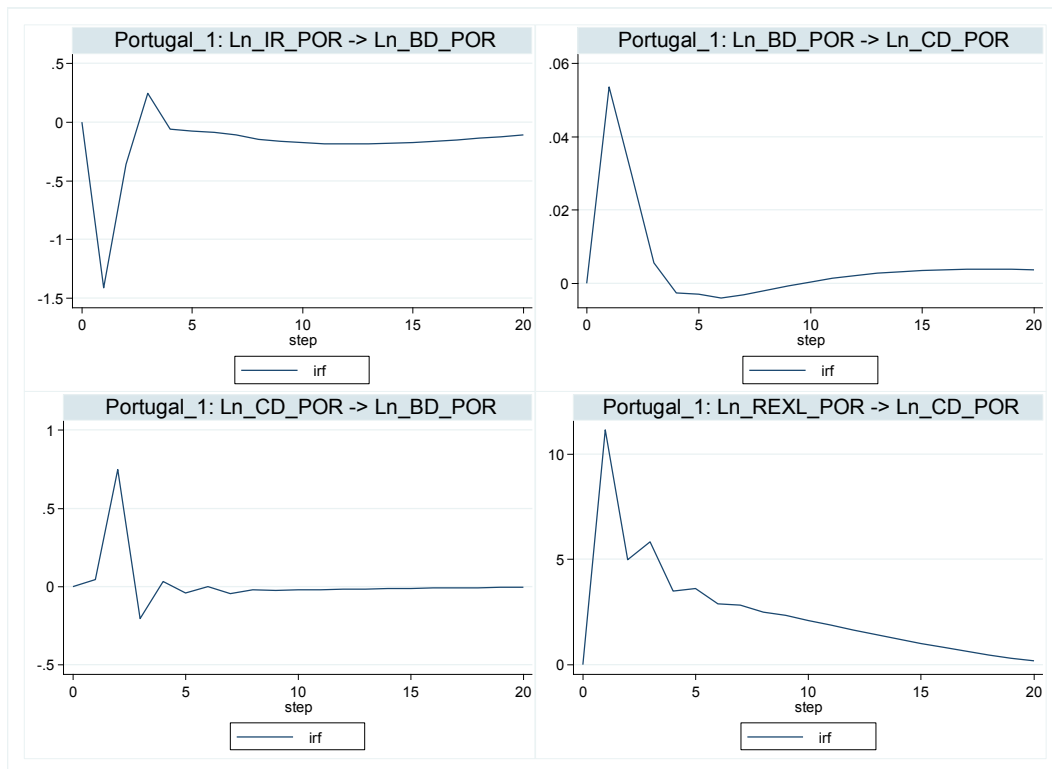


Figure 6D: Impulse Responses: Portugal-(1999Q1-2009Q4)-IR-REXL-BD-CD

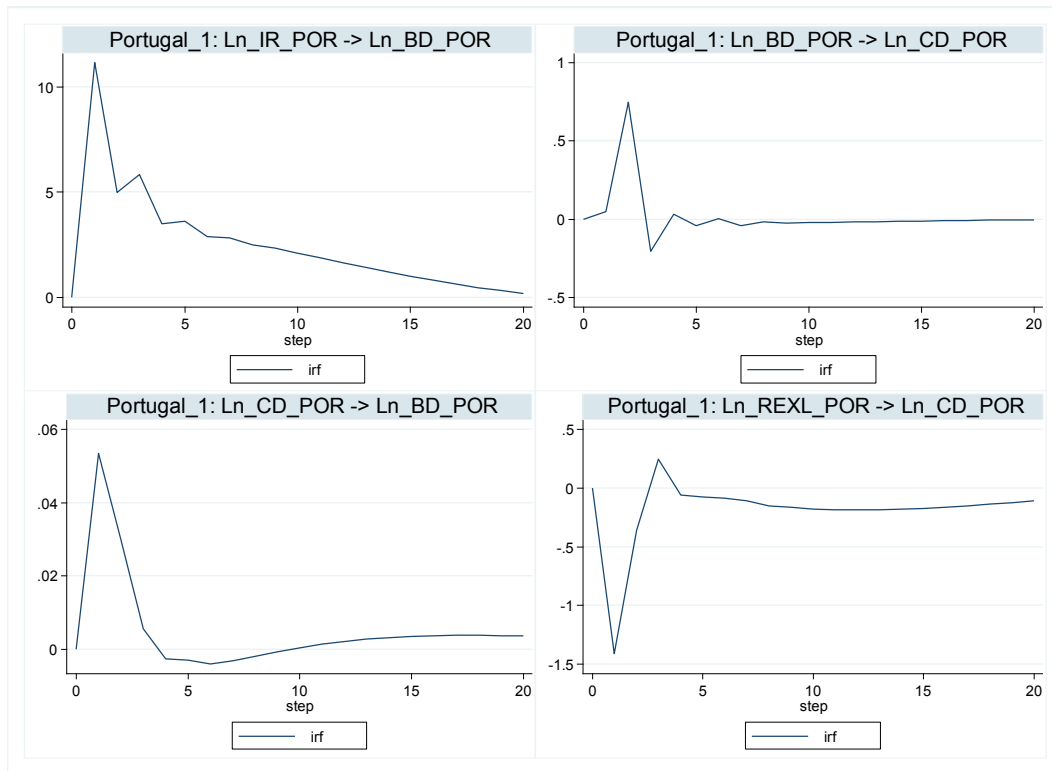


Figure 6E: Impulse Responses: Italy-(1999Q1-2009Q4)-IR-REXL-CD-BD

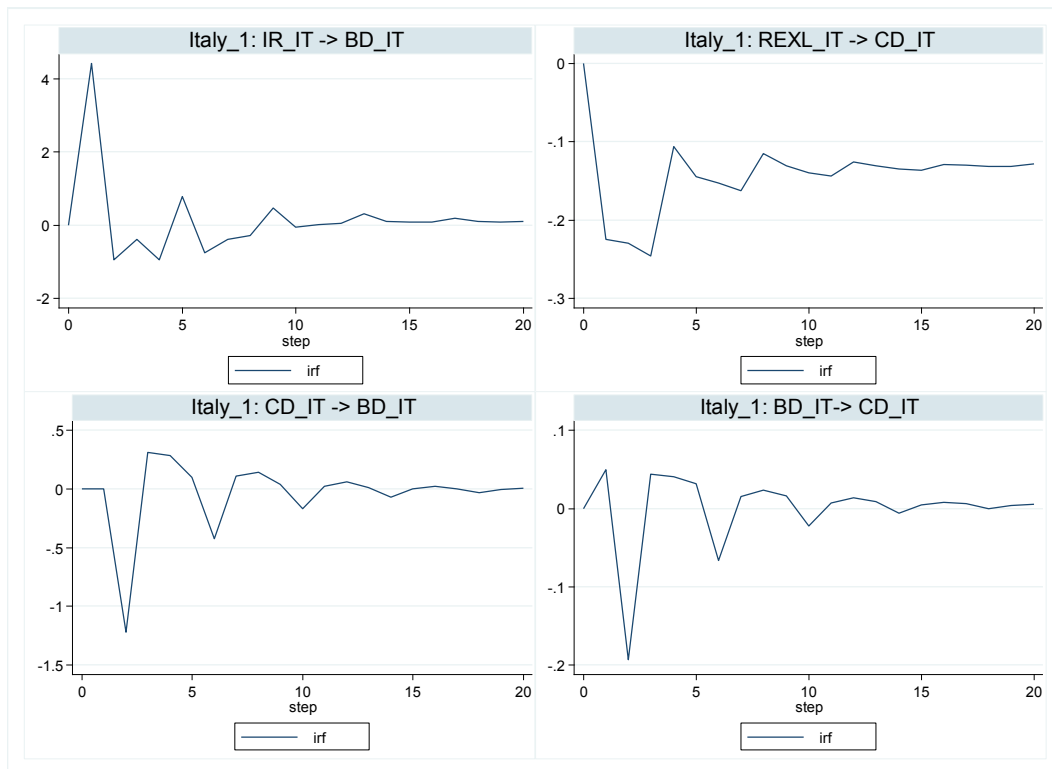


Figure 6F: Impulse Responses: Italy-(1999Q1-2009Q4)-IR-REXL-BD-CD

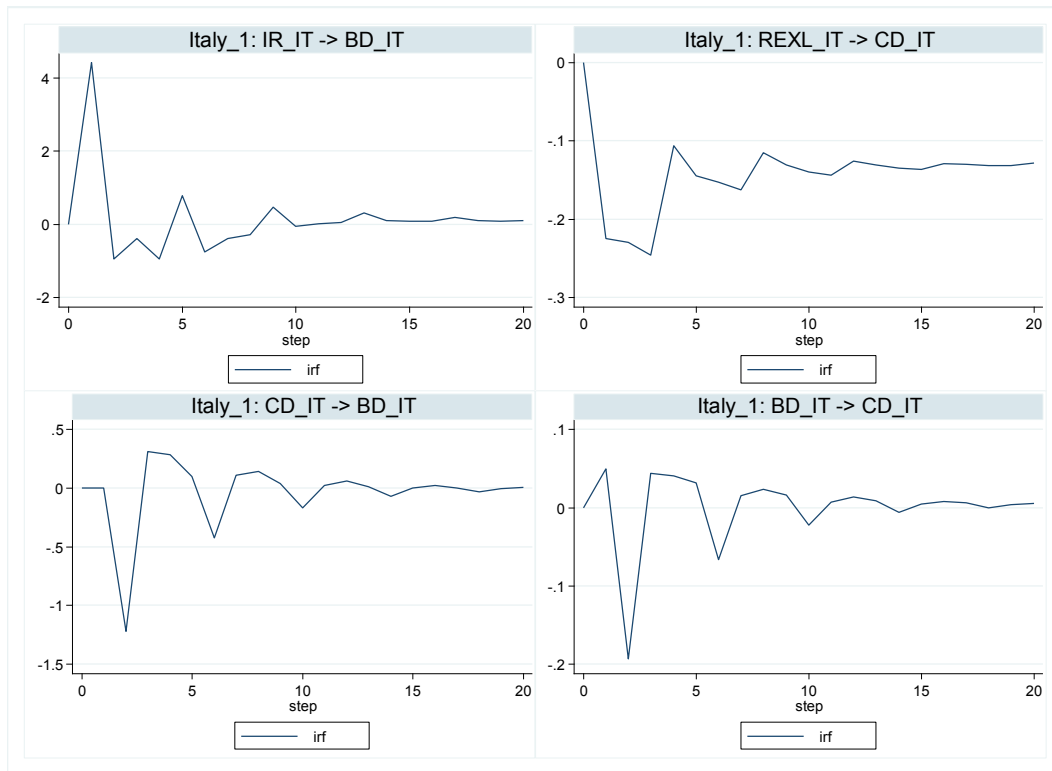


Figure 6G: Impulse Responses: Spain (1999Q1-2009Q4)-IR-REXL-CD-BD

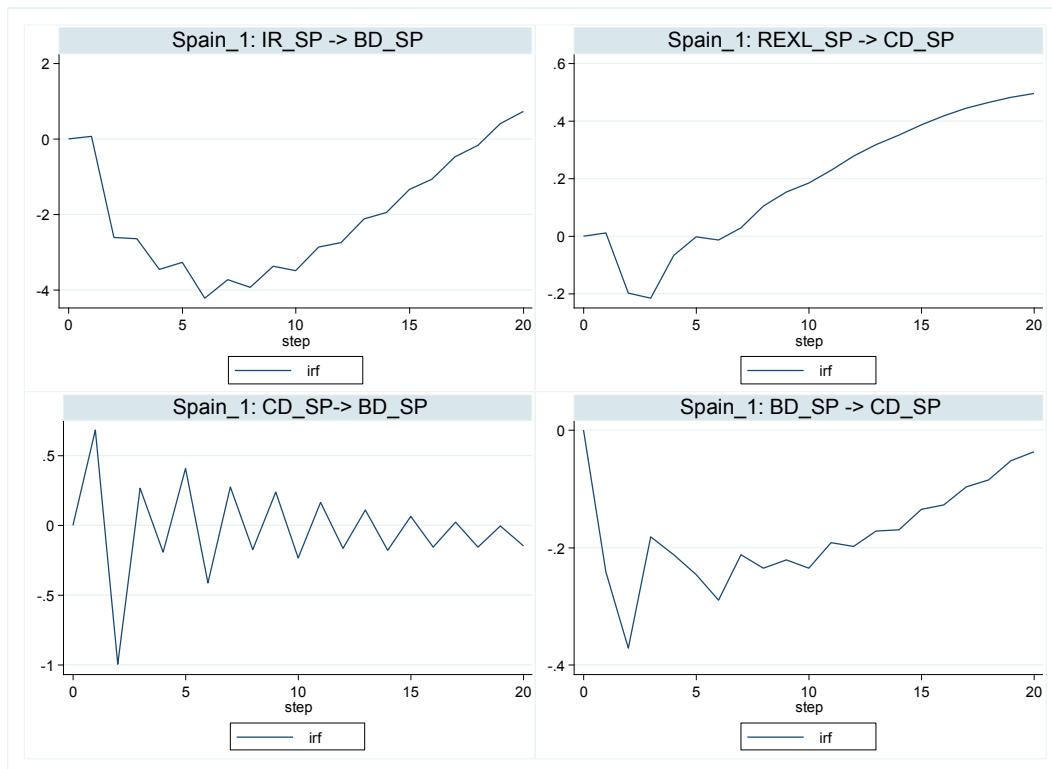


Figure 6H: Impulse Responses: Spain (1999Q1-2009Q4)-IR-REXL-BD-CD

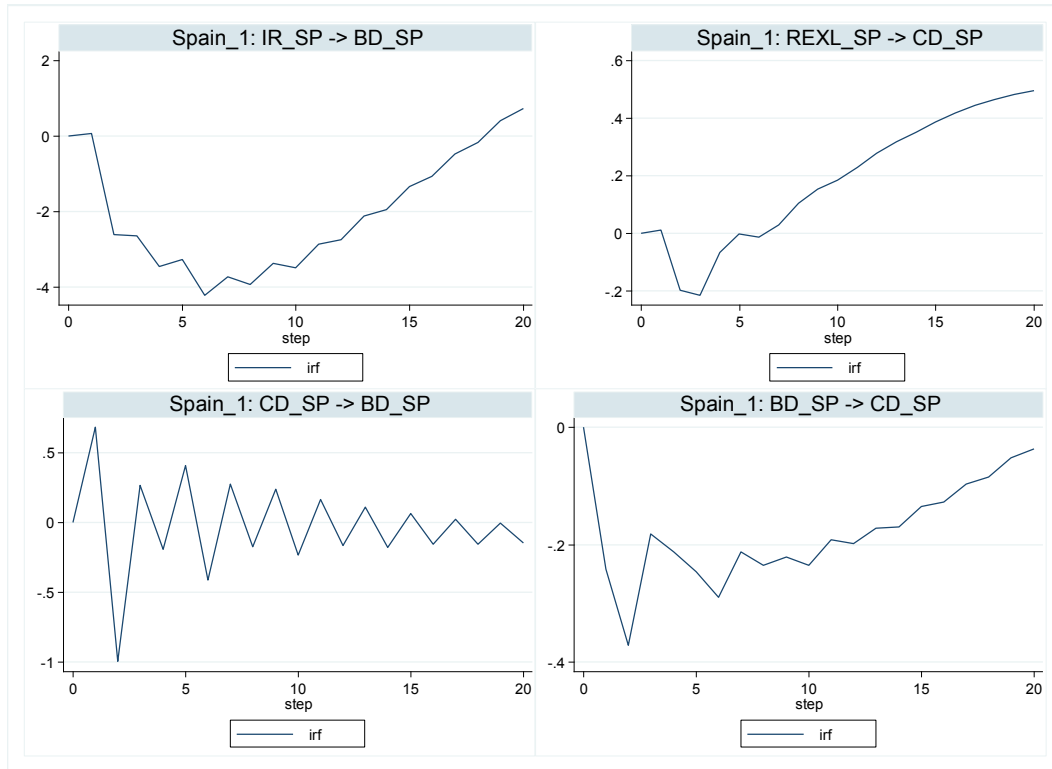


Figure 6I: Impulse Responses: Greece-(2010Q1-2015Q4)-IR-REXL-CD-BD

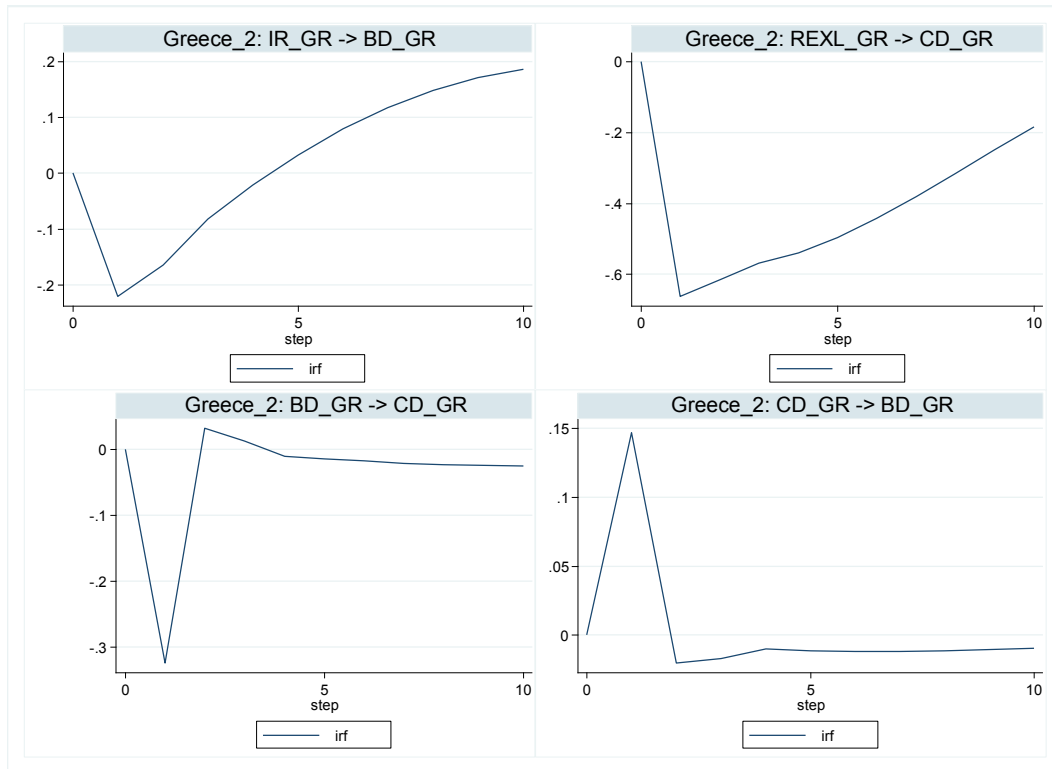


Figure 6J: Impulse Responses: Greece-(2010Q1-2015Q4)-IR-REXL-BD-CD

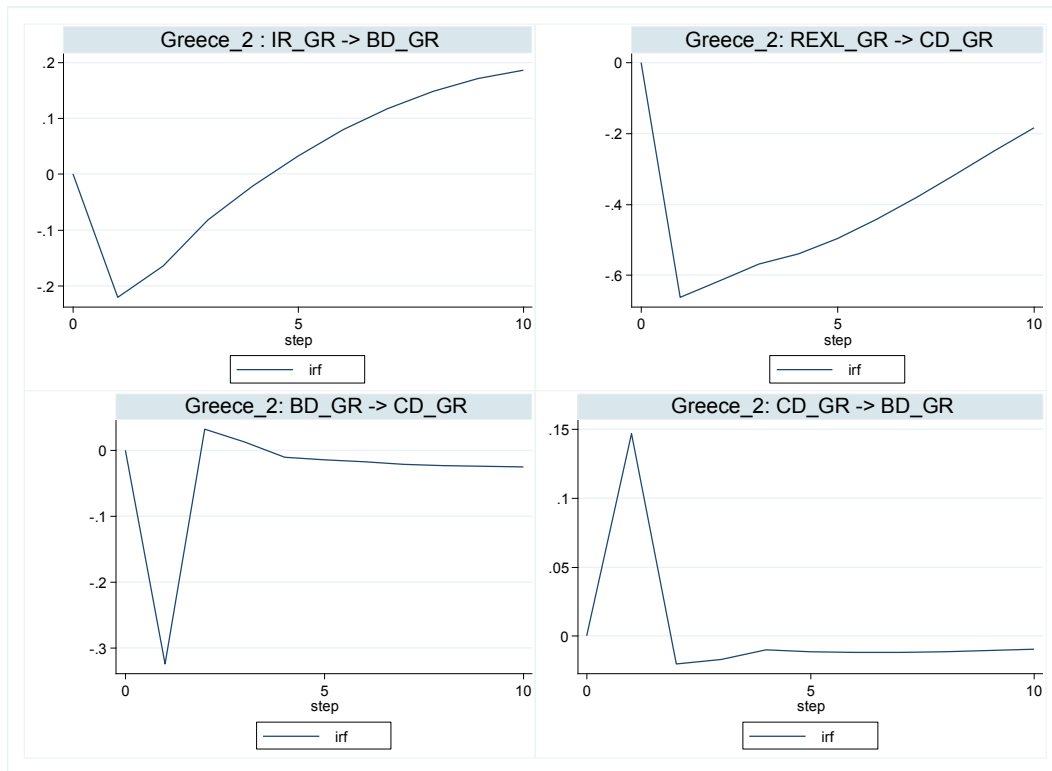


Figure 6K: Impulse Responses: Portugal-(2010Q1-2015Q4)-IR-REXL-CD-BD

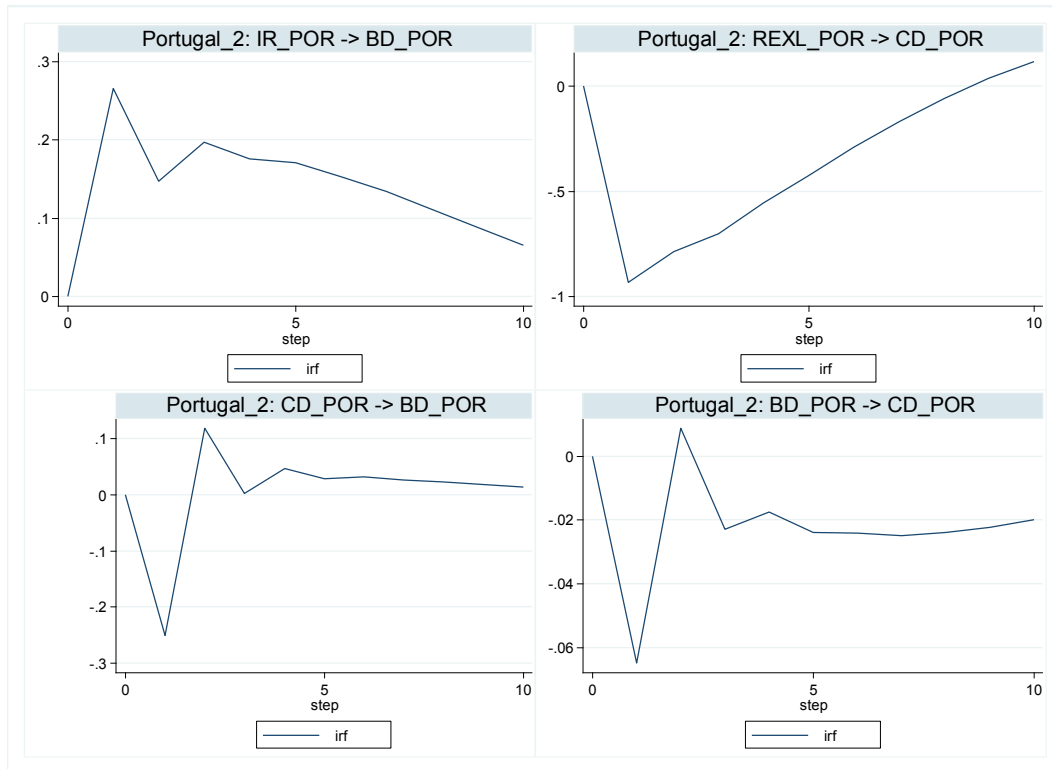


Figure 6L: Impulse Responses: Portugal-(2010Q1-2015Q4)-IR-REXL-BD-CD

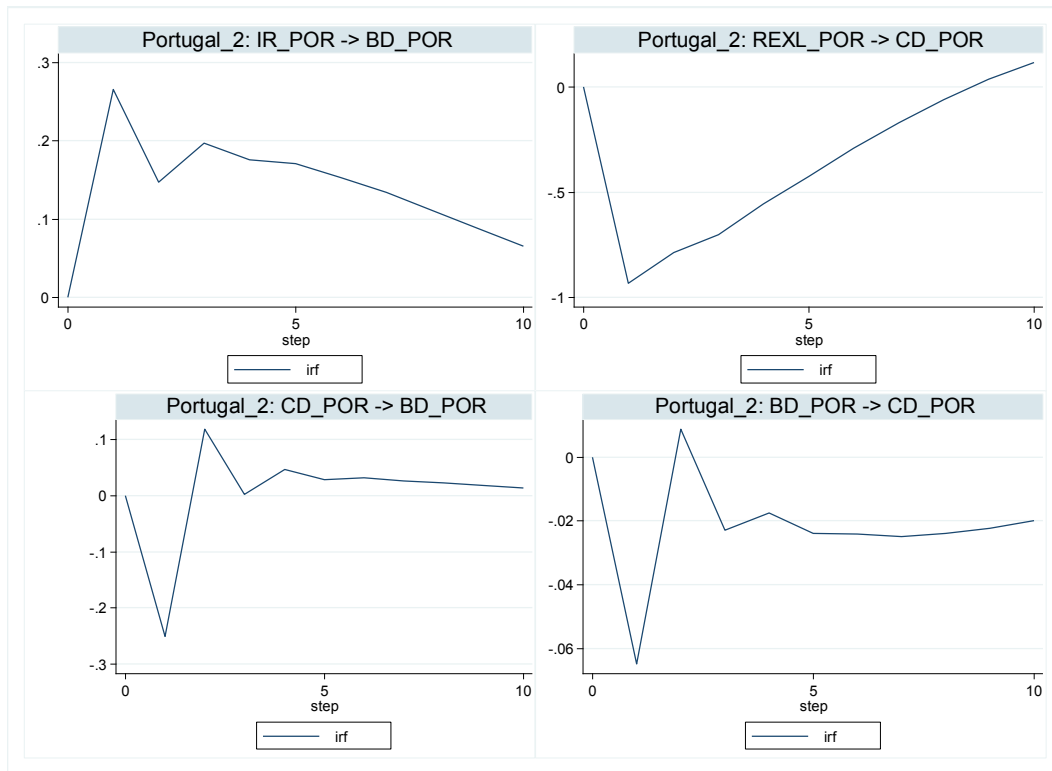


Figure 6M: Impulse Responses: Spain-(2010Q1-2015Q4)-IR-REXL-CD-BD

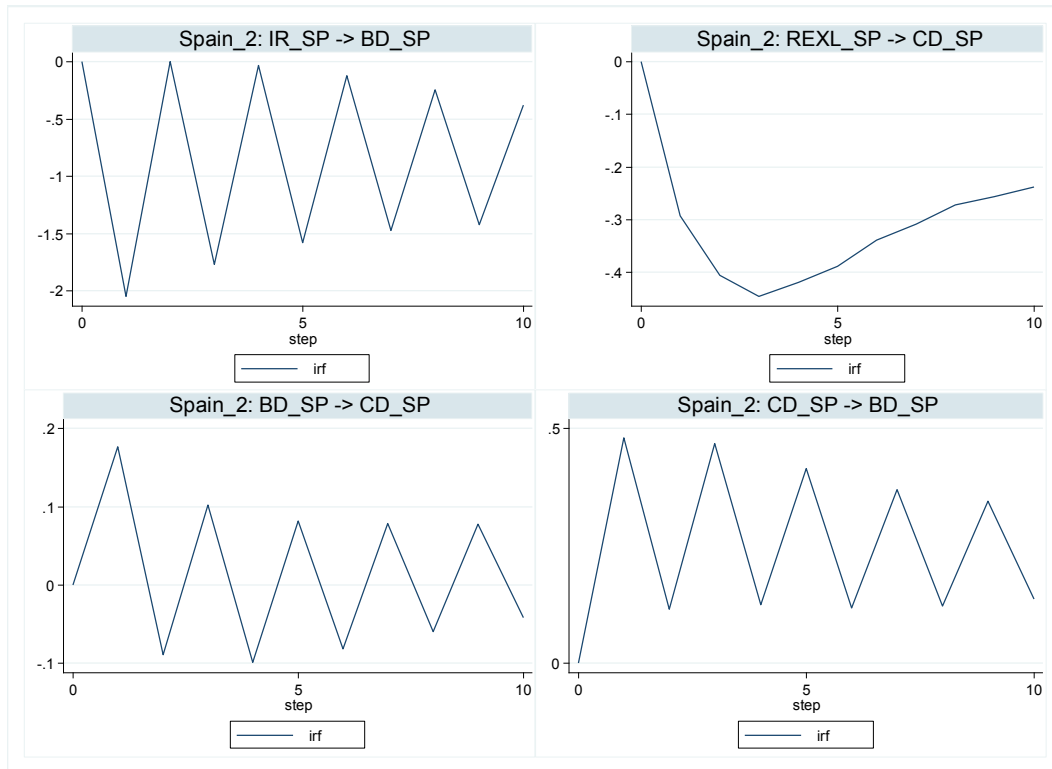


Figure 6N: Impulse Responses: Spain-(2010Q1-2015Q4)-IR-REXL-BD-CD

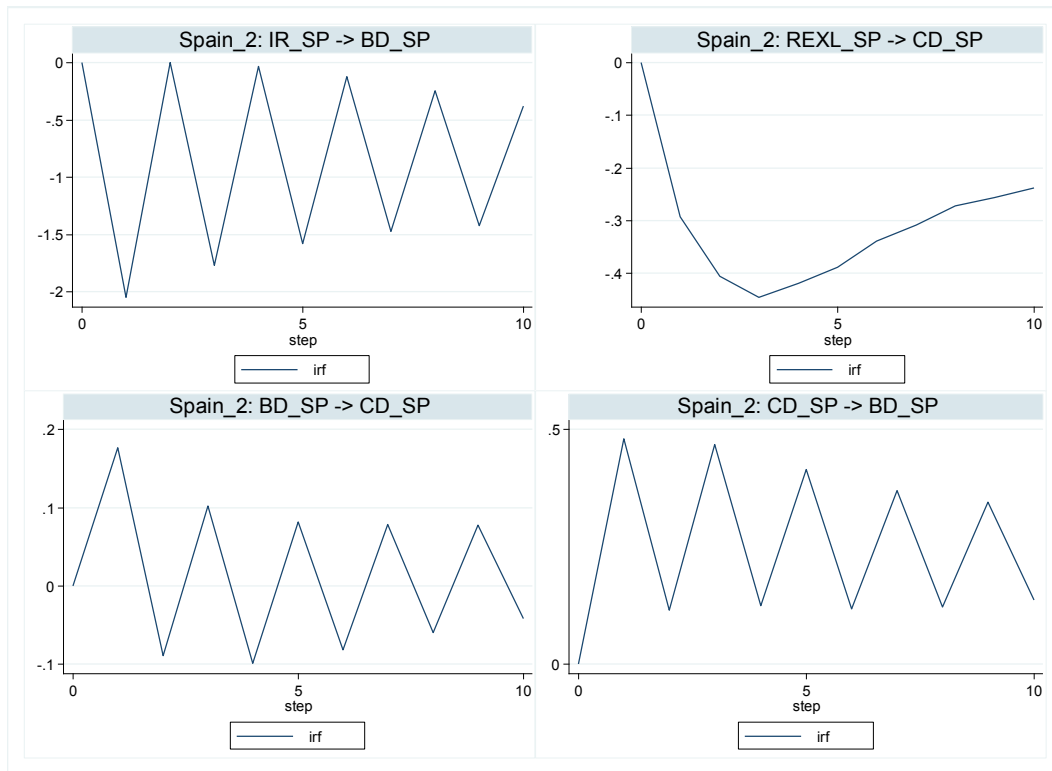


Figure 6O: Impulse Responses: Italy-(2010Q1-2015Q4)-IR-REXL-CD-BD

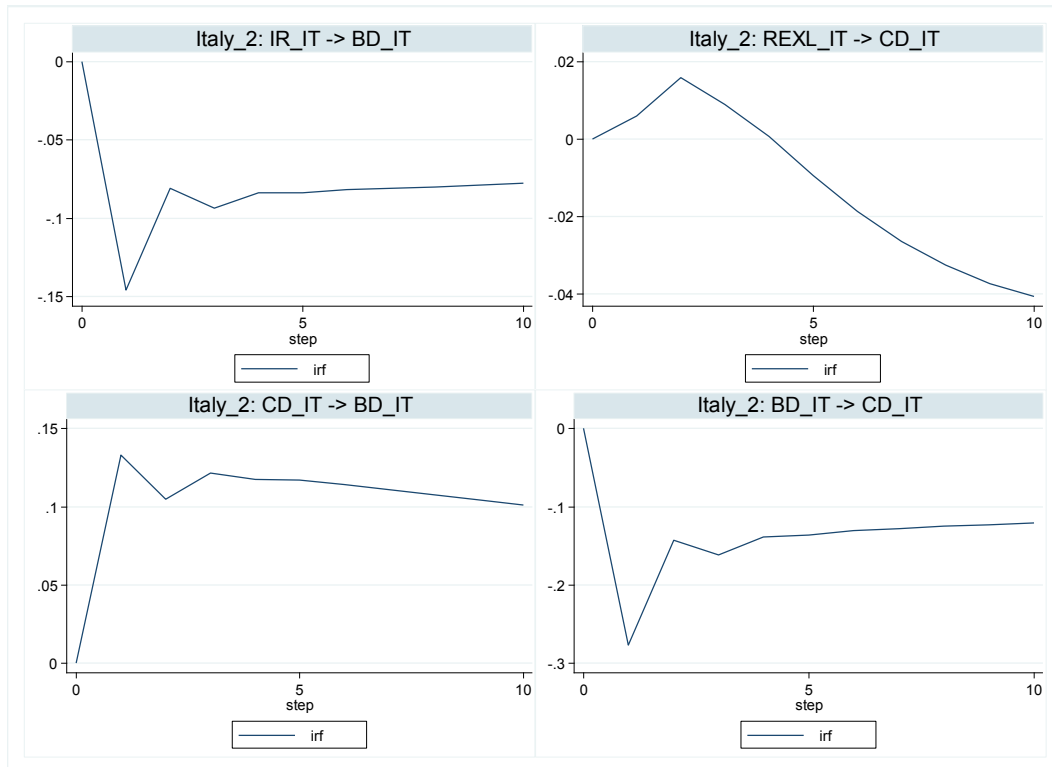
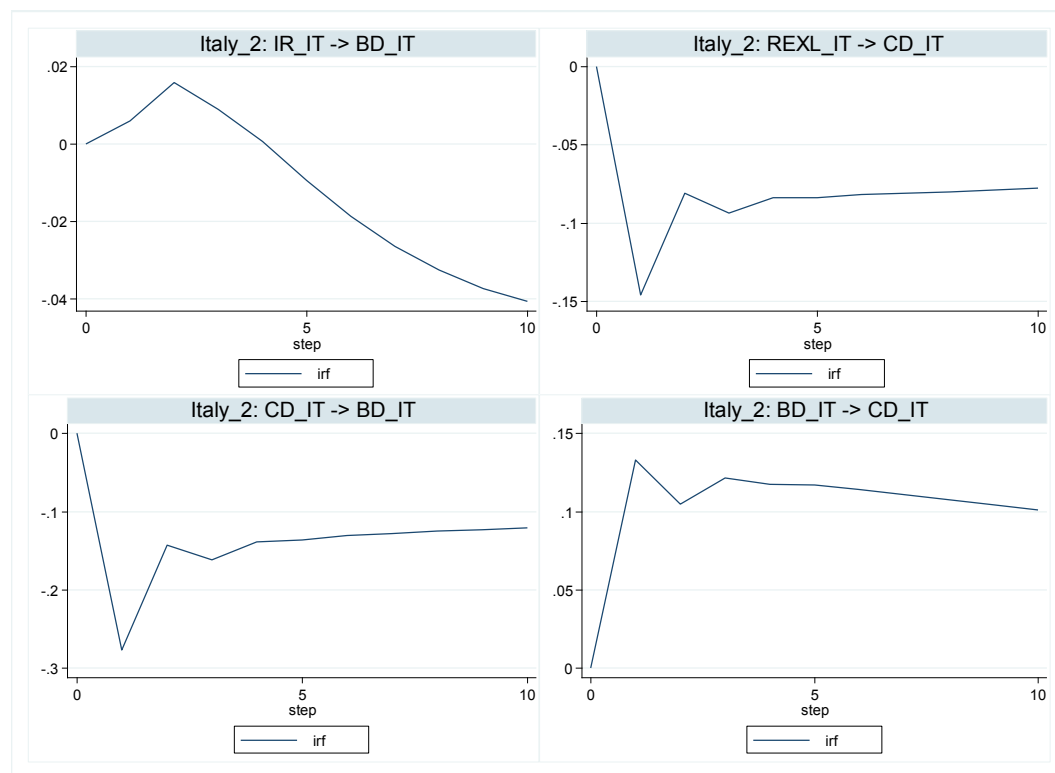


Figure 6P: Impulse Responses: Italy-(2010Q1-2015Q4)-IR-REXL-BD-CD



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