STOCKHOLM SCHOOL OF ECONOMICS
Department of Economics
5350 Master's thesis in economics
Academic year 2014–2015

What Drives Current Account and Trade Balances in Euro Area Periphery Countries?

A Structural VAR Analysis for Greece, Portugal and Spain.

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Abstract

In the years before the Great Recession of 2008–2009 large current account deficits emerged in some countries of the euro area periphery. As a consequence, sizeable net foreign debt positions were accumulated, which contributed to the outbreak of the European Sovereign Debt Crisis (Lane and Milesi-Ferretti 2011). While external balances in Greece, Ireland, Italy, Portugal and Spain were restored in recent years, much research effort has been devoted to determine the underlying reasons of these developments. After identifying trade balance changes as the most important driver of current account balances in the euro area periphery, this thesis enhances the existing literature by determining the importance of demand and price competitiveness factors for the net exports of Greece, Portugal and Spain in a structural VAR framework. The main conclusion from analysing impulse response functions and from employing a forward error variance decomposition is that domestic demand is the most important driver of trade balance changes. While price competitiveness matters to a smaller extend as well, over the full sample period foreign demand does not have a significant effect on net exports. These results are robust to different model specifications. Last, by studying subsamples of the baseline data period, some indicative conclusions are drawn on the determinants of net exports in the time before and after the Great Recession for Spain and Portugal.

Keywords: current account, trade balance, euro area periphery, price competitiveness, domestic demand, structural VAR

JEL Classification: C32, F32, F41, F45

Supervisor:	Jesper Lindé
Date submitted:	14 May 2015
Date examined:	27 May 2015
Discussant:	Magnus Klingspor
Examiner:	Kelly Ragan

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1 Introduction

Before the Great Recession of 2008–2009 countries of the euro area periphery, in particular Greece, Ireland, Italy, Portugal and Spain, faced increasing current account deficits. As a consequence, their net foreign debt rose steadily, which eventually contributed to the outbreak of the European Sovereign Debt Crisis (Lane and Milesi-Ferretti 2011). While in the course of deep recessions in the euro area periphery in some cases domestic demand fell substantially in real terms, in recent years trade and current accounts were restored to being close to zero or above. Since current account surpluses improve upon the position of net foreign assets, European institutions, researchers and policy makers alike have stressed the importance for periphery countries to improve external competitiveness. Ongoing struggles of the Greek government to finance its government expenditures in the first quarter of 2015 illustrate the timeliness of the need for appropriate policies which can help to reduce foreign debt by sustainably improving the trade balance.

With the European Sovereign Debt Crisis a large body of literature has evolved on the divergence of external positions between so-called core countries and the periphery of the euro zone (see, for instance, Belke and Dreger 2013, Chen et al. 2013, Wyplosz 2013, Sinn 2014).[1] Regarding explanations for the current account balance development in euro area periphery countries, a consensus has emerged that reduced sovereign risk premiums, a substantial fall in nominal interest rates and increased foreign debt in the course of the financial integration were the main trigger of the emergence of external deficits (Jaumotte and Sodsriwiboon 2010, De Grauwe 2013 and Gibson et al. 2014).[2] However, there has been disagreement about the subsequent channels of how reduced borrowing costs translated into negative trade and current account positions. There are broadly two competing explanations in the literature: the initially more orthodox view is that deteriorated price and cost competitiveness caused current accounts to diverge (see for instance, Flassbeck and Spiecker 2011 and Sinn 2014). Austerity policies and the attempt to reduce prices in so-called internal devaluations in periphery countries are influenced by this perspective. In contrast, several recent studies point at domestic demand booms to be the underlying cause of external deficits (see, for instance, Wyplosz 2013). In addition, also non-price competitiveness factors are put forward as explanations for the persistence of current account deficits, especially in Greece and Portugal (Boewer et al. 2014, Storm and Naastepad 2014).

In order to shed light on the emergence and subsequent recovery of external deficits in the periphery countries listed above, the first step of this thesis is to decompose current account developments into the relative contribution of its components. In this way, overall trade balance changes are identified as the main drivers of the current account balances in the euro area periphery countries. They explain almost all of the improvements since the crisis. However, in particular for Greece and Portugal also changes in the income and current transfers balance contributed to a considerable degree to the large and long-lasting external deficits.

Based on these findings, the principal aim of this paper is to further analyse the determinants of trade balance developments for Greece, Portugal and Spain. Whereas the previous literature has mostly employed

[1] Members of the euro area that are typically referred to as core countries are Austria, Finland, Germany and the Netherlands (Holinski et al. 2012).

[2] Eichengreen (2010) calls these current account deficits "bad", as they were driven by dis-saving and thus consumption booms instead of increased productivity-enhancing investment. Only the latter could have contributed to a sustainable catch-up growth.

reduced form models to study the behaviour of exports, imports and the trade balance in euro area periphery countries, in this context to the best of my knowledge no paper has yet studied the trade balance and its components in a structural VAR framework. The latter modelling approach is argued to be an improvement upon the existing literature, since it overcomes problems of reduced form regressions with reverse causality and omitted variables bias by treating all variables as endogenous. In particular, simultaneous relationships and feedback effects between the variables can be captured. Thus, this thesis contributes to the existing literature by using a structural VAR model to determine which of the explanatory variables foreign demand, domestic demand and price competitiveness, or which combination of them, can best explain trade balance changes in Greece, Portugal and Spain.

The main result from this econometric analysis using impulse response functions and a forward error variance decomposition is that across different specifications domestic demand is the most important determinant of trade balance movements in all three countries. While foreign demand is found to have no significant impact on the trade balance in the baseline model, price competitiveness measured by the real effective exchange rate matters significantly, but to a smaller extend than domestic demand for Portugal and Spain. In contrast, for Greece price competitiveness does not affect the trade balance significantly. In an extension of the model, impulse response analysis identifies the oil price as another determinant of net exports for Portugal and Spain. An examination of subsamples of the data further suggests that domestic demand was particularly important for the recovery of the trade and thus the current account balance during and after the Great Recession.

This thesis is organised as follows. To begin with, section 2 provides a descriptive analysis of current account and trade balance developments for euro area periphery countries. Sections 3 and 4 present an overview of the related literature and the theoretical determinants of the trade balance, respectively. Thereafter, section 5 introduces the empirical model and the estimation procedure, which is followed by an analysis of the baseline results in section 6. In section 7 the results are checked for robustness and some variations and extensions of the model are studied. Section 8 provides a discussion of methodology and policy implications, before section 9 concludes.

2 Descriptive Analysis of Current Account Balances in the Euro Area Periphery

As a first step towards identifying the principal drivers of external balances in the euro area periphery countries Greece, Ireland, Italy, Portugal and Spain, I analyse the according current account balances and their components. The current account is defined as

$$CA = TB + NY + CT \tag{1}$$

where CA is the current account, TB stands for the trade balance of goods and services, NY is the income balance and CT denotes net current transfers.[3][4] Alternatively, the current account of an economy can also be written as the difference between savings S, and investment I.[5] This gives

$$CA = S - I \tag{2}$$

These expressions are two sides of the same coin. To illustrate this in an example, assume, for instance, consumption in a country increases by 10%, all else equal. On the one hand we would expect imports to increase, given a constant share of foreign goods in the consumption basket. This worsens the trade balance and thus the current account. If the additional 10% of consumption expenditures are financed by foreign debt, the current account worsens further as the income balance declines. On the other hand, thinking in terms of the second current account identity, increasing consumption (as well as borrowing from abroad), everything else equal, reduces savings and thus the current account.

Whereas both approaches can be found in the literature, I will focus in the descriptive analysis section on the first way of decomposing of the current account. This might give more detailed insights onto the mechanisms that drive external balances. In particular, it allows for a further examination of the trade balance and its determinants, which might result in practical policy implications.

2.1 Analysis and Decomposition of Current Account Changes

When examining current account dynamics in the euro area periphery countries, it is of particular interest to study (1) the reasons for the emergence of the substantial current account deficits and (2) the subsequent development of the external position. I consider this descriptive analysis an important step before applying more sophisticated econometric techniques. To see why, consider using the current account balance directly as the dependent variable in a regression analysis. In this way, important dynamics of the subcomponents of this aggregate series might easily be overlooked.

[3]The income balance is formally defined in the Balance of Payments Manual from the IMF (1993) as two types of transactions between residents and non-residents. The first type concerns the compensation of non-resident short-term workers, who stay less than one year in the country. The second type of transactions consist of investment income and payments on external assets and liabilities. Investments include foreign direct investments, portfolio investments, other investments and receipts on reserve assets.

[4]The IMF defines current transfers, which are sometimes called secondary income, as all transfers that are not transfers of capital, whereby there is a distinction made between the two sectors general government and others (IMF 1993).

[5]For the derivation of this national accounting identity, see appendix A.1.

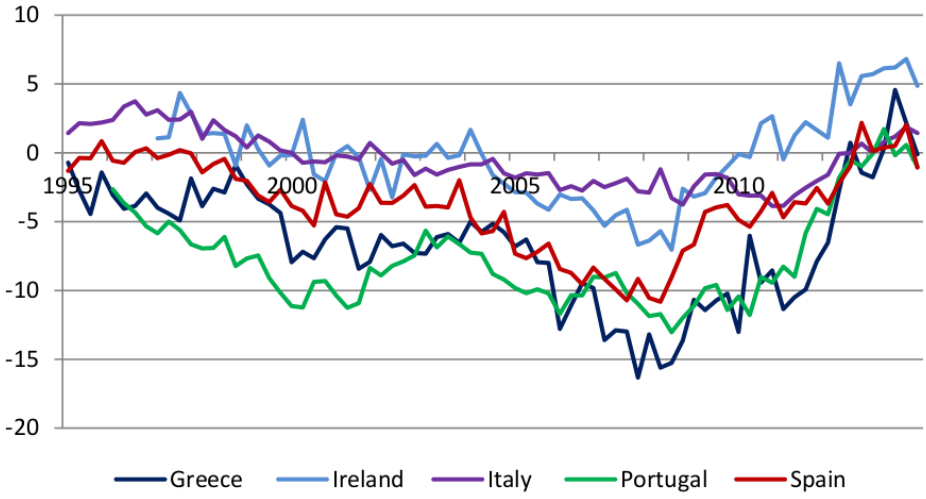

Figure 1: Current Account Balances of Euro Area Periphery Countries, in % of GDP
Source: OECD.Stat

As a start for the descriptive analysis, figure 1 displays the current account balance for Greece, Ireland, Italy, Portugal and Spain between 1995 and 2014 in percent of GDP.[6] It is important to note that the magnitude of the current account deficits between 1995 and 2014 varied substantially within this group of periphery countries. This is the reason why in the main analysis I do not analyse the external position of these countries jointly, for instance, in a panel data framework, but individually. While Italy's current account balance does not exceeded 3.9% of its GDP in any quarter of the period analysed, the largest deficits of Ireland, Spain, Portugal and Greece amount to 7.0%, 10.8%, 13.0% and 16.3% of GDP, respectively.

The fact that the current account balance of Ireland and Italy only starts to decrease from approximately zero and minus 1% of GDP in 2004, respectively, differs from the intermediate case of Spain with a deficit of more than 2% of GDP since 2000 and the two extreme cases of Portugal and Greece, whose current account deficits accumulate to more than 5% of GDP already since 1997 and 2000, respectively. Thinking about potential drivers of these deficits, the latter suggests that for Portugal and Greece structural factors might play an important role for the weak external competitiveness position since the mid-1990s. From figure 1 it can also be seen that as a common trend for all periphery countries the current account balance worsens considerably between 2004 and the Great Recession. Since 2009, and for Italy since 2011, the external position of the five economies has bounced back sharply to, at least almost, positive levels. Due to the synchronization of these movements, it is plausible to hypothesise that they are caused by similar demand changes, price competitiveness developments, or a combination of the two.

In order to identify the components which drive the development of the external balances, figure 2 decomposes current account changes for Greece, Ireland, Italy, Portugal and Spain in the relative contributions of their sub balances. The time intervals 1995–2008, 2004–2008 and 2008–2013 were chosen in order to capture both long-term changes as well as the common trend periods identified in the aggregate current account series.[7]

[6] This Time period is chosen as it matches the data analysed in the subsequent analysis of trade balances

[7] Note that due to data limitations for Portugal and Ireland the first time intervals for these countries start at 1996 and 1997, respectively.

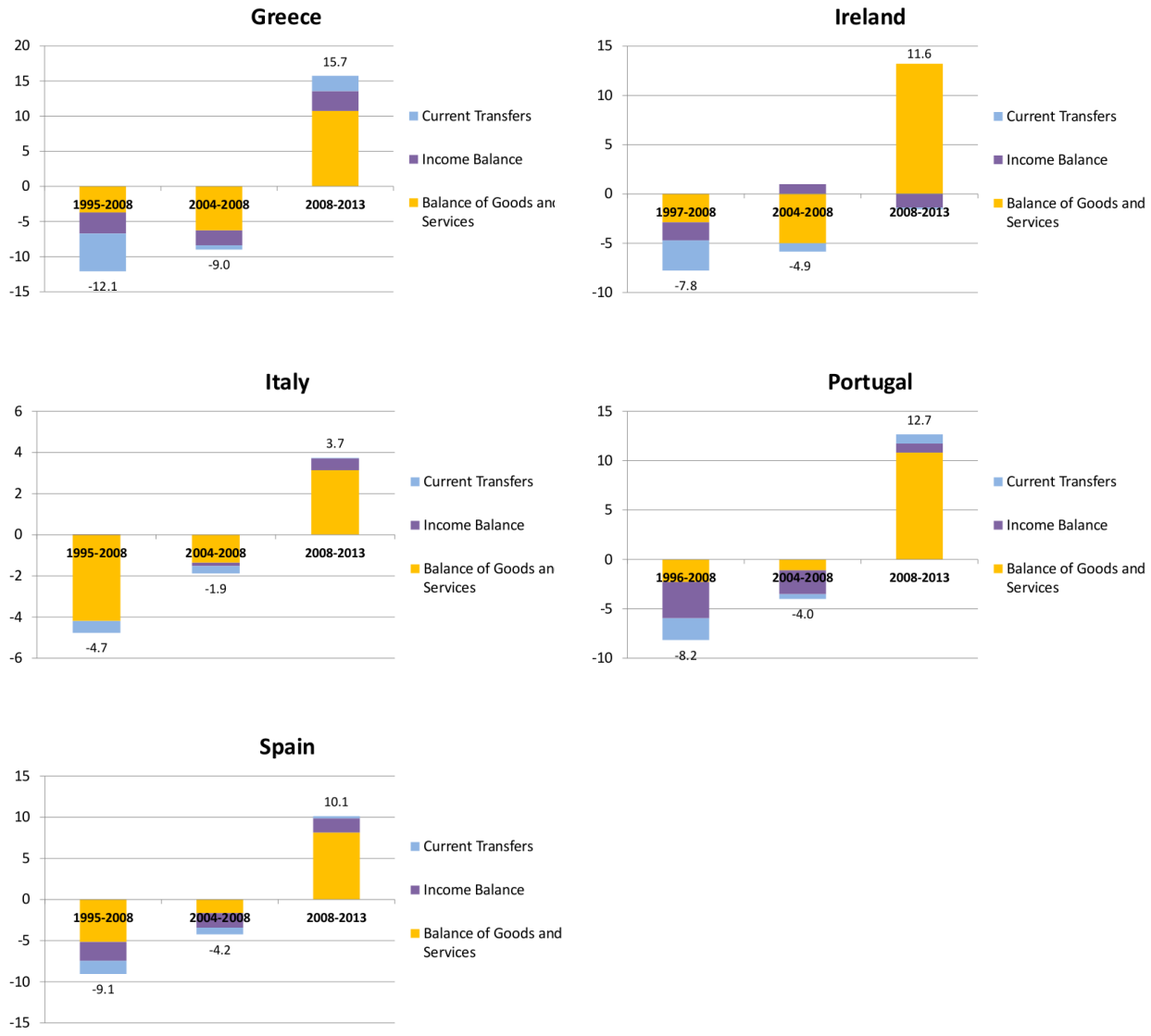

Figure 2: Decomposition of Current Accounts Changes by Component, in % of GDP
Source: OECD.Stat and Author's Calculations.

From these decompositions, overall the trade balance of goods and services can be identified as the single most important driver of the current accounts for the five periphery countries. This can also be inferred from figure A.1 of the appendix, which displays the development of the subcomponents of the current account over time. However, figure 2 reveals that besides the trade balance also the income and current transfers balance contribute in some cases considerably to changes of the current account. Interestingly, in the long interval from the mid-1990s to 2008 for Greece, Ireland and Portugal the joint contribution of the income balance and current transfers exceeds the trade balance component.

For Italy almost all the changes in the current account balance can be explained by movements of net exports, which also holds for Ireland since 2004. The dynamics of the Spanish external position also depend to a considerable degree on the income balance and current transfers. These often neglected parts of the current account make up for more than half of the current account deterioration of Spain between 2004 and 2008. For Greece and Portugal these contributions are even higher. The substantial improvement

of the current account balances since the Great Recession are for all countries largely driven by changes in the trade balance.

2.2 Analysis of Current Transfers and Income Balances

Before analysing the trade balance of goods and services further, this section elaborates more in detail on the changes in the income and current transfers balance. For the euro area periphery countries the balance of current transfers consists to a large extend of inter-governmental aid flows and workers' remittances. To explore the substantial contributions of current transfers to the change in the current account more in detail, figure 3 shows an approximation of the main drivers of the current transfer balance between 1995 and 2008 for Greece, Ireland, Portugal and Spain.[8]

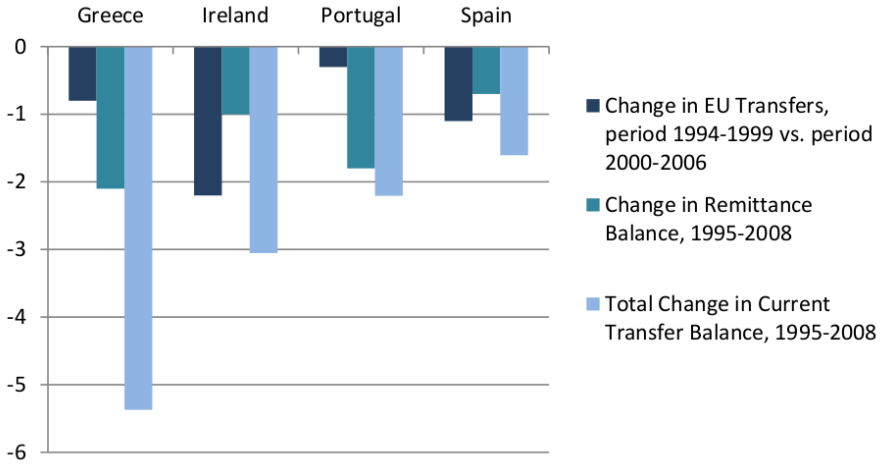

Figure 3: Change in Current Transfers by Component, 1995-2008, in% of GDP
Source: OECD.Stat, MPI Data, European Commission: Reports on Economic and Social Cohesion, Author's Calculations.

For all four countries except Greece, the sum of (1) the reduction of the remittance balance and (2) the decline in EU transfers, which came along with increasing per capita incomes, can approximately explain the total change in current transfers from the mid-1990s to the Great Recession.[9] This decomposition reveals the relatively high importance of the reduction in EU transfers for Ireland and Spain, while for Greece and Portugal the decline in remittances can be identified as a large factor for the drop of current transfers.

Despite its negative impact on the current account balance, the decrease in current transfers *per se* is not worrisome. It can be interpreted as the result of a positive economic development. Over time, the governments of the periphery countries depended less on structural assistance from the EU and more of its workers found employment within the domestic economy. In consequence, the need for emigration and the transfer of remittances from abroad was reduced (see Reis 2013 for the case of Portugal).

In an interesting contribution, Kang and Shambaugh (2013) present a reasoning for how the reduction

[8] Due to data limitations I use average transfers from the EU in the course of the social and economic cohesion policy between the program periods 1994-1999 and 2000-2006 as a proxy for the change in current transfers between 1995 and 2008. Moreover, the case of Italy is not considered here, since for this country the relative contribution of the current transfer balance for current account changes is relatively small.

[9] In the case of Greece, the rough approximation of the change in EU transfers might cause an underestimation of the actual change between the years 1995 and 2008

in current transfers can also have a negative impact on other components of the current account. In theory, declining current transfers, *ceteris paribus*, cause domestic demand, and thus imports, to decrease, which would have a positive effect on the trade balance. However, due to consumption habits, Kang and Shambaugh (2013) argue that in the case of the periphery countries transfer payments were replaced by foreign debt financed expenditures in order to maintain the previous consumption level. As a result, the trade balance remained roughly constant at a deficit level. Moreover, due to the outflow of interest payments on new debt, also the income balance was negatively affected.

Besides the significance of current transfers, figure 2 also illustrates the important role of declining income balances for the changes in the current account balances between 1995 and 2008 for Greece, Ireland, Spain and Portugal. In the latter country, the deterioration of the current account from 2004 to 2008 is to the largest extend caused by the income balance, which also played an important role for Spain and Greece in this period. Thereby, according to Holinski et al. (2012), the negative contribution of the income balance on the current account can constitute a vicious cycle: with continuous current account deficits, as it was evident for Spain, and especially for Greece and Portugal, net foreign debt grows.[10] As a result, interest payments to foreign lenders increase and the income balance worsens. This further contributes to a declining current account balance.

The empirical relevance of this vicious cycle is confirmed by Barnes et al. (2010). They show that for euro area periphery countries the initial net foreign asset position in 2004 has a significant impact on the deterioration of the current account positions until 2008. To make this argument more illustrative, figure A.2 in the appendix displays the net foreign asset position for Greece, Ireland, Spain and Portugal in 2002 and 2010.[11] For all 4 countries, this cumulative external position is negative in 2002 and worsens further until 2010. Due to the existence of current account deficits in Portugal and Greece since the mid-1990s, in 2002 net foreign assets in these countries stand already at -65.3% and -59% of GDP, respectively. In 2010 net foreign debt positions exceed 80% for all four countries.

2.3 Analysis of Trade Balances

Referring again to figure 2, the trade balance is not only the most important driver of the improvement of the current account after the Great Financial Crisis, but it also contributes to the largest extend for Greece, Ireland and Italy to the growing current account deficits between 2004 and 2008, and for Spain between 1995 and 2008. To a smaller extent it causes the current account deterioration for Portugal before 2008.

In this section I further analyse the balance of goods and services by disaggregating it into the development of exports and imports of goods and services over time, which are displayed in figure 4 below.

[10] This is due to the fact that each year in which the current account is negative, the capital account is positive, that is, there is a net capital inflow into the country.

[11] Except data from the World Bank on net foreign assets, which, for instance, records positive values from 2001 through 2008 for Greece, due to a different way of measurement, no annual data on net foreign assets is regularly reported by international or national authorities between 1995 and 2008. Thus, I rely on selected data calculated in a study by Lane (2011).

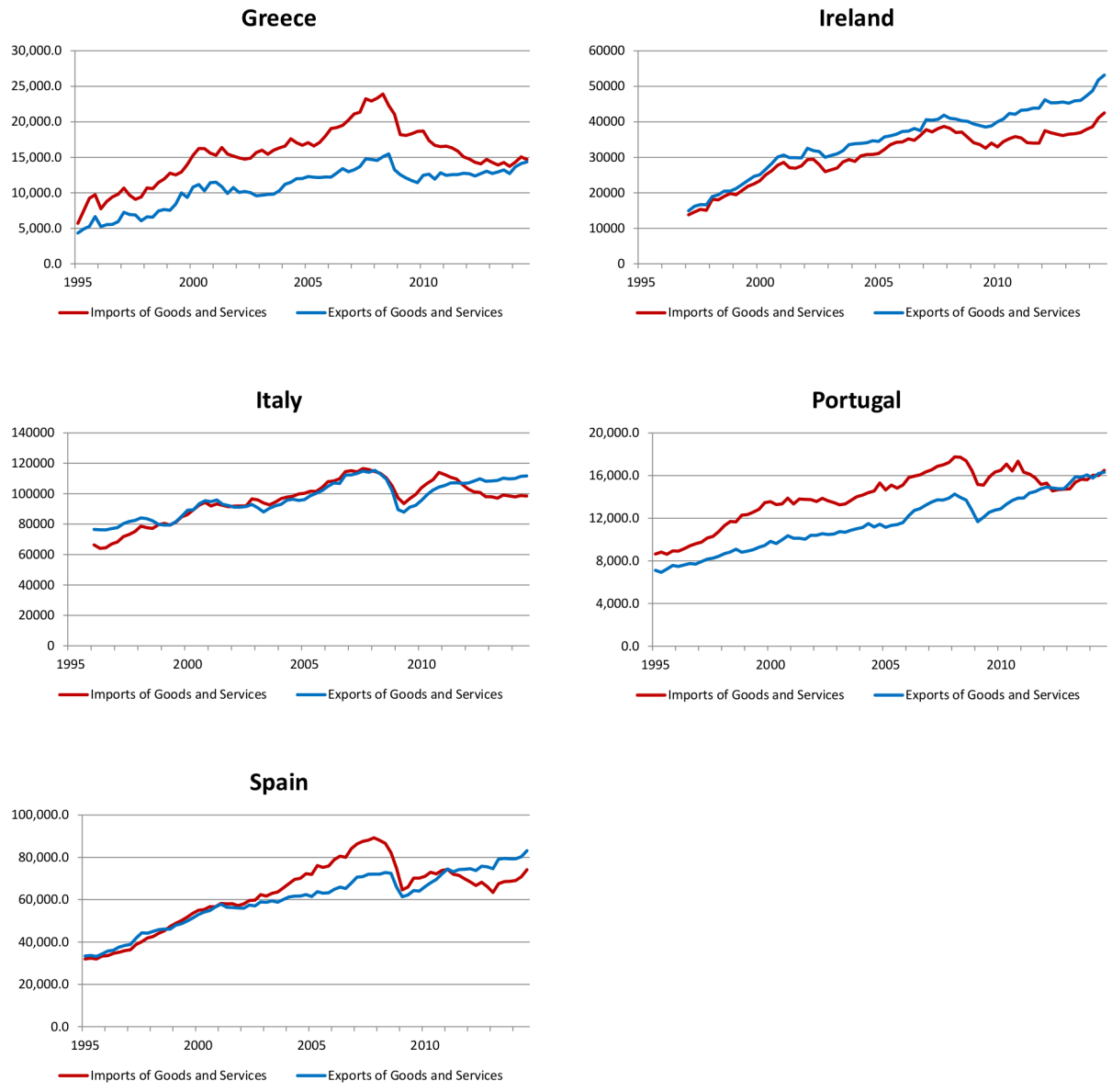

Figure 4: Exports and Imports of Goods and Services in Constant mn Euros for Euro Area Periphery Countries
Source: Eurostat, OECD.Stat

Focusing on the diagram for Ireland first, at first glance it is not clear why there should be a weakness of external competitiveness, since the country has persistently higher exports than imports since 1997. In order to understand how Ireland could run a current account deficit of 7.0% of GDP during the Great Recession, the special structure of the Irish economy needs to be taken into account. Since the 1990s Ireland has been very successful in attracting large amounts of FDI by charging low corporate tax rates (Barry 2004). A large share of the these investments was aimed at creating an export platform serving the European Common Market (Lane and Ruane 2006). As an important consequence, there has been a persistently large outflow of profits from Ireland, which amounted to 14.4% of GDP as a yearly average between 1995 and 2006 (Mencinger 2008). This characteristic of the Irish economy explains the large negative contribution of the income balance to the current account (see also figure A.1). In order to keep the latter balanced, and since the current transfer balance is close to zero, the Irish trade balance needs to be in surplus by approximately as much as the income balance is in deficit. From 2004 to 2008, the trade balance declines from 13.7 to 8.7%

of GDP, which causes the current account deterioration visible from figure 1. The fact that imports decline more than exports between 2008 and 2010 and that they remain at a low level until 2011 enables a surge in both trade and the current account balance once exports increase again from 2010 onwards.

For Italy the trade deficit is only greater than 2% in two consecutive quarters between 2010 and 2011, when also the current account reaches its largest deficit of -3.8%. Overall a temporary negative trade balance of this magnitude is not unusual. Thus, it does not constitute an especially worrisome imbalance. Since in addition Italy's external balance is subject to a strong recovery after 2011, I exclude Italy from the subsequent more detailed econometric analysis of trade balances.

Regarding Spain, a trade deficit exists since 1998. However, it only becomes clearly visible in figure 4 from 2003 onwards, when imports start rising faster than exports until 2008. The fall in imports from 2008 to 2009 and from 2011 to 2013 are essential to bringing the trade balance back to a surplus from 2011 onwards, as exports only rally after the Great Recession towards the previous linear growth trend.

Last, I focus on the trade balances of Greece and Portugal. Initially, both seem to be similar in exhibiting a sizeable deficit, which grows further over time and which remains on a high level until 2010 and 2011, respectively, before it is sharply reduced. However, the adjustment process for the trade balance differs considerable between the two cases. While Greek imports undergo an enormous contraction of 38.0% from 2008 to 2013, Portuguese imports reduce with 11.4% to a considerably smaller extend during the same period. In addition, exports in Portugal increase by 28.6% from 2009 to 2013, which brings them back to their long-run trend. In contrast, Greek exports remain rather flat and only grow by 7.9% between 2009 and 2013. Whereas the trade balance in Greece does not reach positive levels until the third quarter of 2014, Portuguese exports exceed imports in 2012 again. In summary, the recovery of the trade balance in Portugal is driven by both an export increase and a reduction in imports, while for Greece almost the entire adjustment process of the trade balance back to a near-balance is caused by declining imports.

As the last step of this descriptive analysis part, I decompose both exports and imports in their goods and services components. Note that I focus in this and all subsequent parts of the thesis on Greece, Portugal and Spain only. Theses are the countries that exhibited the most extreme current account deficits. In addition, besides the reasons for the exclusion of Italy stated above, the identification scheme outlined in section 5.3 for the econometric analysis might not be properly applicable to Ireland as a very open economy.

Regarding imports first, for all three countries the share of imports of goods is rather invariant over time. Its average stands at 82.3% for Greece, 81.7% for Portugal and 86.1% for Spain in the period from 1995 to 2014. Hence, imports of goods are the main driver of total imports. Focusing on exports, the average contribution of goods exports in total exports between 1995 and 2014 is 47.5% for Greece, 67.2% for Portugal and 74.0% for Spain. In other words, on average in this period more than half of Greek exports, around one third of Portuguese exports and roughly one quarter of Spanish exports were services.

Figure 5 shows the contribution of exports of goods and exports of services to total exports for Greece, Portugal and Spain between 1995 and 2014. While exports of goods in both Portugal and Spain closely track total exports, the graph for Greece reveals the relatively high importance of services exports for total exports. In contrast to Greek exports of goods, which seem to roughly follow a linear growth trend, exports of services undergo a level increase with the creation of the euro zone in 1999 and a level decrease with the Great Recession in 2008, which lasts until the end of the sample time period in 2014. The

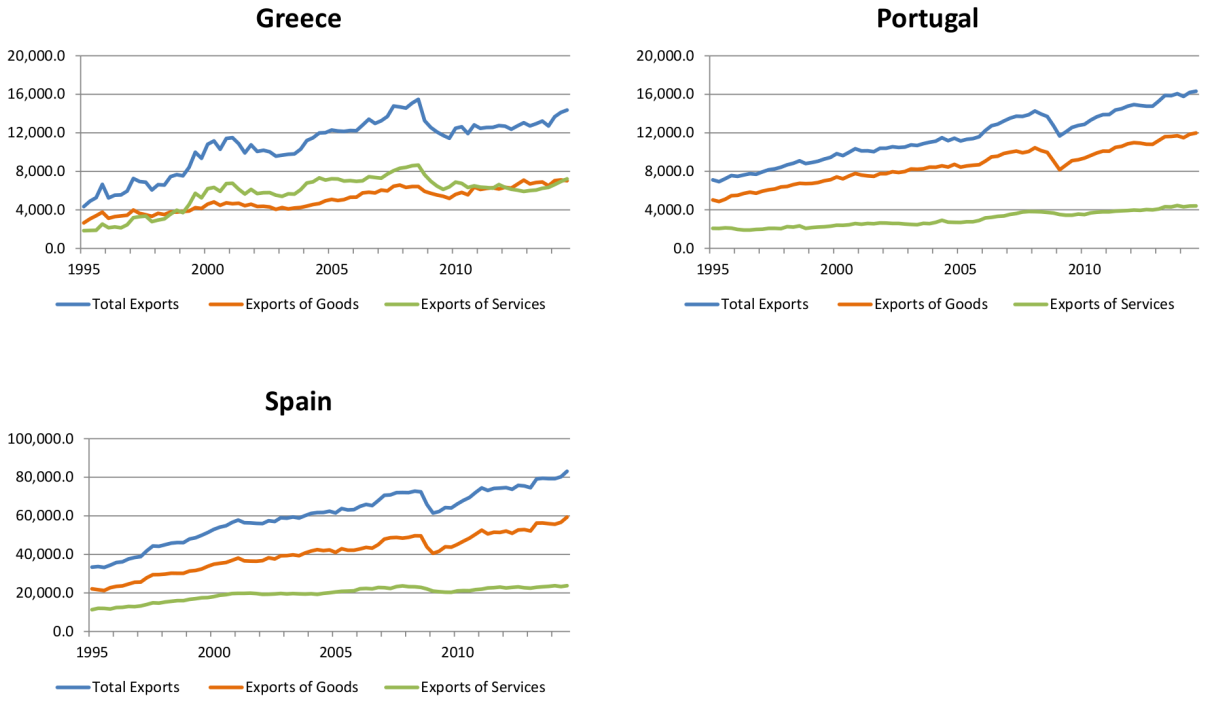

Figure 5: Decomposition of Total Exports in Constant mn Euros for Greece, Portugal and Spain
Source: Eurostat

weak performance of total Greek exports since the crisis can thus be attributed primarily to the weakness of exports of services. What might have caused it? Data from the UN ServiceTrade show that in 2012 for Greek exports of services transportation and travel are the dominating sectors with shares of 48.3% and 37.9%, respectively. Since both sectors rely heavily on foreign demand, the weakness in exports of services is in general likely to be caused by the weak growth performance of the rest of the euro area in recent years. With respect to tourism, also the instability and uncertainty associated with a potential exit of Greece from the European Currency Union might explain the drop of travel related exports of services.

Whereas the descriptive analysis of trade balances in the euro area periphery countries is informative on the development of exports and imports in general, it is not possible to properly disentangle their relative contribution to trade balance changes. Neither can it show the relative importance of demand and price competitiveness factors for the development of exports, imports and the trade balance. Therefore, I will tackle these questions with more elaborate econometric methods in the main analysis of this thesis. Before elaborating on the underlying theory, the next section presents a review of the previous literature about the determinants of current account and trade balances in the euro area periphery.

3 Literature Review

During the last years, an increased number of studies has focussed on current account and trade imbalances in the euro area which arose after the creation of the European Monetary Union. In contrast to current account deficits in the euro area periphery, core countries like Germany, the Netherlands and Austria ran large surpluses.

It is generally acknowledged that the maintenance of the substantial deficits in the periphery countries

was enabled by a continuous flow of credits, mainly in the form of debt. It originated from the core countries, in particular France and Germany, which also acted as intermediaries for financial inflows from outside the euro area (Chen et al. 2013, Hobza and Zeugner 2014). However, different explanations about the origins and the channels of the emergence of the external deficits in the euro area periphery have been put forward in the literature.

3.1 Price and Cost Competitiveness

In an early paper, Blanchard and Giavazzi (2002) argue that the current account deficits of Greece and Portugal are in line with a catching-up process of these two countries. Since they were the poorest countries in the euro zone, the fact that that investment outweighed savings was interpreted as a positive sign. However, as several authors note, productivity growth in these countries was very low, which impeded actual convergence (Sondermann (2014), Pancotto and Pericoli (2014), and Zemanek et al. (2010)).[12] Nevertheless, inflation rates in the deficit countries increased substantially along with nominal wages, which over a longer time horizon exceeded the ones in the euro area core countries. The resulting unit labour cost and inflation rate divergence between core and periphery is in this view considered to be the main cause of the external imbalances (see, for instance, Flassbeck and Spiecker 2011 Belke and Dreger 2013, Sinn 2014).

Zemanek et al. (2010) show that these surges of the price level originate in the non-tradable sector. They further argue that by increasing the overall price level in the economy, which constitutes a reverse Balassa Samuelson effect, exports become less competitive. The latter is held responsible for the widening of the current account deficits before the Great Recession in the euro area periphery. In a case study about Portugal, Blanchard (2007) comes to a similar conclusion. However, he argues that export prices are only indirectly influenced by higher inflation in the non-tradable sector. Since he describes the country as a price taker for its export goods, firms selling abroad become less competitive over time due to higher input prices from the non-tradable sector. As a result, profit margins and thus in the long term also external competitiveness decline.

On a more global perspective, Chen et al. (2013) show the importance of the increase in external euro area competition for the euro area periphery countries. Having a similar portfolio of export products as Emerging Asia and Emerging Eastern Europe, especially Spain, Portugal and Greece would have needed a depreciation given their trade balances. However, due to continuous capital inflows and as a result of a substantial nominal appreciation of the euro, their real effective exchange rates appreciated substantially, with is argued to have further contributed to the deterioration of the net export position of the euro area periphery countries.[13]

The main policy recommendation in this view on the imbalances aims at restoring external price competitiveness in the periphery countries (see for instance, Belke and Dreger 2013). A shared rebalancing, in which core countries allow for higher inflation rates is also mentioned, but not considered viable. Since

[12] When analysing Portugal in detail, Reis (2013) explains low productivity growth with an underdeveloped financial sector, which misallocated inflowing capital to the relative unproductive non-tradable sector. More generally, Dullien (2013) argues that the supply shock of capital with the financial integration caused the real exchange rate in the periphery countries to appreciate. As a result, resources were allocated increasingly towards the non-tradable sector, which generally exhibits a lower productivity growth than the tradable sector. As a result, productivity growth on the country level was affected negatively.

[13] A decomposition of the latter between 2000 and 2010 reveals that for all periphery countries more than 50% of the appreciation was due to the appreciation of the nominal exchange rate of the euro (Chen et al. 2013).

nominal external devaluations would only be possible with at least a temporary exit from the currency union, another option is boosting exports through internal devaluations. However, taking into account a downward price stickiness on the aggregate level, such reductions are generally very difficult to achieve (Sinn 2014).

3.2 Domestic Demand

In a second branch of the literature, a number of recent studies find domestic demand to be at the root of higher inflation rates and current account divergence within the euro area. The according mechanism can be described as follows. As a result of the reductions of country risk, interest rates drastically decreased with the introduction of the Euro (Chen et al. 2013). In this way, consumption and investments booms in the euro area periphery were fuelled, which is seen as the main reason why current account balances deteriorated. In addition, Lane and Pels (2012) show that with the introduction of the euro also overly optimistic expectations about the convergence of periphery countries, measured by growth forecasts, can explain the increase in debt financed investment, especially in the construction sector. Rather than declining export competitiveness, it is thus argued that in consequence of the demand booms, higher imports caused trade and current account balance to decline (Uxó et al. 2011, Wyplosz 2013, Diaz Sanchez and Varoudakis 2013, Podstawski 2014).

Gaulier and Vicard (2012) add to this view that higher unit labour costs are only a symptom of domestic demand shocks and that exports are not necessarily affected by prices increases in the non-tradable sector. Gabrisch and Staehr (2013) confirm this argument econometrically by showing that unit labour costs do not Granger cause current account balances, but that there is evidence for Granger causality vice versa.

3.3 Structural Factors and Non-Price Competitiveness

Besides explanations based on price competitiveness and domestic demand, several studies highlight the relevance of non-price and structural factors for the external deficits in the euro area periphery countries (Storm and Naastepad 2014, Tressel and Wang 2014, Carrasco and Peinado 2014). In search of the underlying causes of price competitiveness deterioration, Johnston et al. (2014) find evidence that differences in wage bargaining systems between core and mostly periphery countries affected exports in the latter negatively. The reason is the inability of periphery countries to tie the non-tradable sector inflation to the tradable sector price increases, which led to real appreciations. This stands in contrast to wage setting institutions in core countries like Germany and Austria, where it was possible to exercise wage moderation.

Moreover, the sectoral specialization and the quality of exports is used as an explanation for weaknesses of some euro area periphery countries' trade balances. In a detailed sector and product level analysis, Bennett et al. (2008) assess that the average product quality has not improved considerably in most periphery countries between the mid-1990s and 2005, and in particular not relatively to other euro area countries. Storm and Naastepad (2014) further emphasize that especially Greece, Spain and Portugal are specialized in low and medium levels of technology of their industry output, similar to the one of emerging markets like China. As exports from the latter rose in quantity and quality, world market shares of the periphery countries underwent a decline.

In a more long term perspective, Sondermann (2014) as well as Irac and Lopez (2014) identify institutional quality, educational levels and R&D investments as determinants of persistent productivity differences

between periphery and core countries of the euro zone. In addition, in 2007 Greece, Italy, Portugal and Spain were at the bottom in the group of OECD countries with respect to the Doing Business Indicator (Bennett et al. 2008)). These facts suggest that there might be a lack in external competitiveness due to an relatively unfavourable business climate. It might also imply difficulties in the attraction of export orientated foreign direct investment. Giordano and Zollino (2014) underline the direct relevance of efficiency, and possibly industry specialization along with that, for the trade balance by showing that for the periphery countries total factor productivity relative to the euro area average has a positive effect on exports.

Last, in a political economy view, Fernandez-Villaverde et al. (2013) argue that the political pressure for reforms in periphery countries of the euro zone was considerably reduced by the elimination of sovereign risk premiums on government bonds. As a result, institutional quality deteriorated and the credit booms, which enabled the persistent current account deficits, were prolonged.

3.4 Contribution of This Thesis in the Context of the Current Research Frontier

The most common approach to identify drivers of current account and trade balances in the euro area in the very recent empirical literature is the estimation of reduced form models. Using panel data to this end, Jaumotte and Sodsriwiboon (2010) find that current account deficits in the euro zone are mostly caused by a decline in private savings. Furthermore, similar to Barnes et al. (2010), they conclude that there is a residual that cannot be explained by typical current account determinants.[14]

Tressel and Wang (2014) also approach current account dynamics from the savings and investment side for the post-crisis period from 2008 to 2013. They try to disentangle cyclical and structural factors and find that cyclical effects dominate, especially for Greece. For Spain structural factors seem to be more important for the export recovery. Regarding export growth, foreign demand is identified as the most import factor, while price competitiveness has only a small effect.

Furthermore, in a panel error correction model with data on 17 euro area countries Comunale and Hessel (2014) estimate the dependence of exports, imports and the trade balance on standard demand and price competitiveness measures with the aim of explaining current account imbalances. They conclude that while price competitiveness has some influence, domestic demand is the most important explanatory variable for these imbalances. Moreover, the authors use different measures of a financial cycle variable, which is found to have good explanatory power for the trade balance.

In contrast to the studies above, Christodoulopoulou and Tkacevs (2014) conduct country level regressions for all euro area members. They derive marginal effects of traditional determinants of exports and imports with a focus on employing different price competitiveness measures. Their main results are that, in contrast to exports, imports are quite insensitive to changes in relative prices. In addition, they also find an unexplained residual part in their regressions which they attribute to non-price competitiveness factors.

Methodologically different from the studies using reduced form estimations, Diaz Sanchez and Varoudakis (2013) use a general VAR model with annual panel data to investigate the change in the current account in percent of GDP of euro area countries. They find domestic demand booms to be most important for the deficit countries. Furthermore, with a similar aim, Podstawski (2014) employs a structural time-varying

[14]Typical current account determinants include initial net foreign assets, government balance, level and growth of GDP per capita, demographics, the oil balance and a measure of financial liberalization.

VAR model with a mix of long term and sign restrictions. The variables in his system are the GDP deflator, output, the short term interest rate and the current account balance in percent of GDP. He also identifies domestic demand and in addition an overly accommodative monetary policy to be key drivers of the external balances of euro area periphery countries.

In this thesis I further analyse the current account balances in euro area periphery countries from its accounting side as the composite of the trade, income and transfers balance. In contrast to the more broad view on the savings and investment relationship, this appears to allow for a more disaggregated examination and thus for potentially more specific policy implications. As an example of the limitation of the savings and investment view on the current account, in an according analysis Tressel and Wang (2014) state that the common recovery pattern of the current account in the periphery countries after the Great Recession cannot be explained by standard determinants of the savings and investment relationship.

Regarding methodology, Barnes et al. (2010, p.11) note that in the reduced form settings which aim to explain the current account balance, "[*i*]*n the econometric sense, there is no presumption that the right-hand side variables are independent of each other or the error term*". He explicitly acknowledges that it is difficult to establish causality in such a model framework. A similar criticism might apply to reduced form export and imports regressions, which in their modern form specify a high degree of interconnections between variables. As an example, in addition to traditional determinants, Christodoulopoulou and Tkacevs (2014) include domestic demand in their export regression and exports in the import regression. These observations motivate me to combine the variables of both export and import regressions in one model framework.

Thus, in this thesis I extend the literature by estimating the effect of demand and price competitiveness factors on exports, imports and the trade balance of the three euro area periphery countries Greece, Portugal and Spain in a structural VAR model.[15] Compared to the analysis by Diaz Sanchez and Varoudakis (2013), I am able to recover structural shocks and thus a causal interpretation of the estimates. Regarding Podstawski (2014), this thesis differs by focusing on the trade balance and its determinants.[16]

4 Determinants of Exports, Imports and the Trade Balance in Theory

In this section I summarize the standard theory of trade balance determinants before tailoring it to the case of the euro area periphery countries Greece, Portugal and Spain for the last 20 years.

4.1 Traditional Determinants of the Trade Balance

In general the trade balance is defined as net exports, that is, the difference between exports and imports.[17] Thus, the trade balance can be explained by the determinants of its components. In the standard literature (see, for instance, Blanchard and Johnson 2013), in a model with multiple open economies, exports X are

[15] Beetsma et al. (2008) use a similarly specified structural VAR model to analyse government spending shocks on trade balances.

[16] In addition, the study by Podstawski (2014) might suffer from omitted variable bias due to a lack of standard explanatory variables for the current account.

[17] If not otherwise stated, in the following exports and imports will always refer to both goods and services.

written as a function f of foreign demand, FD, and the real effective exchange rate, $REER$, as follows:

$$X = f(\underset{(+)}{FD}, \underset{(-)}{REER}) \tag{3}$$

It is straight forward that higher foreign demand will cause increased demand for domestic goods. In addition, if an increase in the real effective exchange rate (REER) denotes an appreciation, a higher REER, that is, a deteriorated price competitiveness, is expected to let sales abroad fall.

As the second component of the trade balance, imports, M, are traditionally explained by a function g of domestic demand, DD, and the real effective exchange rate, $REER$, such that

$$M = g(\underset{(+)}{DD}, \underset{(+)}{REER}) \tag{4}$$

With higher domestic demand, the demand for foreign goods is also expected to increase. Moreover, an appreciation makes foreign goods and services relatively cheaper at home. In consequence, an expenditure switching effect towards foreign goods is expected to take place, which causes higher imports. It is assumed here that the increase in the quantity of imports outweighs the price effect from the fact that the imports have become cheaper, so that the total value of imports rises.

When analysing the effect of the three determinants foreign demand, domestic demand and real effective exchange rate on the trade balance, TB, it is immediately clear from the two functional forms above that in theory an increase in foreign demand should have a positive effect on the trade balance, while an increase in domestic demand should affect net exports negatively. Moreover, according to the Marshall-Lerner condition, a depreciation of the real effective exchange rate should improve the trade balance. In a dynamic model, this ultimately positive effect appears in the shape of the so-called J-curve (Blanchard and Johnson 2013). Thereby, immediately after the depreciation, when quantities can be assumed to be constant (due to consumption habits and fixed contracts) the price effect of the depreciation on imports comes into effect. The same quantity of imports has a higher value in domestic terms now, which affects the trade balance negatively. However, over time with adjusting quantities, it is assumed that net exports will increase by more than the initial drop, due to higher exports and a reduced quantity of imports. Hence, the trade balance can be expressed as a function h, whereby

$$TB = h(\underset{(+)}{FD}, \underset{(-)}{DD}, \underset{(-)}{REER}) \tag{5}$$

4.2 Additional Determinants of the Trade Balance for the Euro Area Periphery Countries

Considering next the specific case of the determinants of exports and imports for the euro area periphery countries since 1995, a recent study by Esteves and Rua (2015) stresses the relevance of the supply side of exports in Portugal. The authors argue, and find econometric evidence, that domestic demand is inversely related to exports. When the domestic economy is slacking, firms increase efforts to export, whereas in times of high domestic demand pressure sales to other countries are reduced. Since Belke et al. (2015) as well as Christodoulopoulou and Tkacevs (2014) confirm the empirical evidence on this effect and as they

additionally find to some extend similar effects for Spain and Greece, I include domestic demand as an additional determinant of exports, such that

$$X = f^*(\underset{(+)}{FD}, \underset{(-)}{REER}, \underset{(-)}{DD}) \tag{6}$$

Furthermore, a modelling approach to imports during the last 20 years needs to account for the development of modern production structures in the form of international value chains (Christodoulopoulou and Tkacevs 2014). Export production relies thereby to a considerable degree on imported intermediate goods and services. Figure 6 shows the import content of exports for the three periphery countries, which, for instance, ranges in the period of the mid-2000s from 26% in Greece to 39% in Portugal.

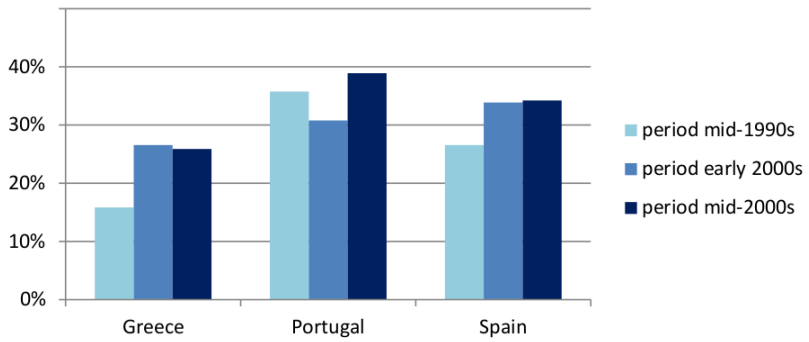

Figure 6: Import Content of Exports (Goods and Services)
Source: OECD STAN

Embedding this dependency of exports on imports in the function describing imports, I obtain

$$M = g^*(\underset{(+)}{DD}, \underset{(?)}{REER}, \underset{(+)}{X}) \tag{7}$$

In principle now all determinants of exports can also potentially explain imports to some extend. As a consequence, the expected sign of the effect of the real effective exchange rate on imports becomes unclear. This effect is traditionally assumed to be positive. However, given a REER appreciation, the magnitude of the reverse effect of lower intermediate imports due to lower exports counteracts this positive effect and can potentially turn it negative. With respect to domestic demand, a decrease can now also have a slightly positive impact on imports through increased export production. However, I still expect the direct income effect of domestic demand on imports to be dominating.

What implications do these extensions of the export and import functions have for the determination of the trade balance as in equation 5? First, the effect of foreign demand on the trade balance is reduced from the total change in exports to the change of exports less their import content. In other words, the size of the remaining effect depends on the value added from imported intermediate inputs to the resulting exports. Second, in the presence of a supply side adjustment of exports, the negative effect of an increase in domestic demand on the trade balance becomes stronger. In addition to more imports also exports are expected to be reduced, at least in the short run. Third, regarding the real effective exchange rate, the Marshall-Lerner condition can still be assumed to be satisfied. However, in the case of a depreciation, the

decrease in imports will be smaller due the rise in intermediate import demand stemming from increased exports. As a result, the positive effect on the trade balance becomes lower.

Due to the increased number of possible feedback effects, the augmented expressions of the functions for exports and imports and their impact on the trade balance determination give a first motivation for the model selection in the subsequent econometric analysis.

5 Empirical Methodology and Estimation

5.1 The Structural VAR Model

Based on the theoretical considerations above I start the econometric analysis by selecting a suitable model. For several reasons outlined below I choose a vector autoregressive model with lag length p (VAR(p)). Its structural form can be written in matrix notation as

$$By_t = c + \beta_1 y_{t-1} + ... + \beta_p y_{t-p} + \epsilon_t \tag{8}$$

where $y_t = [fd, dd, reer, m, x]'$ is a (5×1) vector of the variables foreign demand, domestic demand, real effective exchange rate, imports and exports.[18] The β_i, for $i = 1, ...p$, are (5×5) coefficient matrices, c denotes a (5×1) vector of intercepts and ϵ_t is (5×1) vector of error terms. The latter is assumed to be white noise. Moreover, the matrix B is defined as

$$B = \begin{pmatrix} 1 & b_{11} & b_{12} & b_{13} & b_{14} \\ b_{21} & 1 & b_{22} & b_{23} & b_{24} \\ b_{31} & b_{32} & 1 & b_{33} & b_{34} \\ b_{41} & b_{42} & b_{43} & 1 & b_{44} \\ b_{51} & b_{52} & b_{53} & b_{54} & 1 \end{pmatrix}$$

For the mth row, the elements b are the negative coefficients of the contemporaneous elements of the y_t vector, excluding the mth element. By multiplying both sides of equation 8 with B^{-1}, the primitive system can be rewritten in the reduced form

$$y_t = A_0 + A_1 y_{t-1} + ... + A_p y_{t-p} + e_t \tag{9}$$

where $A_0 = B^{-1}c$, $A_i = B^{-1}\beta_i$, for $i = 1, ..., p$, and $e_t = B^{-1}\epsilon_t$.

The VAR(p) model described above is referred to as the baseline model. It consists in essence of a system of equations, whereby each of the 5 variables is regressed on its own lags and present as well as lagged terms of all other variables. In this way, all variables are treated as endogenous. Therefore, the VAR model allows for interaction and feedback effects between the variables, which could not properly be accounted for in an alternative model specification of standard single or error correction export and import regressions.

[18] Although I am mainly interested in explaining the trade balance as an important part of the current account, in my baseline model I do not include net exports as a single variable. Incorporating both exports and imports in the VAR framework instead has the advantage that sources of changes in the trade balance can be analysed as well.

In particular, based on the vector moving average representation of the VAR model and given stability of the system, the coefficient estimates can be used to compute impulse response functions (IRF). The latter reveal the dynamic behaviour of variables in response to shocks to other variables in the system over time. In this way, compared to simple regression estimates a more detailed picture of the effects of interest can be studied. For a formal derivation of the impulse function for a VAR(p) model, see appendix A.2.

Dynamic feedback effects matter in my analysis, since I am interested in the total effect of shocks to domestic demand, foreign demand and the real effective exchange rate on the trade balance over time. As an example for a reciprocal relationship between two variables, consider the augmented function of export determinants in equation 4.2. Given a foreign demand increase, exports are expected to rise. As higher sales abroad increase income and thus consumption at home, and as extra exports might trigger additional investments, domestic demand might increase as well. However, recall that the latter variable is also a explanatory variable for exports, if supply side factors are relevant. This constitutes a reverse causality situation. To account for such effects that might materialize over time, the dynamic structure of a VAR model is well suited.

As another important advantage of using a VAR model, the impulse response functions obtained from the VAR estimates can be used to generate forward error variance decompositions (FEVD). In my analysis, the latter can reveal the relative importance of demand and price shocks as drivers of the trade balance.

According to Lütkepohl (2005), a limitation of the use of VAR analyses with impulse responses appears if important variables are excluded from the system. This would lead to distortions of the impulse response functions. Since the determinants of imports and exports, as the variables of interest, are fairly clear and standard in the literature, I do not expect the VAR model with my set of five variables to suffer from major distortions caused by omitted variable bias. Nevertheless, as such a bias is difficult to rule out completely, in section 7.4 I include the oil price as a further potential determinant of the trade balance in the baseline model. This provides an indication on the robustness of the results.

5.2 Data Description

In order to estimate the VAR model described above for each of the euro area periphery countries Greece, Portugal and Spain, I compile a data set containing measures of the variables foreign demand, domestic demand, real effective exchange rate as well as imports and exports of goods and services. For all variables the according data is in quarterly frequency. It ranges for all countries until 2014q3.[19] The time series for Portugal and Greece begin in 1995q1, which gives 79 data points. However, the Greek series can only be used from 2000q4 onwards, which is further discussed in section 5.4. This leaves 56 observations. For Spain quarterly data for all five variables is only available from 1996q1 onwards, such that I obtain 75 observations. Furthermore, all time series are seasonally adjusted and expressed in real terms, if not stated otherwise. In addition to the series of exports and imports, which are presented in figure 4, the variables foreign demand, domestic demand and the real effective exchange rate in indexed level form are displayed in appendix A.3.

Data for exports and imports is taken from Eurostat in seasonally adjusted form and as chain linked values with base year 2010. The domestic demand series DD is computed by subtracting the trade balance

[19] Data for 2014q4 is has not been available for all variables yet. In particular components of the foreign demand series are missing.

of goods and services from the real GDP Y in levels.[20] The latter is also retrieved from Eurostat in the same real and seasonally adjusted form as the export and import series. I obtain as domestic demand measure the equivalent to the sum of consumption C, investment I and government expenditure G,

$$DD = Y - (X - M) = C + I + G \tag{10}$$

For Greece and Portugal the foreign demand series is constructed as the export weighted real GDP growth of export partner countries as follows

$$FD_i = \frac{\sum_{j=1}^{n} s_j y_j}{\sum_{j=1}^{n} s_j} \tag{11}$$

where s_j is the share of country i's exports with partner country j, and y_j is country j's real GDP growth. For most countries real GDP is retrieved from the IMF IFS database while some data stems from the OECD Stat data base. Bilateral export data is taken from the IMF DOTS data base.[21] In order to strengthen identification as explained in section 5.3, the foreign demand variable for Spain differs from the one above to the extent that y_j in this case does not denote foreign real GDP growth, but the growth rate of the level difference between real GDP and the real trade balance. Please find a more detailed description of the foreign demand variable and a list of the export partner countries in appendix A.3.

In general, the real effective exchange rate can be defined as the weighted average of the bilateral real exchange rates between a country i and its most important trade partners j as

$$REER_i = \prod_{j=1}^{n} \left(\frac{P_i S_{ij}}{P_j} \right)^{w_{ij}} \tag{12}$$

where n is the number of trade partners, w_{ij} are country specific weights and P is a price measure. According to this definition, and also generally in this thesis, an increase in the REER denotes an appreciation. As an input to this formula, it is a priori not clear which price deflator should be used, since all available measures are subject to certain limitations (Ca'Zorzi and Schnatz 2007). Since in the VAR model I intend to explain both imports and exports with the same REER, export prices and unit labour costs in manufacturing can be removed from the list of potential price and cost competitiveness measures, as they cannot properly explain imports. The remaining candidates are the consumer price index (CPI), the GDP deflator, the producer price index (PPI) and unit labour costs (ULC) in the economy as a whole.

The economy-wide ULC measure suffers in particular from the fact that it only reflects the labour cost component. Hence, it omits other input costs, taxes and profit margins (Harmsen et al. 2011). In addition, it is prone to revisions, such that Schmitz et al. (2013) conclude that this kind of cost measure is typically more affected by data quality issues than by price measures. Due to these considerable shortcomings, I do not consider the use of a ULC-based REER further.

Whereas a REER measure based on producer prices is viewed as a good proxy for tradable goods

[20] According to Zellner (1978) the aggregation of seasonal adjusted series produces data of higher value than the seasonally adjusted aggregate of not seasonally adjusted series.

[21] Since data on bilateral exports of goods and services is not available for all bilateral export relationships, I use exports of goods as a proxy for the computation of the export shares.

prices, besides problems with comparability across countries its main limitation is the exclusion of services prices (Schmitz et al. 2013). Since both exports and imports in my sample include services, it cannot properly explain all of the trade balance in the periphery countries. Therefore, I do not implement it in the model.

The most commonly used deflator to compute the REER is the CPI. It has the advantage of being applicable to both the trade of goods and services. However, drawbacks are the disproportional share of non-traded goods in the index, which omits prices of capital and intermediary goods, and its dependence on taxes and subsidies (Harmsen et al. 2011, Ca'Zorzi and Schnatz 2007). The latter also applies to the GDP deflator, which might therefore and due to different calculation methods be not perfectly comparable across countries (Ca'Zorzi and Schnatz 2007). However, in an effort to provide comparable REER measures, the Directorate-General for Economic and Financial Affairs (EcoFin) of the European Commission provides harmonised price deflators with respect to the CPI and GDP. Thus, for the periphery countries I retrieve data on the real effective exchange rate deflated by the Harmonised Index of Consumer Prices vis-a-vis a broad group of 42 trade partner countries and the real effective exchange rate using the GDP deflator as price index. The latter is computed as a weighted average for 37 partner countries.[22] Both series are seasonally adjusted using the X-13ARIMA-SEATS method.

For the baseline specification of the model the REER based on the GDP deflator is utilised. Compared to using the CPI deflator it has the advantage of being less affected by the strong home bias of consumption in the three periphery countries. However, the model is also estimated with the CPI-based REER as a robustness check.

5.3 Identification

Since the aim of this thesis is to obtain IRFs and FEVDs for the *structural* shocks of the vector ϵ_t from equation 8, I need to recover the underlying structural model after the estimation of the reduced form VAR model. As a necessary condition for doing so, an appropriate identification scheme needs to be implemented.

In this section I present the identifying restrictions and their economic rationale for the structural VAR model. With a set of n variables, $(n^2 - n)/2$ restrictions need to be imposed on the structural model for exact identification (Enders 2010). In my case of $n = 5$ this yields 10 restrictions. My set of short-run restrictions on the matrix B^{-1} is displayed in table 1. To improve the readability of the restrictions, column and row titles for the variables foreign demand (fd), domestic demand (dd), real effective exchange rate (reer), imports (m) and exports (x) are added. A zero entry in the table means that in the same quarter the variable of the column header has no contemporaneous effect on the row variable. A dot in the table denotes that the parameter at this position is estimated.

Although also other sets of identifying zero-restrictions were considered, the most suitable specification turned out to be in the form of a triangular Cholesky decomposition, which implies an ordering of the variables. Given the ten restrictions, from the estimated covariance matrix of the reduced form error terms in vector e_t and from the relationship $e_t = B^{-1}\epsilon_t$, the structural shocks can be recovered.

The implementation of the ten zero restrictions is motivated by economic theory. From the first row of the table it can be seen that foreign demand is contemporaneously exogenous. That is, I assume the effect

[22] For a more detailed description of these exchange rate series, please refer to the technical annex available from the Directorate-General EcoFin.

	fd	dd	reer	m	x
fd	1	0	0	0	0
dd	.	1	0	0	0
reer	.	.	1	0	0
m	.	.	.	1	0
x	.	.	.	.	1

Table 1: Identifying Short-Run Restrictions on the Matrix B^{-1}

of all other variables on foreign demand to be zero in the same quarter. In particular for small countries like Greece and Portugal this is a reasonable assumption, since their economic activities, above all, imports, domestic demand and the real effective exchange rate, cannot significantly affect the real GDP of their main export partners. The main channel by how this would be possible is through contemporaneously increased export production abroad. However, the resulting change in the GDP of the main export partners, mainly large economies, can be assumed to be negligible.[23] For completeness, it is not clear in which way exports could have an effect on foreign demand. The causality in this relationship goes vice versa.

For Spain as a country of intermediate size, it is possible that especially the effect of import demand on foreign demand (which could also initially be triggered by domestic demand or exports) is non-negligible. Although the impact is likely to be small, it might be significantly different from zero. This is the reason why for Spain instead of using foreign real GDP, the foreign demand variable is constructed as the weighted average of a domestic demand measure of the foreign partner countries. In particular, by subtracting the trade balance from real GDP for these foreign countries, foreign exports can no longer be affected by changes in the domestic demand of Spain. Subsequent changes in consumption or investment, if present, are assumed to only come into effect with a lag. With respect to identification, the domestic demand based measure of foreign demand is clearly superior to the real GDP based measure. However, it comes at the minor cost that the import demand for intermediate goods and services from foreign partner countries stemming from their exports cannot be accounted for anymore.

Next, consider the zero restrictions in the second row of table 1. While it is not clear why a change in imports should affect domestic demand, the possible spill-over effect from a change in exports on consumption and investment is assumed to be lagged. The reasoning behind the latter is that firms do not always operate at their capacity limit, which gives them room to change the output quantity in the short term in response to changes of foreign demand. For servicing extra demand, also existing stocks of goods can be used. Only if increased demand from abroad shows some persistence, it becomes rational for firms to undertake additional investments and to potentially hire new employees, which could lead to significantly more domestic consumption in response.

What is the contemporaneous effect of the real effective exchange rate on domestic demand? This question cannot be answered using regression analysis, due to endogeneity in the form of reverse causality.[24] Thus, I combine theory and empirical evidence to show that the effect is most likely very small and can thus assumed to be not significantly different from zero for the three periphery countries. Besides the already

[23] The assumption that a small country cannot affect the rest of the world is a common assumption not only in theory, but also in the previous VAR literature, see, for instance, Cushman and Zha (1997), Buckle et al. (2007) and Gossé and Guillaumin (2013).

[24] Domestic demand changes are likely to be accompanied by price changes, which affect the real effective exchange rate.

discussed effects of import and exports on domestic demand, which could also be caused by a change in the REER, now also the direct change in consumption behaviour after a change in the REER needs to be considered.

Thereby, in theory there are two opposing effects. With an appreciation, according to the *substitution effect* domestic demand falls, as foreign goods and services become relatively cheaper compared to domestic products. At the same time the *income effect* predicts that domestic demand increases. As foreign goods and services have become less expensive, and since consumption switching will be incomplete due to the imperfect substitutability of at least some goods, the expenditure share for foreign goods decreases. As a result, some of the previously used income can be spent on domestic goods. The relative magnitude of these effects is not clear. However, I argue that for the three periphery countries both effects and their sum are small in absolute terms.

The size of both the income and the substitution effect depend on the share of foreign products in domestic consumption. For Greece, Portugal and Spain this so-called home bias in goods and services is comparably high. Data for 2000 and 2003 show that in these countries more than 80% of all goods and services in domestic demand are domestic products and that this share remained almost constant over these three years (Balta and Delgado 2009). Moreover, imperfect substitutability of foreign goods with domestic goods, as, for instance, for petroleum, makes it unlikely that a one period shock in the REER can change the share of foreign goods and services in domestic consumption considerably.

Further evidence for this can be found in the literature about the transmission of exchange rate changes to consumer price inflation, which generally reveals very low effects in the short run (see Engel (2003) for an overview). According to Campa and Mínguez (2006), the pass-through of a change in the nominal effective euro exchange rate by 10% to consumer prices is only approximately 0.4% for all euro area periphery countries. In this context Fitzgerald (2008) argues that the main obstacle to the transmission is the rather invariant share of expenditure on home output.[25] The very small response of consumer prices to exchange rate shocks implies that domestic demand is affected very little, since otherwise prices would be affected more.

I conclude from the combined evidence on the large home bias and small magnitude of the response of import and consumer prices to exchange rate changes that the impact of changes in the real effective exchange rate on domestic demand is very small. For the estimation of the structural VAR model it is assumed to be insignificantly different from zero contemporaneously. A robustness test of the results with respect to this short run restriction is presented in section 7.1.

As depicted by the two zeros in the third row of table 1, I assume that changes in exports and imports do not contemporaneously affect the real effective exchange rate. Consider first a possible effect of the two trade variables on the relative price levels between trade partner countries and the home country. As discussed above, the pass-through of import prices to the domestic consumer price index is found to be low. Moreover it can be assumed to be lagged, due to only infrequent price changes decisions by firms (Fabiani

[25] To give another explanation how the transmission of exchange rate changes to domestic consumer prices is hindered, it is worth noting that both the income and the substitution effect rely on the assumption that with a change in the REER also relative prices between domestic and foreign goods change. This does not need to be the case if foreign producers chose a pricing-to-market strategy, in which the price of the goods (and services) is fixed in the export market. In a study about the five largest euro area economies, Warmedinger (2004) finds that the pricing-to-market effect is particularly strong for Spain in the contemporaneous quarter.

et al. 2006). The foreign weighted average of price levels is not likely to be affected by a change in the home country's exports for the same reasons. Regarding nominal exchange rates, only a fraction of trade matters for a particular bilateral relative price of currencies, which makes the effect, if there is one, very small. In addition, since for most of my sample period the periphery countries are part of the euro area, their individual impact on the external nominal euro exchange rate can assumed to be negligible for Greece and Portugal, but it is also very limited for Spain.

Last, I focus on the contemporaneous relationship between exports and imports. The ordering of these two variables is not immediately clear, since both are likely to move simultaneously, for instance in reaction to a change in the REER. In case of a pure domestic demand shock, besides the expected effect on imports, also exports might respond. If foreign demand changes, it is likely that exports respond, but also intermediate good imports for export production might react.

Thus, the contemporaneous zero restriction for the effect of exports on imports, where I assume the latter production process to be less important, should be seen as provisional. However, it is important to note that the ordering of exports and imports does not influence the IRFs for exports and imports from shocks to domestic demand, foreign demand and the REER. Since I am primarily interested in the effect of the latter on the trade balance, the corresponding results are not affected by the zero restriction of exports on imports.

5.4 Diagnostic Tests and Model Specification

Before the structural VAR model with the data and identification scheme described above is estimated, a series of diagnostic and model specification tests is performed. Using the Dickey-Fuller-GLS test on the variables in levels, the existence of a unit root cannot be rejected to the 5% significance level for any lag length up to 8 lags for any of the variables for Greece, Portugal and Spain.[26] With the aim of obtaining stationary series, I transform all series into first differences, that is, quarter over previous quarter growth rates.[27] Using these series, after all VAR estimations performed in the subsequent analysis the stability condition that all eigenvalues lie inside the unit circle is fulfilled.[28]

From visual inspection I find the variance of Greek export and import growth to be non-stationary (see figure 7). After sizeable fluctuations in in the second half of the 1990s, the variance of these two series becomes smaller and roughly constant from about 2001 onwards. Moreover, I detect irregularities in the export and import shares of GDP from the years 1997 and 1998 for Greece. As a result of both observations, I restrict the data sample (in levels) for Greece to the period from 2000q4 to 2014q3, which leaves 56 data points. For Greece, Portugal and Spain the five time series in first difference which are used for the estimation of the baseline model are displayed in the figures A.4, A.5 and A.6 in the appendix.

[26] As I only have data in first difference for foreign demand, I construct an index as the level variable.

[27] Note that letting the REER enter into the VAR model in levels, that is, as an index, is not considered. Besides its non-stationarity, the magnitude of its change would be rather arbitrary.

[28] Checking for stationarity of the individual transformed series, for Portugal and Spain all series except domestic demand are indicated to be stationary. For Greece only the REER series remains non-stationary. However, this does not violate the joint stability of the system.

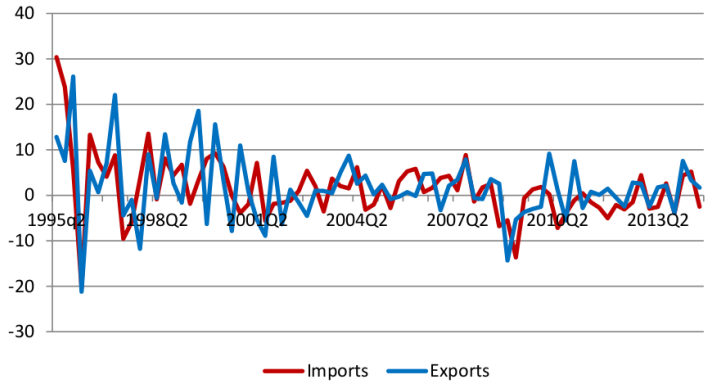

Figure 7: Greek Exports and Import Series in First Difference (in %)
Source: Eurostat

In order to choose an appropriate lag length for the VAR model, first the Akaike and the Bayesian Information Criteria as well as Likelihood-Ratio tests are considered. However, for all three countries, with one exception, the indicated lag lengths are either not consistent for different maximum lag lengths, for which the criteria and tests are employed, or they are economically not plausible.[29] As an example of the latter, the Bayesian Information Criterion persistently selects zero lags in the cases of Spain and Greece. Such a model specification would only capture the true data properties if past changes in variables had no effect on present changes. This is unrealistic. In general, with quarterly data, including p lags in the model implies that the variables in the system can be affected by shocks which occur during the previous p periods. Since it seems reasonable to assume that variables are affected by shocks occurring in the past year, I consider four lags for my baseline model.[30]

As another important diagnostic check, it needs to be ensured that no autocorrelation remains in the residual series for the chosen lag length. If this condition is not fulfilled, the estimates of the VAR model are likely to be biased. In a first approach to test for remaining serial correlation in the residuals I apply a Lagrange Multiplier (LM) test that uses an asymptotic χ^2-distribution to determine the critical values (adjusted for the according degrees of freedom). As one outcome, for Portugal the null hypothesis of no serial autocorrelation in the residuals is rejected to the 5% level for the 3rd lag of the residual series (using the baseline model lag length of 4). However, for higher lag lengths there is no such issue to the 10% level anymore. As another observation from this LM test, for Spanish and Greek data augmenting the estimated VAR model with four lags by more lags does not completely eradicate the potential problem of remaining serial correlation as expected.[31]

However, it needs to be taken into account that the critical values of the asymptotic χ^2-distribution are most likely oversized, that is, the critical values are too small. As a result, it is possible that they suggest autocorrelation to be present even if that might actually not be true. To cope with this shortcoming, I bootstrap critical values for the LM test.[32] Comparing the latter to the LM test statistic obtained from

[29] An exception is the BIC suggestion of one lag for Portuguese data. After estimating the VAR model for Portugal with this specification, I dismiss it due to remaining serial correlation in the residual series.

[30] Restricting the maximum lag number to 4, also the LR test selects this lag length.

[31] For some model lag length between 4 and 8, the null of no autocorrelation is rejected to the 10% level for Spain for one residual lag, respectively. For Greece in the same model lag length range there is a limited number of residual lags for which the null of no autocorrelation is rejected to the 5% level.

[32] In this bootstrapping procedure with replacement first an artificial data sample using the estimated VAR and the resulting

the actual data sample, for 4 model lags in the case of Portugal I can confirm the rejection of the null hypothesis of no remaining serial autocorrelation to the 5% level for three residual lags out of the total of 40 autocorrelation lags (up to residual lag length 8, for the five estimated equations). In addition I can show that for Spain in total there remains merely a single autocorrelation lag for one equation, for which the null of no autocorrelation can only be rejected to the 10% level, considering 5, 6 and and 7 model lags. For Greek data, the bootstrapped LM test statistics show that in fact overall there is only one remaining residual lag in the above described set of 40 lags for which the null of no autocorrelation is rejected to the 5% level, for 5, 6 and 7 model lags. Since for Spain and Greece, there is no issue with remaining serial correlation to the 5% level for 4 model lags, I keep my initial lag length choice for these countries. For Portugal I decide to use 5 lags, for which no remaining serial autocorrelation in the residuals is detected.

5.5 Construction of Impulse Response Functions for the Trade Balance

A major interest of this econometric exercise is to derive the responses of the trade balance to shocks from domestic demand, foreign demand and the REER. This can be done using the IRFs of exports and imports. For the according aggregation, the following formulas are established. The trade balance TB in % of GDP at time t can be defined as

$$TB_t = \frac{X_t - M_t}{Y_t} \tag{13}$$

where X, M and Y denote exports, imports and output in levels. Computing the total differential of this equation yields the change in the trade balance dTB

$$dTB_t = \frac{dX_t - dM_t}{Y_t} - \frac{(X_t - M_t)dY_t}{Y_t^2} = \frac{X_t}{Y_t}\frac{dX_t}{X_t} - \frac{M_t}{Y_t}\frac{dM_t}{M_t} - \frac{(X_t - M_t)dY_t}{Y_t^2} \tag{14}$$

Assuming trade to be balanced[33], that is, $(X_t - M_t) = 0$, this expression simplifies to

$$dTB_t = \frac{X_t}{Y_t}\left(\frac{dX_t}{X_t} - \frac{dM_t}{M_t}\right) \tag{15}$$

If the shock occurs in period $t = 0$, to derive the values of the *cumulative* IRFs for the kth step ahead for the trade balance in % of GDP, I compute

$$dTB_t = \frac{X_t}{Y_t}\left(\sum_{t=0}^{k}\left(\frac{dX}{X}\right)_t - \sum_{t=0}^{k}\left(\frac{dM}{M}\right)_t\right) \tag{16}$$

whereby $\left(\frac{dX}{X}\right)_t$ and $\left(\frac{dX}{X}\right)_t$ are the impulse responses to a shock on exports and imports. Hence, in essence inside the brackets I subtract an approximation of the area up to period k below the IRF for imports from

residual is generated. This results in a dataset with the same statistical properties as the original dataset. From 5000 replication of this step I obtain sets of simulated residual series for each of the 5 error terms of the VAR. For the latter series, the LM test statistic is computed up to 8 lags of the residual autocorrelation. For each of the 8 lags of the 5 residual series I order the 5000 LM test statistics and I obtain the critical values as the 95% percentile of these distributions, which would asymptotically yield χ^2-distributions.

[33] This assumption is not only convenient, but it also describes a relevant case of policy analysis, as trade was (nearly) balanced in all three periphery countries in recent years.

the same approximated area below the IRF for exports. The cumulative IRF shows the total effect of a shock to the trade balance k quarters after the shock.

In addition, information on the export share of GDP, $\left(\frac{X_t}{Y_t}\right)$, for the case of balanced trade is needed. As approximations, I use export shares of the quarters in which the trade balance in % of GDP is closest to zero within the sample. For Spain this is in 2000q4 and 2011q1 with -0.04 and 0.08% of GDP, respectively. The according export shares are 25.7% and 27.6%. When computing the IRF for the trade balance, I use the latter number. However, the average of these two numbers, which is 26.6% is also used for comparison. The time periods in which trade is closest to be balanced for Greece is in 2014q3 with 0.70% of GDP and in Portugal in 2012q4 with 0.09% of GDP. The corresponding export shares are 30.7% and 35.3%. Since exports and imports shares have generally grown in these countries over time, the latter approximations are most suitable for analysing the effects of shocks to the trade balance in more recent years. To possible explain the the emergence of the trade deficits between 2004 and 2008 more accurately, I use as the hypothetical export share, for which trade is balanced, the average between the actual export and import shares of GDP in these four years. This yields 27.2% and 32.1% for Greece and Portugal, respectively.

5.6 Confidence Bands

The confidence bands for the IRF of all variables, including the trade balance, are obtained in a bootstrap process: after estimating the unrestricted VAR model, bootstrapping with replacement is applied to generate an artificial data sample using the estimated VAR and the resulting residuals. This results in a dataset with the same statistical properties as the original dataset. In the related literature a large number of replications for bootstrapping confidence intervals around IRFs is recommended (see, for instance, Efron and Tibshirani 1994). Following Lütkepohl et al. (2015), I choose 5000 replications. Using the 5000 simulated VAR data sets, IRFs are computed and ordered from smallest to largest. The upper and lower bound of the 95% confidence interval around each IRF point estimate (derived from the actual data) can then be obtained as the 97.5% and 2.5% percentiles of the set of simulated IRFs. An adjustment of the upper and lower bound for small sample bias is undertaken by correcting for the difference between the point estimate for the IRF from the actual data and the median of the bootstrapped IRFs.[34]

6 Results

6.1 Impulse Response Analysis

Using the identification scheme and the model specification described above, I obtain the baseline impulse response functions for structural shocks of one standard deviation to foreign demand, domestic demand and the REER on all other variables. While the responses of foreign and domestic demand as well as for the REER can be found in figures A.7, A.8 and A.9 of the appendix, figures 8, 9 and 10 below display the impulse response functions for exports (x), imports (m) and the trade balance (tb) with respect to shocks from foreign demand (fd), domestic demand (dd) and the REER (reer). The latter is based on the GDP

[34] Selective visual inspection of the sets of simulated IRF kth step ahead function values confirms that the simulated data for each set seems approximately normally distributed.

deflator in this baseline specification of the model. The solid blue lines are the point estimates of the IRFs, while the red dotted lines mark the boundaries of the 95% confidence interval. The impulse responses of the trade balance presented here are cumulative and they calculated using the export shares of GDP for the balanced trade cases in recent years, as this is considered to be the most relevant case for policy making.[35]

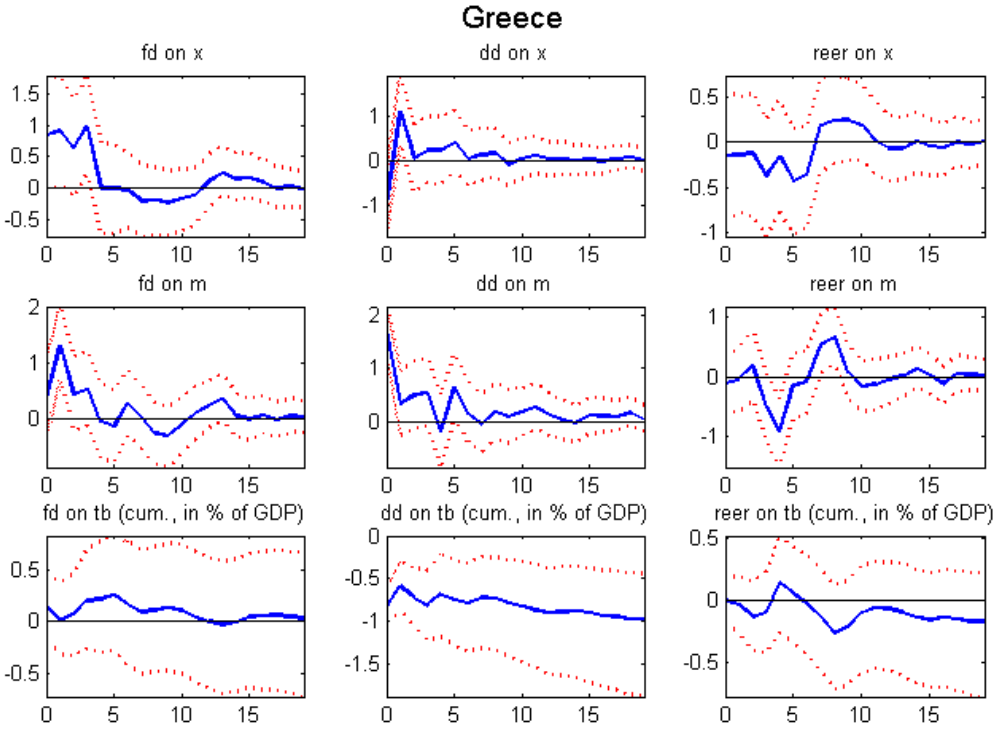

Figure 8: Baseline Impulse Response Functions for Greece.

Notes: The impulse variables are foreign demand (fd), domestic demand (dd) and the real effective exchange rate (reer). The response variables are exports (x), imports (m) and the trade balance (tb). The time horizon on the x-axis is 20 quarters. The shocks are one standard deviation in magnitude and the responses on the y-axis are in percentage points for export and import responses. The blue solid lines are the point estimates, while the red dotted lines depict the 95% confidence bands.

[35]The difference between the IRFs obtained for the export share of recent balanced trade and the generic one for the pre-crisis period between 2004 and 2008 is practically zero for all trade balance responses of Portugal and Spain. For Greece the negative response of domestic demand for the export share of the pre-crisis period is approximately 0.1 percentage points of GDP smaller (after 20 periods) than the one of recent years.

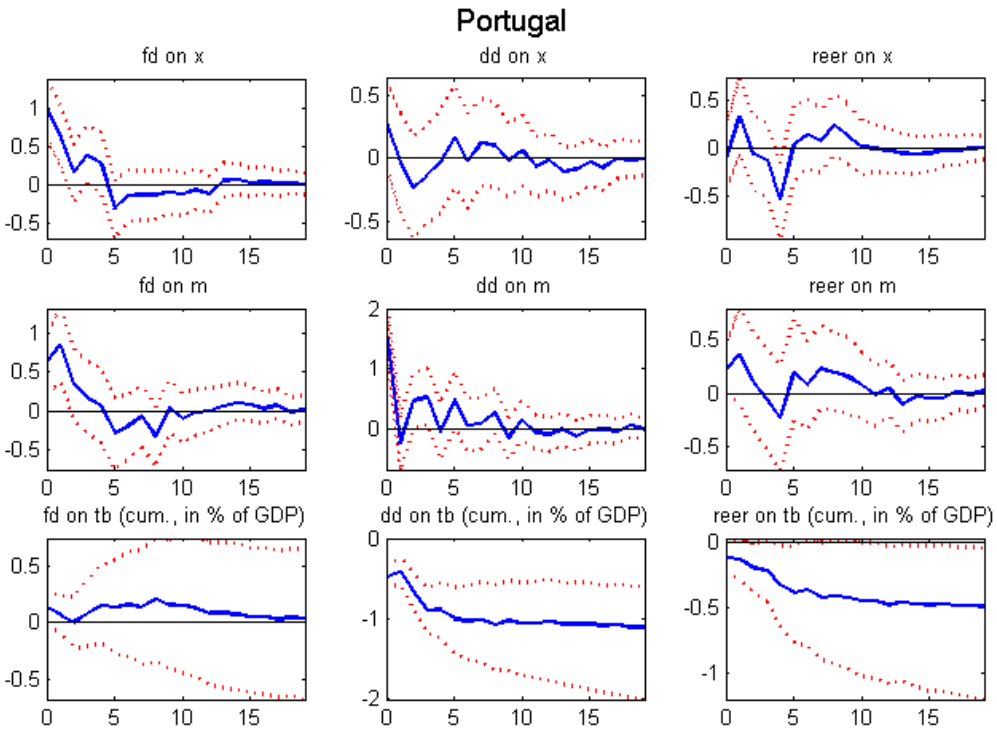

Figure 9: Baseline Impulse Response Functions for Portugal.

Notes: The impulse variables are foreign demand (fd), domestic demand (dd) and the real effective exchange rate (reer). The response variables are exports (x), imports (m) and the trade balance (tb). The time horizon on the x-axis is 20 quarters. The shocks are one standard deviation in magnitude and the responses on the y-axis are in percentage points for export and import responses. The blue solid lines are the point estimates, while the red dotted lines depict the 95% confidence bands.

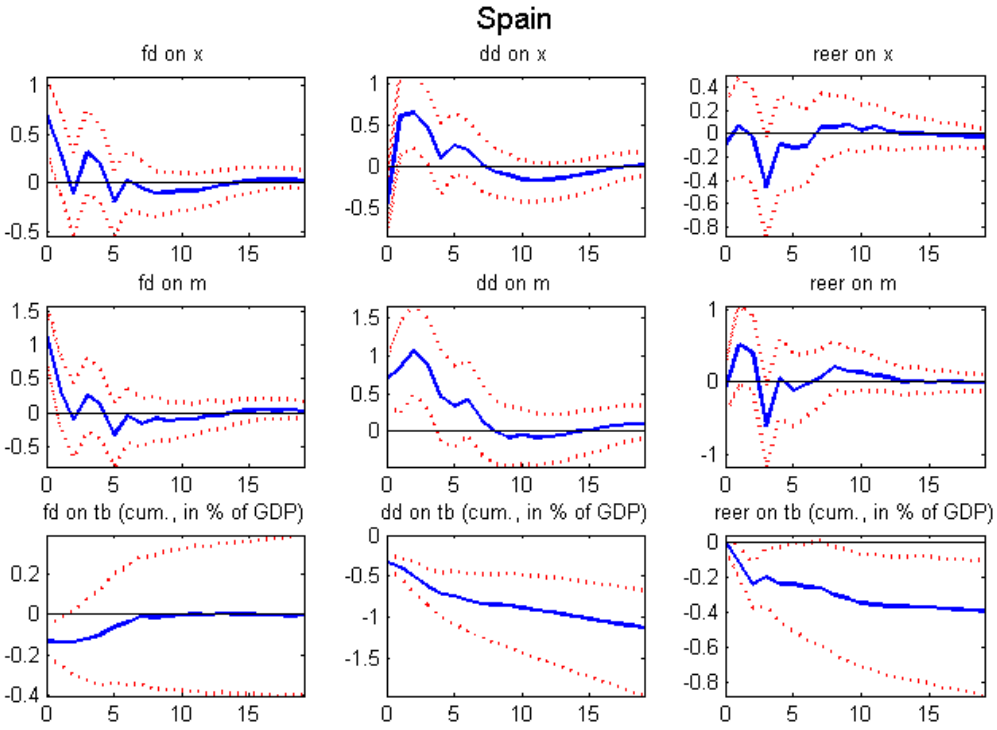

Figure 10: Baseline Impulse Response Functions for Spain.

Notes: The impulse variables are foreign demand (fd), domestic demand (dd) and the real effective exchange rate (reer). The response variables are exports (x), imports (m) and the trade balance (tb). The time horizon on the x-axis is 20 quarters. The shocks are one standard deviation in magnitude and the responses on the y-axis are in percentage points for export and import responses. The blue solid lines are the point estimates, while the red dotted lines depict the 95% confidence bands.

Overall the signs of the impulse responses are in line with theoretical expectations. The main results from these figures are that (1) domestic demand has a significant negative impact on the trade balance for all three countries, (2) the REER matters only to a smaller extent for Portugal and Spain and (3) foreign demand is not found to significantly affect net exports. The origins of these findings are explored in detail in the following.

To start with, it can be seen that a one standard deviation shock of foreign demand has a significant positive effect in at least one quarter in the first year after the shock for all three countries. The magnitude of the export response is about 1% for Greece and Portugal and roughly 0.7% for Spain. This is in line with the results from comparable studies, which use reduced form exports equations (see, for instance Christodoulopoulou and Tkacevs 2014 and Comunale and Hessel 2014). Interestingly, foreign demand also causes a significant increase in imports for all three countries, which is even higher than the export increase for Greece and Spain. Since foreign demand is usually not included in import regressions, this is a rather novel result. What might cause it?

The most obvious explanation is the import content in exports discussed in section 4. However, given figure 6 one would expect an increase of imports in response to foreign demand by no more than 40% of the increase of exports. Allowing for a possible increase of this ratio after 2005, and considering estimates on the import elasticity of foreign demand by Christodoulopoulou and Tkacevs (2014), this figure could be as high as 56% and 70% for Greece and Spain, respectively.[36] Nevertheless, the export channel cannot explain the entire increase of imports after the foreign demand shock.

Thus, it is worth considering the effect of foreign demand on domestic demand, which is significantly positive at around 0.25 percentage points for Greece and 0.2 percentage points for Portugal and Spain (see appendix figures A.7, A.8 and A.9). This effect can potentially be explained by financial transmission mechanisms and for the lagged response by a positive income and investment effect of exports.[37] Given the increase in domestic demand, imports are expected to rise as well. To derive the according effect on imports, I use the contemporaneous import elasticities of domestic demand, expressed in standard deviations of domestic demand. They are approximately 1.3, 2.1 and 1.5 for Greece, Portugal and Spain, respectively. These numbers are obtained from dividing the contemporaneous effect of domestic demand on imports by the standard deviation of domestic demand. Multiplying the contemporaneous effects of foreign demand on domestic demand above with these elasticities yields approximately 0.3 for Greece and Spain and 0.4 percentage points for Portugal. These are the indirect effects of foreign demand via domestic demand on imports. Adding the latter effects to the (maximum) indirect effect of the import content of exports yields roughly the magnitude of the contemporaneous and short run responses of imports to a foreign demand shock.[38]

[36] Christodoulopoulou and Tkacevs (2014) find the import elasticity of goods with respect to exports for Greece, Portugal and Spain to be highly significant and approximately 0.35, 0.45, and above 0.64, respectively. For imports of services, the elasticities are 1.12 and 0.33 for Greece and Spain, while it is insignificant for Portugal. Using the average shares of exports of goods and exports of services from section 2.3 as weights, I obtain roughly 56% for Spain and 70% for Greece. As additional results from Christodoulopoulou and Tkacevs (2014) for Portugal the elasticity of imports of services with respect to foreign demand is significant and around 1. For Spain this elasticity is as high as 1.76. These results originate from a regression in which domestic demand and a CPI-based measure of relative price competitiveness are included. The data set ranges from 1995 to 2013.

[37] For more evidence on the origin of the effect of foreign demand on domestic demand, see section 7.3.

[38] Although the effect of foreign demand on the REER are small in the first three periods, in particular for Greece the significant negative effect on the REER might also contribute to a small amount to the increase in imports due to higher export

However, there is a possibility that the high first quarter response of imports to foreign demand for Greece is still not be completely explained. Due to the uncertainty of the exact import content of exports, it might be the case that the export and domestic demand channel combined can not fully account for the total change in imports. In particular, there may be factors that affect both foreign and domestic demand simultaneously. To explore the impact of common oil price shocks as a possible cause of this, in section 7.4 I include an oil price index in an extension to the baseline model.

Considering the impact of the foreign demand shock on the trade balance, the according cumulative IRFs show that the effects are close to zero and insignificant for all three countries, except for Spain up to the first period, where there is even a small negative effect. This finding is rather unexpected given theoretical considerations. Whereas the import content of exports was assumed to reduce the impact of foreign demand on net exports, its response was still expected to be positive. However, the result of this IRF analysis confirms a similar outcome of Comunale and Hessel (2014) who use a data set of comparable variables and who also do not find a significant effect of foreign demand on the trade balance (which they include as one variable) in their panel error correction model for all euro area countries. As an advantage of using a structural VAR model, it can be shown that the zero response of the trade balance can be explained with the effect of foreign demand on domestic demand, which in turn increases imports. Figure 11 summarizes the channels of how foreign demand affects the trade balance.

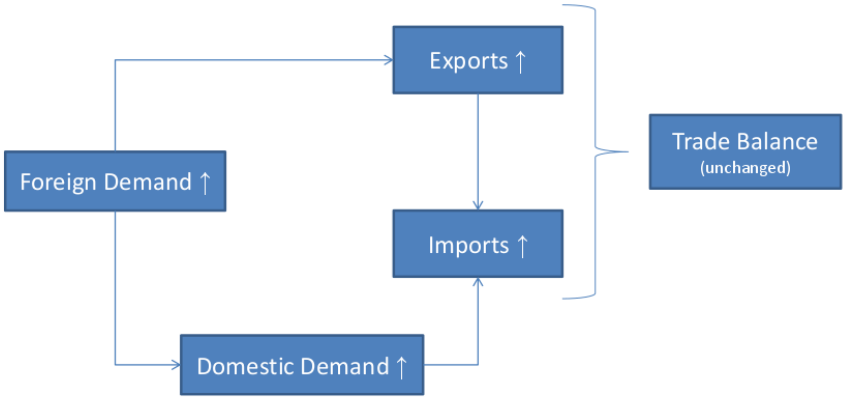

Figure 11: Impact of a Foreign Demand Shock in the Baseline Model

Next, I analyse the impact of a domestic demand shock. The contemporaneous negative response of exports for Greece and Spain confirms previous findings of Christodoulopoulou and Tkacevs (2014), based on the theoretical explanation of supply sided constraints of exporting firms. For Portugal this effect was first detected in the recent literature by Esteves and Rua (2015). I can confirm the negative relationship between domestic demand and exports for this country as well. However, with my data the export drop only comes into effect with a lag and it is not significant. For Greece and Spain, after the period of the shock there is as significant positive effect of domestic demand on exports of approximately 1 and 0.5 percentage points, respectively. This lacks a priori a theoretical underpinning. However, for Spain domestic demand has a lagged and positive significant effect of around 0.2 percentage points on foreign demand. In a similar way

demand.

as above for the import elasticity for domestic demand, I determine the Spanish export elasticity of foreign demand to be around 2.6. The total domestic demand induced effect of foreign demand on exports is thus approximately 0.5 percentage points. Hence, the increase of exports after the domestic demand shock can be explained by the foreign demand feedback of the domestic demand shock.[39]

However, for the peak of Greek exports after the domestic demand shock a similar logic does not apply sufficiently, since the lagged response of foreign demand to domestic demand is below 0.1 percentage points. Given the approximate export elasticity in standard deviations of foreign demand of 2.6, no more than 0.25 percentage points of the increase in exports can be explained. Again, confounding factors in the data such as the oil price might play a role in this context. Moreover, in an analysis of export supply factors and the relationship to the business cycle, Belke et al. (2015) also find a some complementary relationship between domestic demand and exports for Greece.

With regard to the reaction of imports to a domestic demand shock, as expected there is a strong and significant positive response visible from the IRFs of all three countries. Whereas this effect is only contemporaneously large for Greece and Portugal and thus short-lived, in Spain it is contemporaneously somewhat lower, but significant through the first three periods. The according point estimate only reaches the zero level almost 2 years after the shock occurred. This reflects a high persistence of the domestic demand shock in Spain, which is also visible from figure A.9. This hints at the existence of positive feedback effects, which could stem amongst others, from rising construction as the housing bubble emerged and from the substantial immigration to Spain of more than five millions individuals between 2000 and 2008 (Nicodemo 2013). Focusing on the effect of the one standard deviation domestic demand shock on the trade balance, for all three countries the IRFs show consistently a negative and significant cumulative effect of around 1% of GDP three years after the shock. Using the country-specific standard deviations of domestic demand of 1.2, 0.7 and 0.4 percentage points for Greece, Portugal and Spain, respectively, this means that a permanent change in the growth rate of domestic demand by 1 percentage point is estimated to change the trade balance of these three countries in the opposite direction by approximately 0.8%, 1.4% and 2.5% of GDP.

How does price competitiveness measured by the REER based on the GDP deflator affect exports, imports and the trade balance? In line with theory, given an appreciation, with some lag exports in all three countries fall (by less than 0.5 percentage points). In contrast to these other countries, for Greece this effect is not significant. The increase of exports in the first quarter after the shock for Portugal might be due to a value effect, which would imply that foreign clients only reduce their imports from Portugal with some inertia.

Regarding imports, the magnitude of the responses differs between the three countries. While for Portugal and Spain imports first rise in line with expectations, both Greek and Spanish IRFs show a substantial decline of imports in reaction to an appreciation (which is significant for Greece). Part of it can again be explained by falling exports. In addition, the drop in imports indicates that the expenditure switching effect from domestic to foreign goods seems almost irrelevant in these countries, possibly due to a home bias. The decrease in domestic demand after the REER shock of 0.3 for Greece signals a negative income effect, which helps explaining the drop in imports. Using the domestic demand elasticity for imports

[39]Note that the effect of domestic demand on the REER are very small in the first three periods, which makes an effect from this side rather irrelevant.

of 1.3 reported above can explain up to 0.4 percentage points of the import reduction. Moreover, also foreign demand reacts to negatively to the REER shock, by around 0.15 percentage points. Hence, given a an important elasticity of foreign demand (with one lag) of approximately 3.0 the remainder of the import drop is due to the foreign demand feedback. However, a concise explanation of the negative response of Spanish imports remains to be given. Interestingly, comparable results from a reduced from estimation by Christodoulopoulou and Tkacevs (2014) show a negative effect for a REER appreciation on imports of services for Spain, and insignificant effects on imports and goods for all three countries. Furthermore, in samples of different European countries, Dieppe and Warmedinger (2006) as well as Giordano and Zollino (2014) find a negative effect of a real appreciation on imports as well.

Turning to net exports, for Greece the effect of the GDP deflator based REER on the trade balance is basically zero and insignificant. This is an interesting result, given the debate in some of the literature and in politics after the European Sovereign Debt Crisis about the need for the country to pursue an internal devaluation in order to improve price competitiveness and thus the trade balance. This seems in fact at least in the medium term to be a rather ineffective strategy. The cases of Portugal and Spain are different, as there the cumulative IRF for the trade balance suggests that the REER does affect the trade balance inversely as expected in theory. A one standard deviation increase in the REER lets the trade balance deteriorate by 0.5 and 0.4 percentage points of GDP for Portugal and Spain, respectively. Expressed differently, a one percent increase in the growth rate of the REER is estimated to have a negative effect of approximately 0.8 and 0.6% of GDP on net exports. Thus, the appreciation of the REER before the crisis seems to have contributed to the deterioration of the trade balances of these two countries, while a depreciation of the REER can most likely help improve it.

6.2 Forward Error Variance Decomposition

Besides the graphical analysis of IRFs, the according estimates also allow to conduct a forward error variance decomposition (FEVD), which is also known as *innovation accounting*.[40] Thereby, the kth step ahead forecast error variance is decomposed into the components which are due to the different shocks in the system. Thus, the FEVD can be used to compute the proportion of the movement in a series that is due to its own shocks versus the parts that are due to shocks from the other variables (Enders 2010). In this way, the relative importance of the shocks to a response variable are determined.

Since the shocks stemming from exports and imports cannot adequately be identified, these part of the forecast error variance cannot be further examined. However, the relative contributions of foreign demand, domestic demand and the REER are available. By normalising their joint share in the forecast errors to one, the relative contribution of these three shocks to the forecast error variance of trade balance can be calculated.[41] For the exact procedure, see appendix A.4. Figure 12 shows the according shares for a forecast horizon of 40 periods.

[40] For the formal derivation of the FEVD, see Lütkepohl 2005, chapter 2.3.3.

[41] Since here I need the simple (non-cumulative) IRFs for the trade balance, I construct the according $(h \times 1)$ vectors by subtracting the IRF value for the kth step ahead from the value of the $(k+1)th$ step ahead, for $k = 1, ..., h-1$.

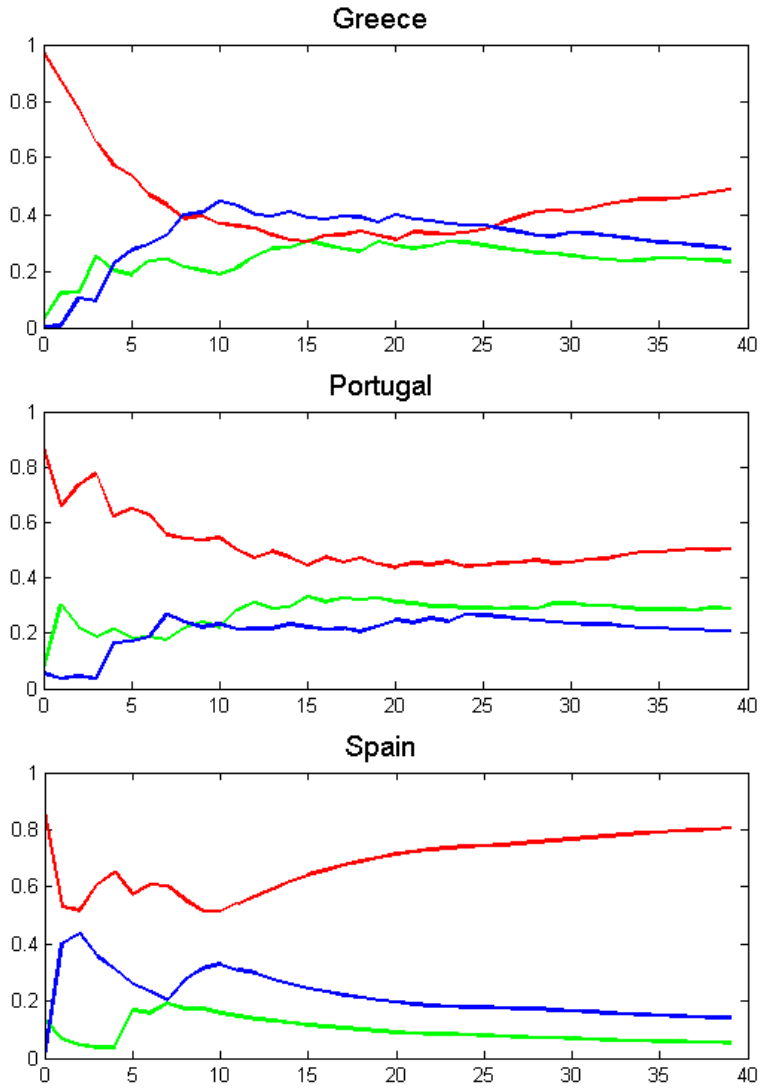

Figure 12: Forward Error Variance Decomposition: Relative Contributions of Shocks to Foreign Demand (Green), Domestic Demand (Red) and the REER (Blue) to Their Joint Portion of the Forecast Error Variance of the *kth* Step Ahead Forecast of the Trade Balance

Before interpreting these graphs, it is important to note that almost all significant effects and considerable movements in the baseline IRFs for imports and exports take place in the first 10 periods after the shock. Hence, the relative contributions of shocks to the forecast error variance of the trade balance is also most important within this time horizon.

From figure 12 it can then be seen that in the first 7 step ahead forecasts in all three countries the domestic demand shocks are clearly dominating. Their contribution falls over time from very high initial levels. For Portugal and Spain the domestic demand shock is most influential for all time horizons considered. After 40 periods its relative share stand at 50% for Portugal and, after a rally, at 80% for Spain. For Greece, despite its insignificant effect on the trade balance in the according IRF, the contribution of the REER temporarily becomes the highest out of the three shocks. However, when this occurs, the absolute importance of the three shocks is already quite small. For Spain the REER shock's relative contribution is most important in the first periods after the shock, while it remains modest for Portugal. The low relevance of foreign demand is especially visible for Spain, whereas for Greece and Portugal it becomes slightly more

relevant for higher time horizons.

As a potential limitation to the informative value of this analysis, the possibility that the combined share of the shocks of foreign demand, domestic demand and the REER in the forecast error variance of the trade balance is small cannot be rejected. Albeit rather unlikely, this would imply a high degree of exogeneity of the trade balance, that is, its "own" shocks would dominate the forecast error variance of the trade balance. To cope with this, as a robustness check I set up a slight variation of the baseline model. In particular, exports and imports are replaced by the single variable of the trade balance in percent of GDP (in levels). Therefore, the vector y_t from the baseline model in equation 8 can now be written as the (4×1) vector $y_t^{TB} = [fd, dd, reer, TB]'$, where TB denotes the trade balance in % of GDP. Regarding pre-testing and model specification, the LM-test suggests that remaining autocorrelation in the residuals is of no concern and that all VAR models satisfy the stability condition.

Based on the according IRFs, the FEVD with respect to the trade balance for the four shocks of foreign demand, domestic demand, the REER and the trade balance itself for Greece, Portugal and Spain and selected time horizons are displayed in table A.1 in the appendix. In general, the comparability of these results with the ones obtained from the baseline model might not be perfectly granted due to the different model specifications. However, regarding the contribution of the forecast error variance of the trade balance to its "own" shocks, the new results can be informative. They suggest that the trade balance is to some degree rather exogenous in the short term, especially for Greece and Portugal, with shares in the forecast error variance of approximatley 30% and 40% in the first step ahead forecast. With longer forecast horizons of 4 quarters and more also the trade balance for the latter countries becomes highly endogenous. This provides evidence that the combined share of the three shocks form foreign demand, domestic demand and the REER, on which the FEVD of the baseline relied, is not insignificant.

7 Robustness and Extensions to the Model

7.1 Robustness With Respect to the REER Measure and One Identification Restriction

As discussed in section 5.2, for determining export and import behaviour there is no consensus on the best price competitiveness indicator. Therefore, after using the REER based on the GDP deflator for the baseline model, as a robustness check I compare the baseline results with the IRFs from employing the CPI-based REER measure. The latter can be found in appendix A.10, A.11 and A.12. The main conclusion from this exercise is that the baseline results are very robust to the change in the measure of price competitiveness. The IRFs are almost identical. The only very slight difference is the somewhat more pronounced effect of the CPI-based REER on the trade balance for Greece and Spain. The point estimates of the cumulative trade balance response after 20 periods shifts downwards by 0.1 to 0.2% of GDP. Whereas this does not change the insignificance of the effect of the CPI based REER on the trade balance in the case of Greece, for Spain the CPI based measure of price competitiveness confirms that the REER has a significantly negative total effect on the trade balance.

Furthermore, another robustness check is conducted concerning one particular identifying restriction.

Whereas in section 5.3 it is argued that the contemporaneous effect of a shock to the REER on domestic demand is likely to be small, the possibility that it is different from zero could not be ruled out. In order to determine if a small positive or negative value instead of a zero for this restriction would cause a change in the baseline results, similarly to Beetsma et al. (2008) I explore a grid $[-0.2, -0.15, -0.1, -0.05, 0.05, 0.1, 0.15, 0.2]$ of possible values for this parameter. The according IRFs are then compared to the baseline results. I find that baseline impulse responses of exports, imports and the trade balance are robust to changes of the different values of the grid. For all three countries, from visual inspection the only difference that appears for the maximal and minimal parameter values of the grid concerns the responses of imports and exports to a REER shock, which change slightly in the first two periods, and for Portugal also minimally thereafter.

7.2 Robustness with Respect to Cointegration

In this section, the robustness of the baseline results is tested by allowing for cointegration relationships between the variables of the system. If cointegration is present, the estimates from the model in section 5.1 might be biased. To see why, note that by using some algebra, the VAR model in reduced form from equation 9 can be rewritten as

$$\Delta y_t = A_0 + \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma \Delta y_{t-i} + e_t \tag{17}$$

where $\Pi = \sum_{j=1}^{p} A_j - I_k$ and $\Gamma_i = -\sum_{j=i+1}^{p} A_j$. I_k denotes the (5×5) identity matrix.

Engle and Granger (1987) show that if the variables in vector y_t are I(1), the matrix Π has rank $0 \leq r < K$, where r is the number of independent cointegrating vectors. If the variables in the system cointegrate, then $0 < r < K$ and it can be seen from the equation 17 that the estimates of the VAR in first difference will be biased due to the omission of the lagged level term Πy_{t-1}.

The model in equation 17 also has an error-correction interpretation, which is why it is commonly referred to as a vector error correction model (VECM). The following analytical steps to estimate this model follow the procedure of Johansen (1995). To begin with, using the Dickey-Fuller-GLS test, all variables of the baseline model in levels are found to be unit root processes for all countries.[42] In order to find out if cointegrating relationships exist, the trace test is applied to the level variables. In this way, I find the number of independent cointegrating vectors for Greece and Spain to be 4 and for Portugal to be 1. As for this test, in the subsequent estimation the same lag lengths are used as for the baseline model. Further, the VECM requires at least r^2 identification restrictions. For the estimation of the model in equation 17, the conventional Johansen restrictions are applied. Moreover, diagnostic tests are conducted after the preliminary estimation. Firstly, the eigenvalue stability condition appears to be fulfilled, and the number of imposed unit moduli confirms the correct determination of the number of cointegration relationships Secondly, the null hypothesis of no remaining serial autocorrelation in the residuals of the VECM cannot be rejected at conventional significance levels.[43]

[42] Thereby, all variables are expressed in index form with the value in 2010q1 being 100. The reason for this is that I do not have data on foreign demand in absolute levels, but only in quarter-on-quarter growth rates.

[43] Moreover, all residuals from the cointegration relationships are also indicated to be white noise, except for one cointegration relationship for Spain. The joint Jarque-Bera test for the null hypothesis of normally distributed disturbances for all equations is not rejected at the 5% level for Greece and Portugal. In the case of Spain, only for the domestic demand equation normality

Whereas in principle also the long run equilibrium between the variables and and short-run adjustment processes could be studied in this cointegration framework, this section focuses on comparing the impulse responses from the VECM with their baseline counterparts. The IRFs for Greece, Portugal and Spain from the VECM are reported in appendix A.13, A.14 and A.15, respectively. Their derivation is the same as for the IRFs of a VAR(p) model, once the coefficients matrices A_i for $i = 1, ..., p$ are recovered. The according procedure is shown in appendix A.5.

The main findings from comparing these impulse responses with the ones from the baseline structural VAR model are twofold. First, the IRFs from the two models are very similar in their shape. Second, in the IRFs from the VECM both positive and negative effects are generally indicated to be greater in magnitude in both directions. The scaling factor seems to depend on the magnitude of the response from the baseline model. This implies that a bias from the omission of the cointegration term is present. However, it seems to affect the impulses of exports and imports for a given shock in a fairly similar way. Hence, the IRFs for the trade balance in the baseline model are less affected by the individual biases for exports and imports, such that they are at least qualitatively and in most cases also quantitatively accurate.

In general, the IRFs from the VECM are not well suited to show the total effect of a shock over time. To understand the reason for this, note that in contrast to the IRFs of the structural VAR model, it can be seen from figures A.13, A.14 and A.15 that some of the IRFs of the VECM do not taper off for increasing time horizons. This is due to the fact that some of the eigenvalues of the parameter coefficient matrix are one. The shocks which produce the latter kind of IRFs are called permanent, while all other shocks are denoted as transitory. Moreover, note that permanent shocks imply that the according cumulative IRFs diverge over time. This is also the reason why no cumulative IRFs are displayed for the trade balance. For the same reason also a FEVD that uses the IRFs of the VECM can be inaccurate, since it is possible that the mean squared errors of forecasts diverge over time.

Nevertheless, the possibility to distinguish permanent from transitory shocks provides a further insight. Most notably, for all three countries domestic demand shocks are permanent for imports. This might reflect consumption habits and the consumption and investment stimulating impact of the substantial decrease in interest rates in the euro area periphery, which came along with the creation of the European Currency Union. The long recessions with domestic demand and import contractions might contribute to the lasting effect of the domestic demand shock as well. Apart from this relationship, for Greece and Spain all other shocks seem to be transitory. The case of Portugal is different, where all shocks exhibit some degree of persistence.

7.3 Analysis of Shorter Time Periods

In this section I estimate the baseline structural VAR model for different sample periods. Firstly, this serves as a rough check with respect to parameter instability. Most prominently, potential structural breaks could be the euro introduction in 1999q1 and the Great Recession. Thus, I choose to examine the subsamples of the pre-crisis period and the period since the creation of the European Currency Union. Note that I do not aim at using the VAR estimates for forecasting. Hence, in case parameter instability matters, the baseline

in the residuals is rejected to the 5% level. However, Johansen 1995 notes that many of the asymptotic properties of the VECM can also be derived under the weaker assumption that the disturbances are merely i.i.d..

results reflect the average parameter estimates over the different business cycle stages of the full sample. As a second motivation for this exercise, a more specific insight on the drivers of the trade deficit emergence before the Great Recession might be obtained. In addition, a comparison between the pre-crisis subsample and the full sample IRFs and FEVDs can also be used to determine if the drivers of the trade balance have changed with the Great Recession.

Due to the fact that the Greek data sample used for the previous estimations only starts in 2000q4, which makes it already rather short, estimates for variations in the sample periods are only examined for Portuguese and Spanish data. For the pre-crisis period, 2008q1 is chosen as the end. The remaining number of observations are 53 and 49 for Portugal and Spain, respectively. For the sample starting with the euro introduction, 63 data points remain for both countries. The usual diagnostic tests are conducted for the four subsamples. With the same model specification as in the baseline, also for the shorter samples stability is obtained and no remaining serial autocorrelation in the residuals is detected.[44]

The resulting IRFs are reported in appendix A.16, A.17, A.18 and A.19. Starting with the IRFs for the pre-crisis period, compared to the full sample, for Spain the effects of foreign demand are very similar. However, the responses to a domestic demand shock change, such that with the pre-crisis sample exports do not react significantly positively anymore and most strikingly, the import response is not clearly positive as in the baseline, but it fluctuates highly at rather insignificant levels. The ambiguity might thereby stem from the relatively few numbers of observations. In case it does not, the result is unexpected. It implies that there is only a short run negative cumulative effect of the domestic demand shock on the trade balance, which becomes insignificant over time. The REER still has a significantly negative effect on the trade balance, of about 0.25% of GDP in the long run.

Firstly, these results indicate a relatively higher importance of price competitiveness during the pre-crisis period. Secondly, these IRFs suggest indirectly that domestic demand was especially relevant for the trade balance development during and after the Great Recession. Thus, there might be an asymmetry in the effect of domestic demand on imports. The fact that in Spain domestic demand rose throughout the pre-crisis period while it fell afterwards could suggest that imports react weakly or not even significantly when domestic demand increases, but that declining domestic demand has a significant negative effect on imports. Albeit potentially very interesting, note that, due to small sample size of 49 observations these findings should be treated with some degree of caution.

Moving on to the results for Portugal, in the pre-crisis period surprisingly foreign demand has neither a significant effect on exports nor on imports. This hints at a lack of competitiveness of Portuguese export products during that time. Moreover, since for the full sample there is a positive significant effect of foreign demand on exports and imports, the export sector might have become more competitive over time, in particular with the crisis and its aftermath. Recent evidence by Belke et al. (2015) points in a similar direction. The authors of this study argue that in times of weak domestic sales, firms compensate low domestic demand by increasing their effort of selling on foreign markets or by even entering export markets for the first time. Further, the responses to a domestic demand shock in the pre-crisis period are comparable to the baseline results, with the difference that the negative trade balance response is only around half as

[44]For the calculation of the cumulative trade balance responses I use the export shares for the balances trade in recent years in order to have comparable results to the baseline outcomes.

big in magnitude. Hence, similar to the case of Spain, this suggests that the decline in domestic demand played a particularly important role for the trade balance development since the Great Recession. As such, the enormous improvement of Portuguese net exports by 9.7% of GDP between 2010q2 and 2013q1 can be primarily attributed to the fall of domestic demand by 15.3% during the same period. With respect to the REER, in the pre-crisis time there is no significant effect on the trade balance. As the latter does not hold for the full sample, this suggests that trade has become more sensitive to price competitiveness after the crisis for Portugal. This can further explain the fast trade balance recovery between 2010 and 2013.

Turning to the subsample period since the euro introduction, for Spain all IRFs are basically the same as in the full sample baseline. The only slight difference is that imports react a little more positively to a REER shock, which makes also the effect on the trade balance slightly stronger. The results for Portugal with the sample since 1999q1 are also very similar to the baseline outcomes. One minor difference is that, compared to the full sample, the trade balance reacts less to a domestic demand shock in the subsample. Moreover, the REER has a somewhat larger and clearly negative significant effect of approximately 0.6% of GDP on the trade balance. These differences might be due to an increased relative importance of price competitiveness versus domestic demand in later years of the subsample, which would be in line with the conclusion on increases price sensitivity after 2008 from above.

An implication from the fact that there are only very few differences between the subsample since the euro introduction and the full sample is the confirmation that it is not the greater weight of the time before 1999 that causes the differences between the pre-crisis sample and the baseline model. Instead, as assumed in the interpretations above, the differences stem from the data in the period between 2008q2 and 2014q3.

As an additional step, I focus on the effect of foreign demand on domestic demand, which was found to be significantly positive for all three periphery countries for the full samples. It matters due to its function as a transmission channel for a foreign demand shock on imports. While for the subsample for Portugal and Spain since the euro introduction this effect is unchanged, it is important to note that for the pre-crisis period foreign demand does not have is significant impact on domestic demand in both cases. Thus, it appears that this effect in the data is driven by the time since 2008. The external shock of the financial crisis that originated in the US and the subsequent spread of the banking crisis in Europe are well documented (see, for instance, Popov and Udell 2010). The simultaneous large drop in both foreign and domestic demand in this context is likely to be a principal driver of the estimated effect of foreign on domestic demand. Moreover, with the development of the European Sovereign Debt Crisis another common shock occurred, which affected aggregate demand in the countries of the euro area simultaneously (Beirne and Fratzscher 2013).

Last, besides the IRF analysis also forward error variance decompositions of the trade balance are conducted for the four subperiods. The according graphs are presented in appendix A.20, A.21, A.22 and A.23. In short, a comparison of the relative contribution of the three shocks to foreign demand, domestic demand and the REER in the time of the European Currency Union with the baseline contributions show very little differences for both Portugal and Spain. For the pre-crisis period, the relative contribution of domestic demand is slightly lower for Spain. Also, for this subsample in the 4 step ahead forecast error variance of the trade balance the REER is more relevant than domestic demand. Regarding Portugal, the relative importance of domestic demand is reduced by more. Whereas it still clearly dominates in the period of the shock, thereafter first foreign demand and then the REER contribute to an similar share as domestic

demand to their joint contribution to the forecast error variance of the trade balance.

The results and thus also the interpretations of this additional exercise are broadly in line with the findings from studying the IRFs. One difference appears to be the case of Spain before the time of the Great Recession, where domestic demand cumulatively does not have a significant effect on the trade balance in the long run in the IRF analysis. However, the short data sample property seems to cause relatively high fluctuations in the IRF for a shock of domestic demand on imports. In turn, this might blur the relative high importance of domestic demand for the trade balance that can be seen from its relativly contribution to the forecast error variance of the trade balance.

7.4 Extension of the Baseline Model by the Oil Price

In this section I extend the baseline model for the three periphery countries with an oil price measure as an additional variable. Firstly, this is motivated by the strong response of imports to a foreign demand shock found in the IRFs for all three periphery countries. In case oil price shocks originate from the supply side, the oil price could be a potential source of some co-movement between foreign and domestic demand, and thus imports. Furthermore, possibly another more direct channel to explain the import response to foreign demand could be as follows: due to the foreign demand increase also the oil price rises in response. In consequence, the rather price-inelastic imports of oil becomes more expensive, which increases total imports in value. In analyses of oil price determinants, Kilian and Hicks (2013) conclude that demand factors were most important in explaining oil price changes after 2003. Breitenfellner et al. (2009) also stress the importance of demand factors for the oil price development in the 2000s. As a third motivation to extend the baseline model by the oil price, note that the oil import balance is also a standard determinant in current account regressions (see, for instance, Tressel and Wang 2014).

As a measure for the oil price, I use data from the FRED data base on the real crude Brent price index for Europe (see figure A.24). Regarding identification of the new system containing six variables, I maintain the Cholesky scheme and thus the previous variable ordering as shown in table 1. The difference is that now I insert the oil price in the variable vector y_t of equation 8 such that $y_t^{oilprice} = [fd, dd, oilpr, reer, m, x]'$, where *oilpr* denotes the oil price measure. In this way, the contemporaneous effect of the oil price on domestic and foreign demand is assumed to be zero. This assumption is backed by research on the effect of oil price supply shocks on GDP, which finds significant responses only for substantial lags (Kilian 2008).

For the estimation of the new structural VAR model the oil price series, which is found to be non-stationary, is transformed into first differences. None of the other diagnostic checks described section 5.4 for the same model lag lengths as in the baseline gives rise to concern. The estimated IRFs for Greece, Portugal and Spain are shown in appendix A.25, A.26 and A.27.

In short, the IRFs show that the results from the baseline model are overall robust to the inclusion of the oil price variable. As a minor difference, the responses of exports and imports to demand shocks are somewhat alleviated in the extended model.[45] A contemporaneous effect of the foreign demand shock on imports via an oil price increase cannot be confirmed. Although the oil price reacts positively to a foreign

[45] While the effect of foreign demand on domestic demand as a transmission channel remains unchanged, domestic demand has now only a negligible effect on foreign demand. Hence, the effect of domestic demand via foreign demand and thus exports on imports becomes basically irrelevant. This might explain the weaker import response to domestic demand.

demand shock as expected, imports do not respond to oil price changes in the same quarter. Moreover, from the IRFs it can be inferred that the oil price is not a common factor driving both foreign and domestic demand. The according IRFs do not show a particularly strong co-movement.

Apart from this, I find that the oil price has cumulatively a significant positive effect on the trade balance for Spain and Portugal, of 0.4% and 0.5% of GDP, respectively, due to relatively high import reductions. The latter are caused by domestic demand contractions that come into effect with an oil price shock. For both countries the decline in imports exceeds the drop in exports, which itself stems from lower demand from abroad and possibly higher input costs. This counters the finding of Chen et al. (2013) that oil price increases contributed to rising trade deficits in euro area periphery countries. The difference in outcomes might thereby be caused by the more limited analysis of the effect of oil price shocks on terms of trade, the different time period analysed (1990 to 2009) and the potential neglect of dynamic demand considerations in the case of Chen et al. (2013).

A further result from the IRFs is that the the cumulative negative response of the trade balance to a domestic demand shock is robust to the extension of the VAR model by the oil price. The latter is also true for the insignificant effect of foreign demand on the trade balance. Regarding price competitiveness, the trade balance response remains unchanged for Portugal, while it becomes close to being significantly negative for Greece. For Spain it becomes insignificant after six quarters. Last, compared to the rather counter intuitive result in the baseline model for Greece, in the extended model the negative response of imports to a shock to the REER after one year becomes insignificant.

8 Discussion

This section first critically evaluates the methodological approach of using a structural VAR model to determine the importance of foreign demand, domestic demand and price competitiveness for the trade balance. The second part is devoted to a brief review of policy options with respect to a sustainable stabilisation of trade balances for Greece, Portugal and Spain.

8.1 Methodology and Limitations

In contrast to most of the related literature about current account and trade imbalances in the euro area, which mostly relies on panel data, this thesis estimates separate models for Greece, Portugal and Spain. In this way, it can be allowed for differences in the economic development across these countries and determinants of external balances can be studied on a more disaggregated level. However, compared to panel data estimations, a disadvantage of this method is the relatively small number of observations that can be used. This issue becomes especially relevant when the likely presence of parameter instability motivates a subsamples analysis. As a potential remedy and as an avenue for future research, the estimation of a time varying VAR model might be beneficial in this context, if for a particular country drivers of current account and trade balances are to be determined for certain shorter time periods.

Furthermore, in comparison to reduced from models, a clear strength of the structural VAR approach is the ability to allow for a high degree of interaction between the variables of the system. This matters in particular for the determinants of the trade balance, as shown in section 4. However, a limitation of using

VAR models, in which structural shocks are recovered, is the availability of economically well-grounded identification restrictions. Thereby, in the context of trade balance determination, the use of short-run restrictions, as in this thesis, is especially suitable for small countries. A similar set of restrictions as presented in section 5.3 cannot be applied to relatively large countries of the euro area, like Germany or France. In addition, a high degree of openness can make identification in the context of trade balances and their determinants infeasible.[46]

Moreover, note that the baseline result of an insignificant effect of a foreign demand shock on the trade balance might not universally hold for all stages in the business cycle. To see this, recall that a significant positive effect of foreign demand on domestic demand is found in the baseline model for Greece, Portugal and Spain. The analysis of subsamples of the baseline data further showed that this effect originates primarily from the time since 2008. Hence, it is most likely that the external shock of the Global Financial and Economic Crisis, and possibly common reactions to turmoil during the European Sovereign Debt Crisis, cause the positive effect of foreign demand on domestic demand in the full sample. Thus, the positive effect of foreign demand on imports in the baseline model is most likely exaggerated for time periods of normal stages of the business cycle. This implies that during those phases also the trade balance response to a foreign demand shock can assumed to be more positive as it is indicated in the according IRFs of the baseline model.

8.2 Policy Options

In the short or medium term, domestic demand in the three euro area periphery can be expected to increase again. As a consequence, the results of the baseline model imply that net exports will be affected negatively by such a development. However, the conclusions from the subsample analysis in section 7.3 suggest that compared to the basline model results, for Portugal and Spain the effect can be expected to be smaller. Nevertheless, a deteriorating trade balance is contrary to what is needed to reduce the high net foreign debt positions in the three periphery countries. In a wider perspective, Comunale and Hessel (2014) find that in comparison to euro area periphery countries, for core countries the responsiveness of exports to foreign demand is larger. This implies that Greece, Portugal and Spain are subject to a weakness regarding non-price factors of export competitiveness. Several other authors come to a similar conclusion (see, for instance, Tressel and Wang 2014, Christodoulopoulou and Tkacevs 2014, and Storm and Naastepad 2014). For these reasons, high efforts are still needed to increase export competitiveness.

How can in particular Greece, Portugal and Spain make better use of increases in foreign demand and what can governments do to this end? Addressing this question, Huemer et al. (2013) provide an overview of the dimensions in which politics can influence external competitiveness beyond factor price adjustments. As broad factors they identify the quality of public institutions, infrastructure, market regulation, factor costs and technology as relevant policy areas. Moreover, in a study on Greece, Boewer et al. (2014) explicitly link export performance to institutional quality. According to their estimates, more than half of the underperformance gap of foreign sales of the country, given predictions of regular international trade patterns, could be closed by improving the institutional framework to the EU average. Similar to other authors, as a general policy recommendation for the periphery countries, Guillemette and Turner (2013) suggest implementing

[46] In particular, with a high degree of openness, exports might have a contemporaneous effect on domestic demand, and the REER is likely to have a contemporaneous impact on domestic demand.

structural reforms that aim at increasing productivity and enhancing flexibility of labour markets, along with fiscal consolidations and reductions in labour taxes.

As a long term strategy to make periphery countries exploit foreign demand more efficiently, some scholars also call for modern industrial efforts to improve on non-price factors of external competitiveness of periphery countries (Teixeira et al. 2014, Hein and Detzer 2014 and Storm and Naastepad 2014). This can be motivated by the fact that a self-contained catch-up might be hampered by the presence of strong competitors in the common market. In this context, as suggested by Hein and Detzer (2014), besides investment in infrastructure and R&D, in particular public sector credits and guarantees for exporters could help improve the trade balance. A model for such government assistance could be the practice of Germany.

On the level of the European Currency Union, macroprudential regulation and possibly selective credit controls are considered to be helpful to avoid future debt-based domestic demand booms, which were associated with rising trade and current account deficits (Comunale and Hessel 2014, Hein and Detzer 2014, Brzoza-Brzezina et al. 2015). In addition, the nominal depreciation of the external euro exchange rate in the course of the ECB's monetary policy of quantitative easing might increase exports directed at extra-euro area countries. However, the relatively weak reaction of the trade balance to changes in the REER that could be seen from the baseline IRFs limits the impact of the extremely lose monetary policy, especially for Greece.

9 Conclusion

After the launch of the European Currency Union the current account positions of some euro area periphery countries underwent a dramatic decline, which is found to be a contributing factor for the outbreak of the European Sovereign Debt Crisis (Lane and Milesi-Ferretti 2011). In recent years external balances were restored. This thesis focuses on the question how important demand factors are compared to relative price competitiveness for these developments of current account and trade balances. Based on an initial descriptive analysis, in a novel methodological approach, a structural VAR model with the determinants of the trade balance is set up and estimated for Greece, Portugal and Spain, respectively. The results are as follows.

As the first finding from the decomposition of current account developments of the euro area periphery countries Greece, Ireland, Italy, Portugal and Spain, I identify the trade balance component to be overall the most important driver of the current account changes, especially for the recent recovery. However, the contributions of the income and the transfers balance for the emergence of the deficits should not be neglected, as in some cases they also play a considerable role.

In the main part of this thesis, the impulse response analysis with the estimates of the baseline structural VAR model for Greece, Portugal and Spain shows that for all of three countries domestic demand has a significant negative effect on the trade balance. Moreover, domestic demand is identified as the most important driver of trade balance changes for Greece, Portugal and Spain. A forward error variance decomposition confirms this result, which is also robust to different model specifications. In this way, this thesis contributes to the branch of the literature which finds domestic demand to be the principal channel of how the elimination of sovereign risk premiums and the drastically reduced interest rates with the creation of the European Currency Union caused trade balances and current accounts to deteriorate in euro area

periphery countries. In addition, this result provides a strong motivation for applying macro-prudential regulation as a way to limit unsustainable credit and demand booms in the eurozone.

As a further finding from the structural VAR model, the cumulative impulse response functions reveal a significant negative effect of an appreciation of the real effective exchange rate on the trade balance for Portugal and Spain. However, the effect is smaller in magnitude than the contribution of domestic demand and it is not perfectly robust to the inclusion of the oil price as an addition variable. For Greece price competitiveness does not seem to have a significant impact on the trade balance. This is a noteworthy finding, given the debate about the effectiveness of an internal devaluation in this country.

In addition, across different model specifications foreign demand is not found to have a significant effect on the trade balance for the three periphery countries studied. Whereas in theory an improvement of the trade balance is expected, using the structural VAR model I am able to show that there is a significant positive effect of foreign demand not only on exports, but of an equal or higher magnitude also on imports. The main channels of the latter response are the import content of exports and the fact that foreign demand has a positive impact on domestic demand, which, in consequence, leads to higher imports.

A limitation of using time series data for individual countries is the vulnerability to structural breaks and thus to parameter instability. Therefore, important insights are gained from an impulse response analysis of subsamples of the baseline data. Firstly, the result from the baseline model that foreign demand has a significant positive impact on domestic demand can be traced back to the period from 2008 to 2014. Common shocks in the course of the financial crisis and the financial turmoil with the European Sovereign Debt Crisis are factors which cause a contemporaneous positive effect of the variable foreign demand on domestic demand. This implies that in the absence of crises, which affect both domestic and foreign demand in the same way, the effect of foreign demand on the trade balance is likely to be higher than it is estimated in the baseline.

Secondly, for Portugal and Spain the effect of domestic demand on the trade balance seems to be more important during and after the Great Recession than in the time before. This finding indicates that the magnitude of this effect might depend on the sign of domestic demand growth. More research is needed to determine the validity of such a relationship. Moreover, another important implication is that the fall in domestic demand in recent years can be considered to be the main driver of the sharp improvements of the trade and current account balances for Portugal and Spain, and most likely also for Greece. In retrospect, austerity measures were therefore successful in reducing trade and current account deficits. However, the recovery was not as much due to improved price competitiveness, which was the initially anticipated effect of pro-cyclical policies, but it occurred largely as a result of domestic demand contractions.

Furthermore, in an extension to the baseline model, oil price shocks are found to have a significant positive effect on net exports for Portugal and Spain, but not for Greece. The significant effects are due to drops in domestic demand which are larger than the reduction in foreign demand.

A straight forward implication of the finding of this thesis that the recent recovery of external balances was primarily driven by domestic demand contractions is that a further improvement from this channel counters growth-orientated policy goals and is hence infeasible. Concerning the future development of net exports, and in order to reduce net foreign debt, for governments in Greece, Portugal and to some extend in Spain, the prime target should thus be an improvement of non-price external competitiveness. Improving upon institutional quality might thereby have especially high returns in Greece. Moreover, in

general, structural reform, productivity-enhancing policies as well as public sector credits and guarantees for exporters could help stabilizing the trade balance at positive levels.

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A Appendix

A.1 The Current Account as the Difference Between Savings and Investment

Gross National Income (GNI) is defined as the sum of consumption C, investment I, government expenditures G and the current account balance CA

$$GNI = C + I + G + CA \tag{A.1}$$

In addition, GNI is used for consumption, private savings S_p and taxes T, such that

$$GNI = C + S_p + T \tag{A.2}$$

Combining these two equations yields

$$(I - S_p) + (G - T) + CA = 0 \tag{A.3}$$

With $T - G = S_g$ being public savings, the current account can be expressed as the sum of private and public savings S, less investment

$$CA = S_p + S_g - I = S - I \tag{A.4}$$

A.2 Impulse Response Functions of a VAR(p) model[47]

Firstly, the VAR(p) process with $K = 5$ variables in equation 8 can be written as a VAR(1) representation

$$Y_t = \mathbf{c} + \mathbf{A}Y_{t-1} + E_t \tag{A.5}$$

where

$$\underset{(Kp\times 1)}{\mathbf{c}} = \begin{pmatrix} c \\ 0 \\ \vdots \\ 0 \end{pmatrix}, \quad \underset{(Kp\times Kp)}{\mathbf{A}} = \begin{pmatrix} A_1 & A_2 & \cdots & A_{p-1} & A_p \\ I_K & 0 & \cdots & 0 & 0 \\ 0 & I_K & & 0 & 0 \\ \vdots & & \ddots & \vdots & \vdots \\ 0 & 0 & \cdots & I_K & 0 \end{pmatrix}, \quad \underset{(Kp\times 1)}{E_t} = \begin{pmatrix} e_t \\ 0 \\ \vdots \\ 0 \end{pmatrix}$$

Given stability, the Y_t process has the moving average representation

$$Y_t = \mathbf{m} + \sum_{i=0}^{\infty} \mathbf{A^i} E_{t-1} \tag{A.6}$$

[47] This derivation is based on Lütkepohl (2005).

with

$$\underset{(Kp\times 1)}{\mathbf{m}} = \begin{pmatrix} \mu \\ 0 \\ \vdots \\ 0 \end{pmatrix}$$

and μ being a $(K \times 1)$ mean vector. To obtain the impulse response functions, equation A.6 is multiplied by the $(K \times Kp)$ matrix $J = [I_k : 0 : ... : 0]$, which yields

$$y_t = JY_t = J\mathbf{m} + \sum_{i=0}^{\infty} J\mathbf{A^i}J'JE_{t-1} = \mu + \sum_{i=0}^{\infty} \Phi_i e_{t-1} = \mu + \sum_{i=0}^{\infty} \Phi_i B^{-1} \epsilon_{t-1} \tag{A.7}$$

where $\mu = J\mathbf{m}$, $\Phi = J\mathbf{A^i}J'$ and $e_t = JE_t$. The impulse response coefficients are then obtained from the matrices

$$\Theta_j = \Phi_j B^{-1}, \qquad j = 0, 1, 2, ... \tag{A.8}$$

A.3 Construction of the Foreign Demand Series

For all three periphery countries Greece, Portugal and Spain, for the construction of the foreign demand series, I include all other original EU-12 countries, except the country of interest itself and Ireland, as partners. For Ireland no data is available on quarterly basis before 1997q1. Leaving Ireland out as a trading partner for the other three periphery countries in order to have more data points available is not problematic, however, as Ireland's export share is less than 1% for the other three periphery countries.

As for regional aggregates, such as 'Africa' or 'Emerging and Developing Asia', data on GDP from the IMF IFS data base is only available in growth rates quarter on *previous year's* quarter. Since it is not available in levels either, in order to obtain data in *quarter on previous quarter* growth rates I need to include single countries as export partners in my data set instead. The countries chosen as trade partners were selected if they have a significant export share for at least one euro area periphery country, and if quarterly GDP data is available for them since 1995q1.

The export partner countries in Europe outside EU-12 are Sweden, Switzerland, United Kingdom, Cyprus, Estonia, Latvia, Poland, Slovak Republic and Slovenia. In addition I include Russia, Turkey, Israel, Morocco, Japan, South Korea, Australia, Canada, United States, Mexico and Brazil as export partners. Unfortunately data on China is not available on a quarterly basis over my entire sample length. However, the export share vis--vis the IMF aggregate 'Emerging and Developing Asia', which includes China, is in all quarters since 1995q1 below 3.9%, 2.4% and 3.2% for Greece, Portugal and Spain, respectively.

The foreign demand measure for Spain is not constructed with the real GDP of export partners, but with real GDP less the trade balance. The according series are retrieved from OECD Stat. Due to a lack of data on real GDP in levels the set of partner countries is only a subset of the one described above. In particular, Cyprus, Estonia, Luxembourg, Mexico, Morocco, Poland, Russia, Slovak Republic and Turkey needed to be excluded due to a complete or partial lack of data over the sample period. In addition, for the Netherlands, Austria and Brazil, which account for approximately 5% of Spain's total exports, quarterly GDP data in levels is only available from 1996 onwards. Therefore, I compute the foreign demand only with

data starting in 1996q1.

With my sets of partner countries, on average over all time periods used for the estimation I cover 64%, 87% and 74% of the total exports for Greece, Portugal and Spain, respectively. The relatively low number for Greece is mainly due to its relatively large share of exports to South Eastern European countries, for which data is not available on a quarterly basis for the entire sample length.

Moreover, some of the real GDP series obtained from the IMF IFS data base are not available in seasonally adjusted form. The X-13ARIMA-SEATS method was thus used to deseasonalise the real GDP index series of Cyprus, Israel, Estonia, Latvia, Poland, Slovak Republic, Slovenia, Sweden, Turkey, Russia, Morocco, Brazil and South Korea. In order to overcome missing values for parts of the sample period from 1995q1 to 2014q3, in addition to the IMF IFS real GDP data I use quarter-on quarter real GDP growth data from the OCED Stat database for Austria, Belgium, Greece and Finland.

A.4 Derivation of the Forward Error Variance Decomposition for the Trade Balance

Building on the impulse response derivation of the VAR(p) model in section A.2, the elements of the $(K \times K)$ matrix Θ_i of impulse responses can be used for a forecast error variance decomposition. Lütkepohl (2005) shows that the proportion of the $h-step$ forecast error variance of a variable j that is accounted for by the shock to the variable k can be written as

$$\epsilon_{jk,h} = \frac{\sum_{i=0}^{h-1} \theta_{jk,i}^2}{\sum_{i=0}^{h-1} \sum_{k=1}^{K} \theta_{jk,i}^2} \tag{A.9}$$

where θ_{jk} denotes the $mn-th$ element of Θ_i and K is the number of variables in the model. In my case of the forecast error variance decomposition of the trade balance I cannot use all the contributions of the $K = 5$ shocks, since the structural shocks for exports and imports cannot be properly identified. Thus, I am not able to derive the contribution of a shock to the trade balance to its "own" forecast error variance. However, reducing the total forecast error variance of the trade balance to the portion which is accounted for by shocks to foreign demand, domestic demand and the REER, which gives $\epsilon_{jk,h}$ a new interpretation, allows me to determine the relative contribution of these three variables. Besides the new definition of $\epsilon_{jk,h}$ the only change to the formula in equation A.9 is that now $K = 3$.

A.5 Impulse Response Functions for a VECM

The impulse response functions for the VECM in equation 17 can be calculated in the same was as described in appendix A.2 once the coefficient matrices A_i for $i = 1, ...p$ are recovered. Following Johansen (1995), the according formulas are as follows. From the transformation of the VAR model in first difference into the VECM model it is known that

$$\Pi = \sum_{i=1}^{p} A_i - I_K \tag{A.10}$$

and

$$\Gamma_i = -\sum_{j=i+1}^{p} A_j \tag{A.11}$$

When defining

$$\Gamma = I_K - \sum_{i=1}^{p-1} \Gamma_i \tag{A.12}$$

the first two equations above can be used to solve for the coefficient matrices A_i as

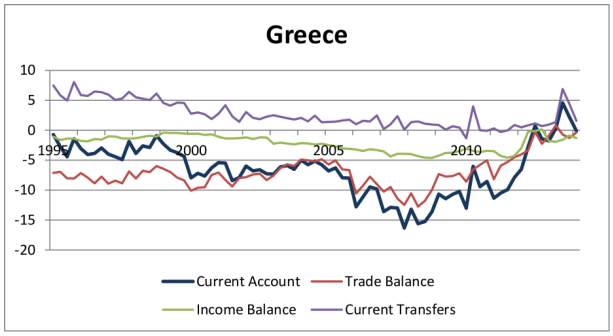
$$A_1 = \Pi + \Gamma_1 + I_K \tag{A.13}$$

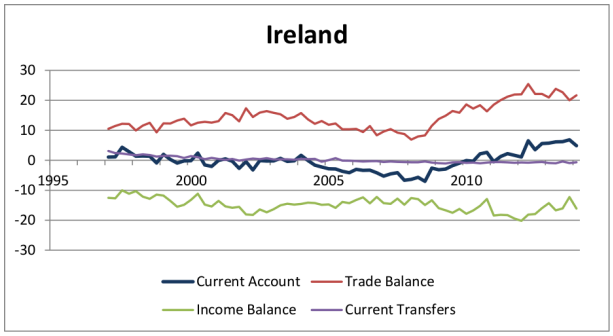
as well as

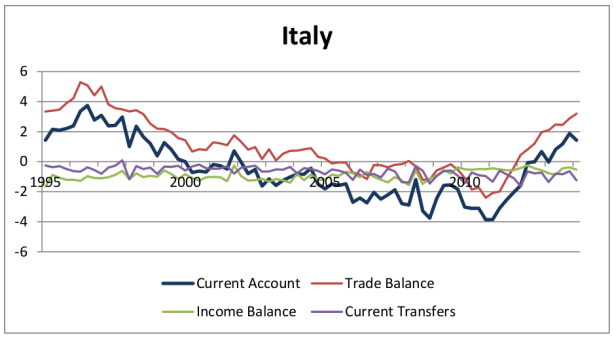
$$A_i = \Gamma_i - \Gamma_{i-1}, \tag{A.14}$$

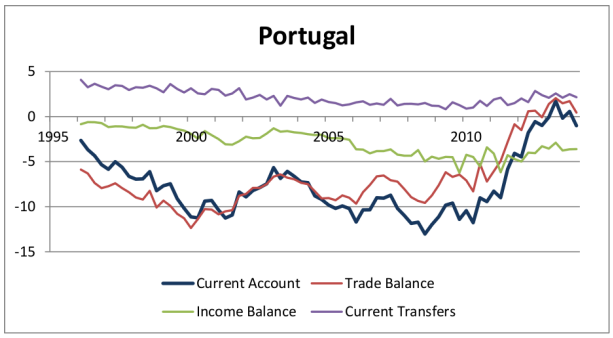
for $i = 1, ..., p-1$, and

$$A_p = -\Gamma_{p-1} \tag{A.15}$$









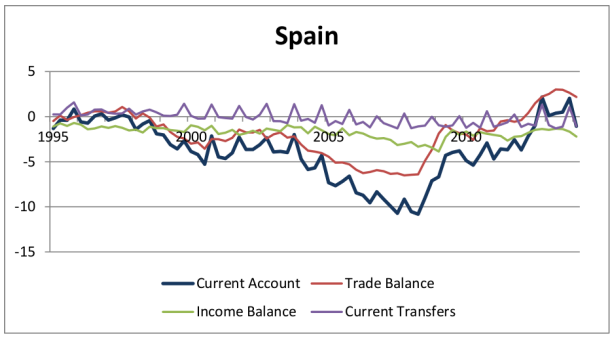


Figure A.1: Current Account and Its Components 1995–2014, in % of GDP
Source: OECD.Stat

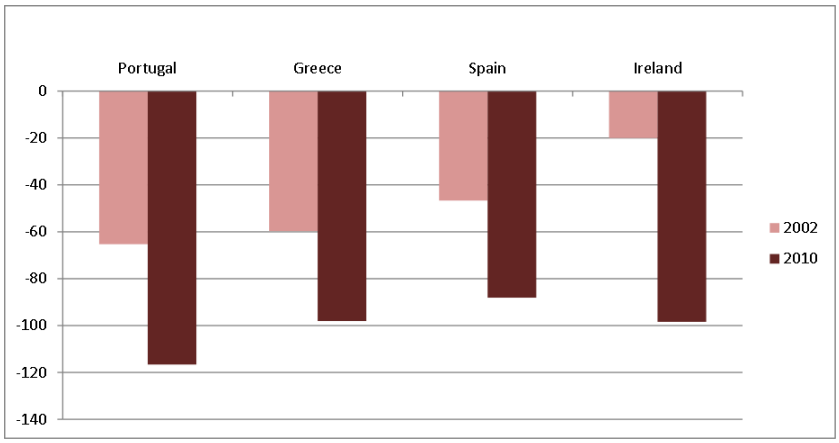


Figure A.2: Net Foreign Assets in % of GDP, in 2002 and 2010
Source: Lane (2011, table 1 and 2)

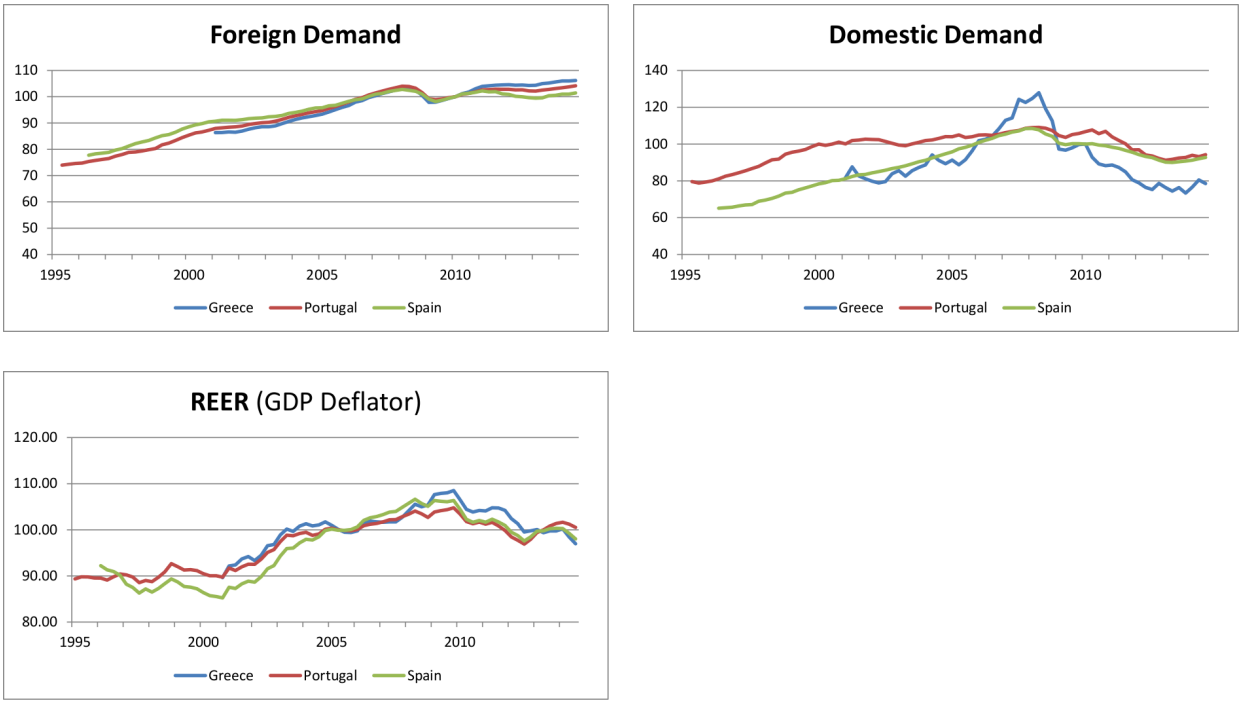


Figure A.3: Foreign Demand, Domestic Demand and the Real Effective Exchange Rate (REER) in Level Index Form (2010q1=100) as Input Series for the Baseline Model
Source: see section 5.2

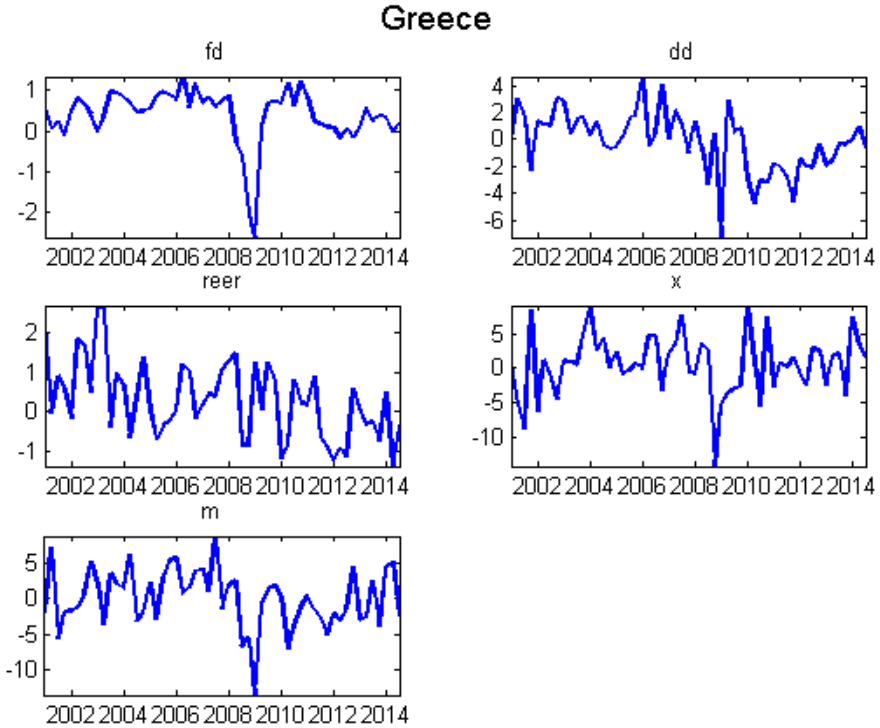


Figure A.4: Variable Series in First Difference of Foreign Demand (fd), Domestic Demand (dd), the Real Effective Exchange Rate based on the GDP deflator (reer), Exports (x) and Imports(m) for Greece
Source: see section 5.2

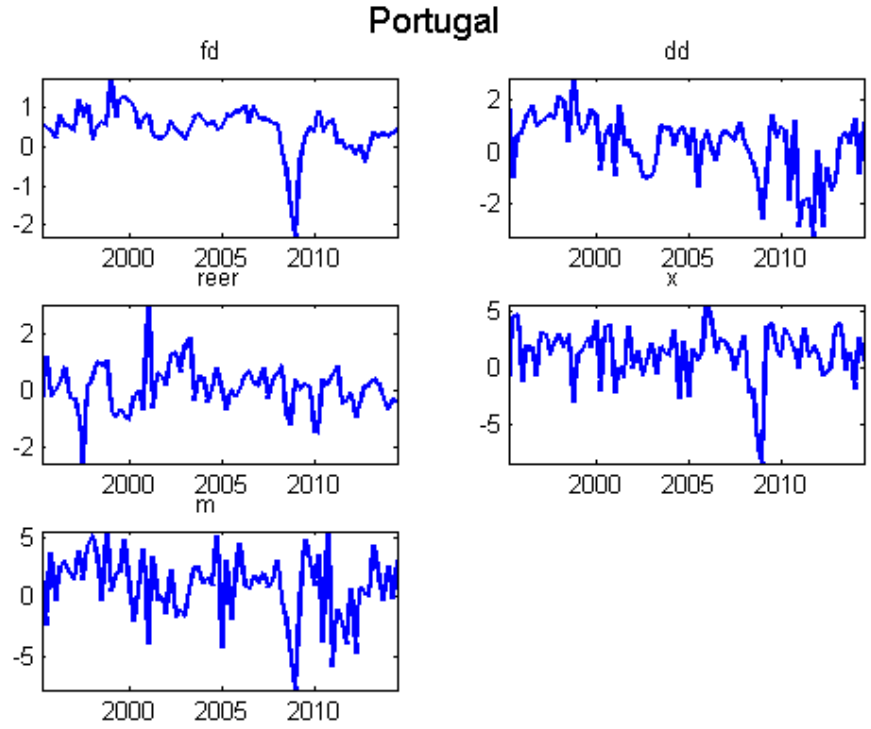


Figure A.5: Variable Series in First Difference of Foreign Demand (fd), Domestic Demand (dd), the Real Effective Exchange Rate based on the GDP deflator (reer), Exports (x) and Imports(m) for Portugal
Source: see section 5.2

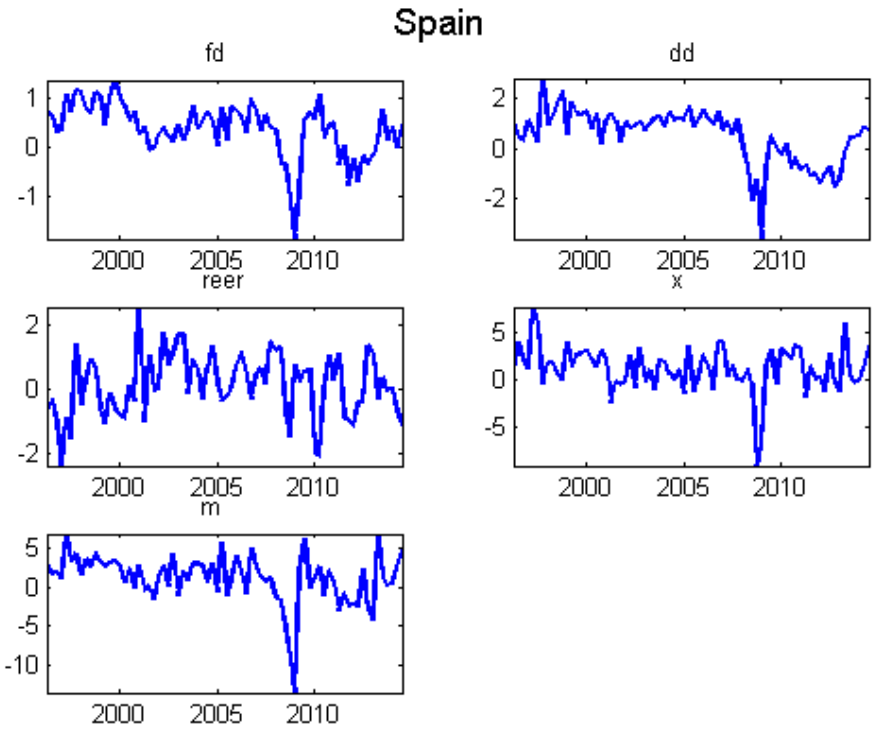


Figure A.6: Variable Series in First Difference of Foreign Demand (fd), Domestic Demand (dd), the Real Effective Exchange Rate based on the GDP deflator (reer), Exports (x) and Imports (m) for Spain
Source: see section 5.2

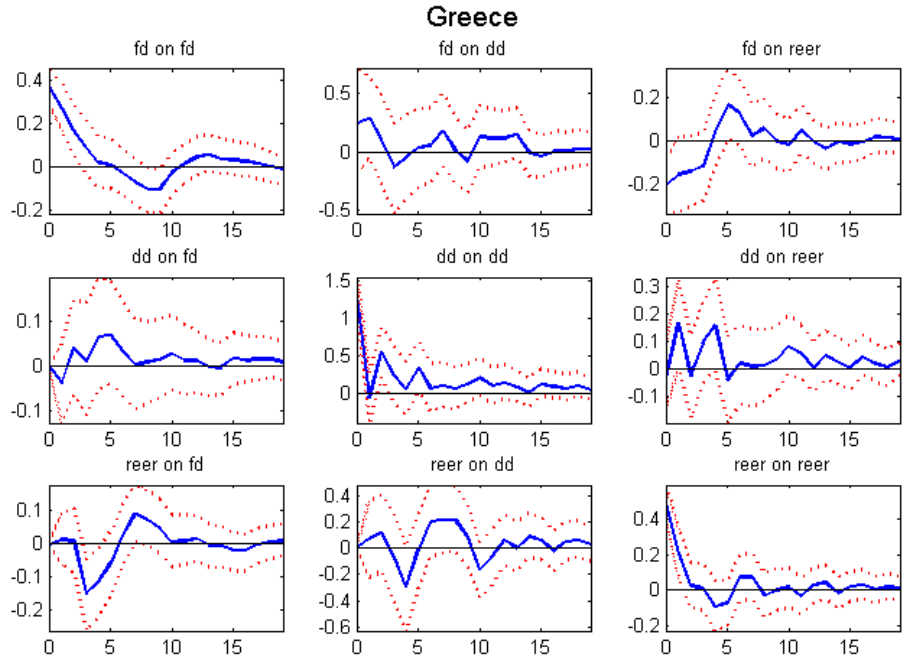


Figure A.7: Other Baseline Impulse Response Functions of Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate (reer) for Greece.

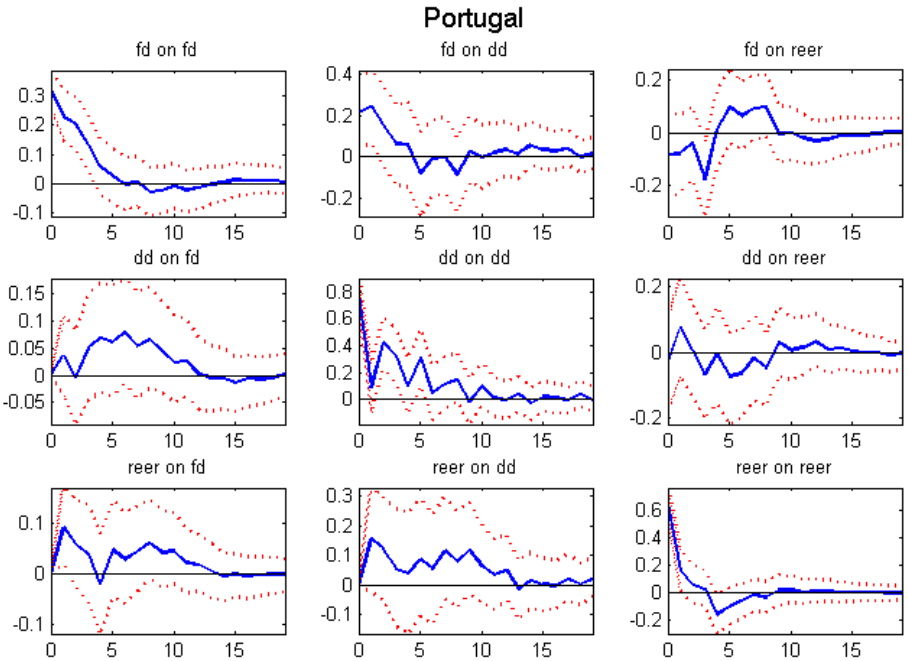


Figure A.8: Other Baseline Impulse Response Functions of Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate (reer) for Portugal.

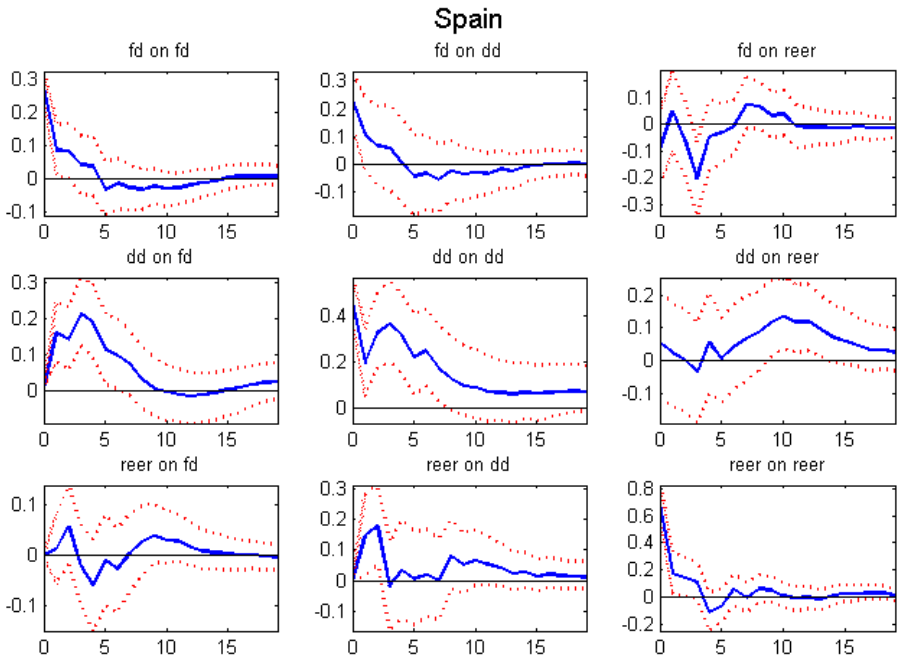


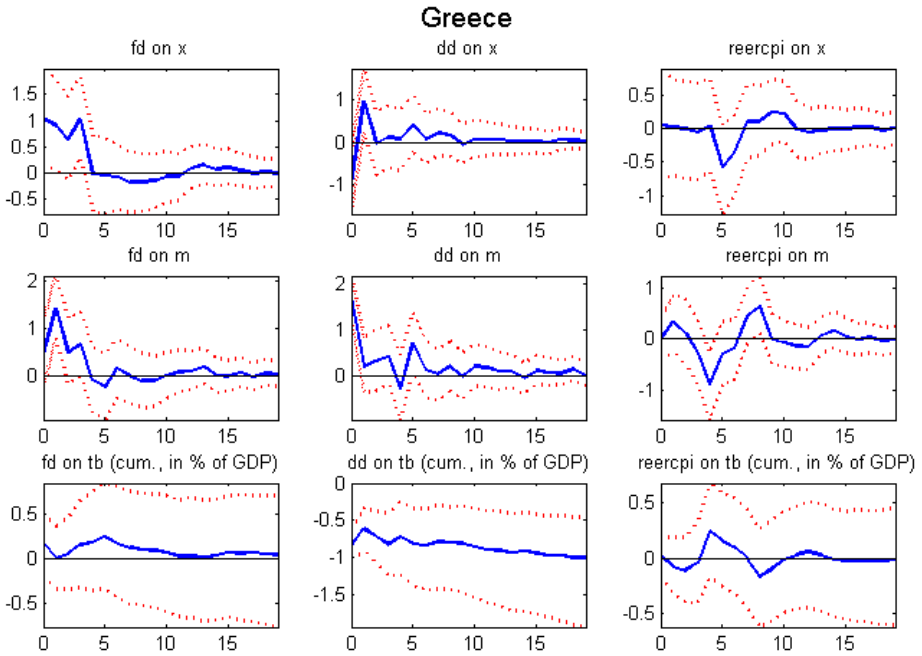
Figure A.9: Other Baseline Impulse Response Functions of Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate (reer) for Spain.

Greece				
Response: Trade Balance	Percentage of Forecast Error Variance Explained By			
Forecast Horizon	Foreign Demand	Domstic Demand	REER	Trade Balance
1	0.000	0.719*	0.000	0.281*
4	0.086	0.803*	0.008	0.103*
10	0.058	0.860*	0.026	0.056
20	0.053	0.769*	0.052	0.127

Portugal				
Response: Trade Balance	Percentage of Forecast Error Variance Explained By			
Forecast Horizon	Foreign Demand	Domstic Demand	REER	Trade Balance
1	0.003	0.547*	0.039	0.412*
4	0.023	0.768*	0.061	0.148*
10	0.010	0.890*	0.056	0.044
20	0.013	0.913*	0.046	0.028

Spain				
Response: Trade Balance	Percentage of Forecast Error Variance Explained By			
Forecast Horizon	Foreign Demand	Domstic Demand	REER	Trade Balance
1	0.254*	0.649*	0.000	0.097*
4	0.215	0.663*	0.084	0.039
10	0.080	0.744*	0.150	0.026
20	0.047	0.753*	0.169	0.030

Table A.1: Forward Error Variance Decomposition with the 4 Variables Model for Greece, Portugal and Spain with Respect to the Trade Balance. A * Symbol Indicates Significance to the 5% Level.



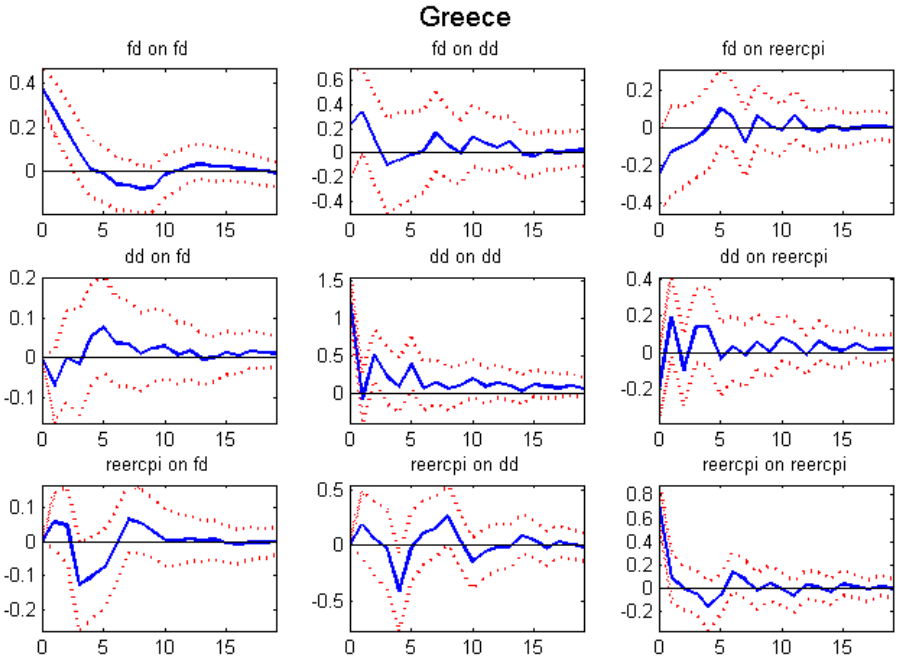
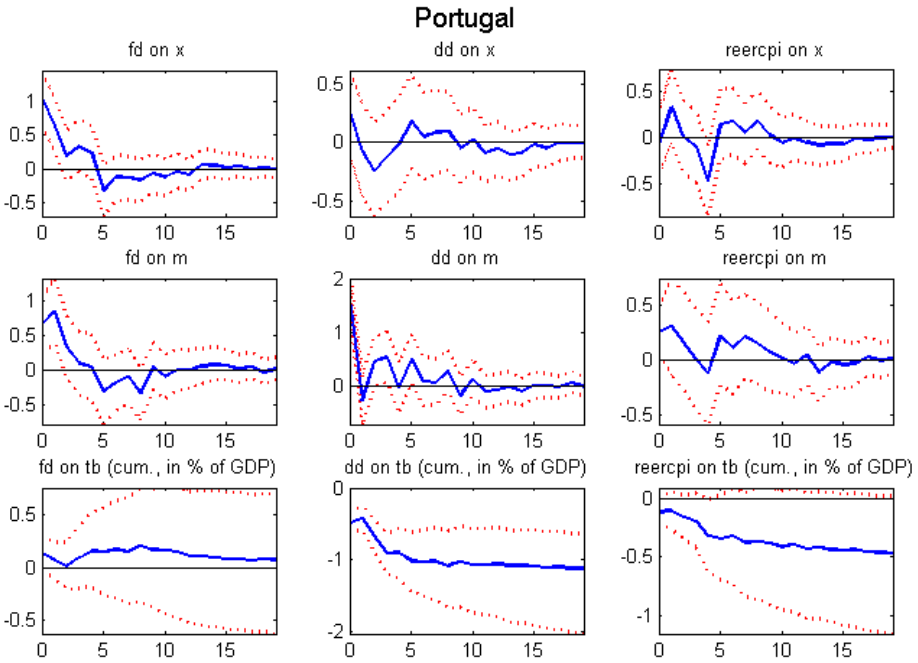


Figure A.10: Impulse Response Functions for Shocks to Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate based on the Consumer Price Index (reercpi) for Greece.



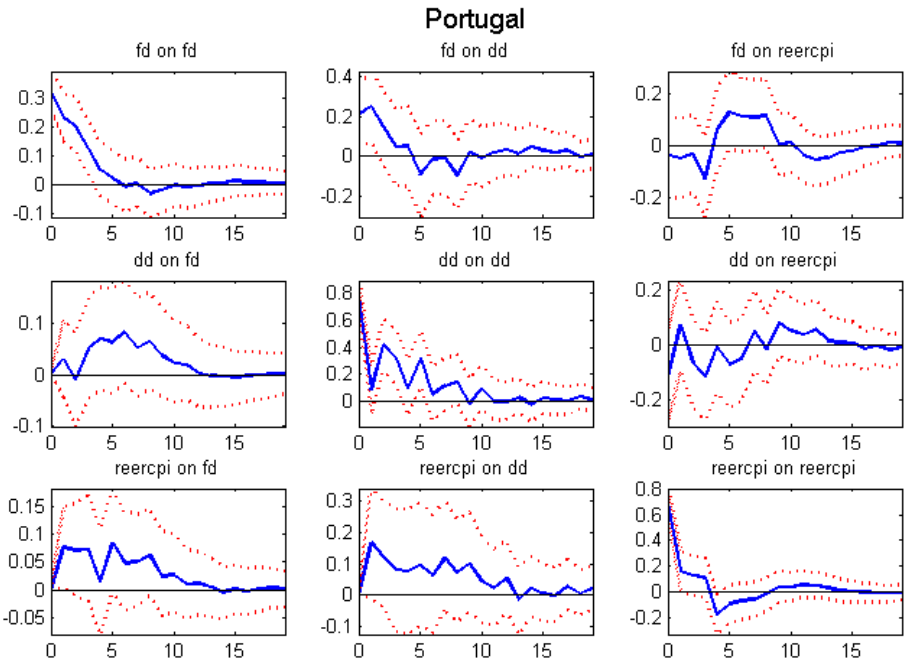
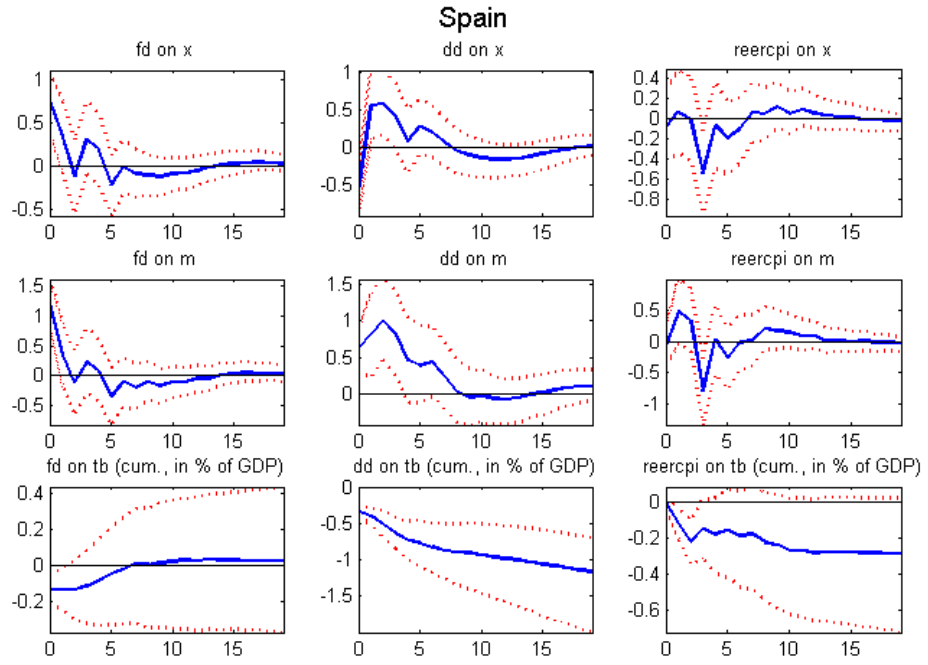


Figure A.11: Impulse Response Functions of Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate based on the Consumer Price Index (reercpi) for Portugal.



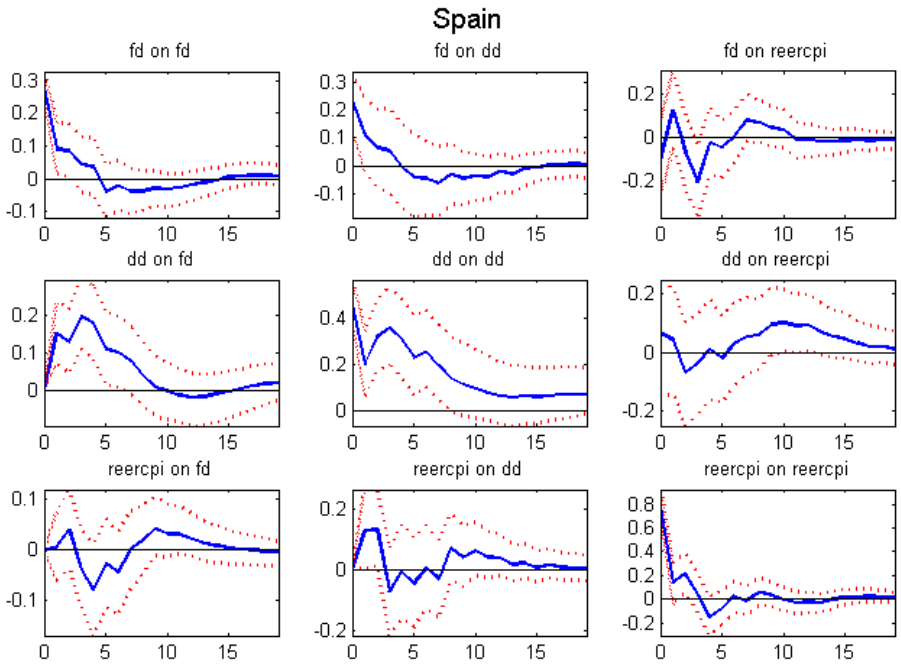
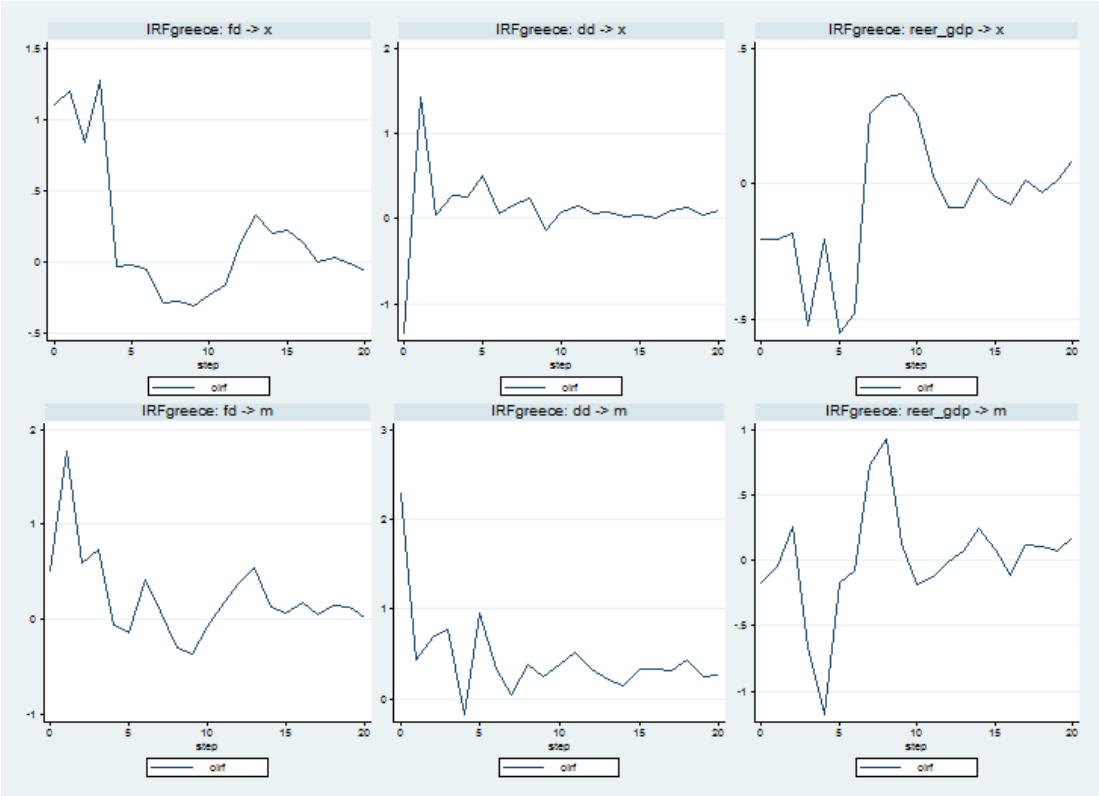


Figure A.12: Impulse Response Functions of Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate based on the Consumer Price Index (reercpi) for Spain.



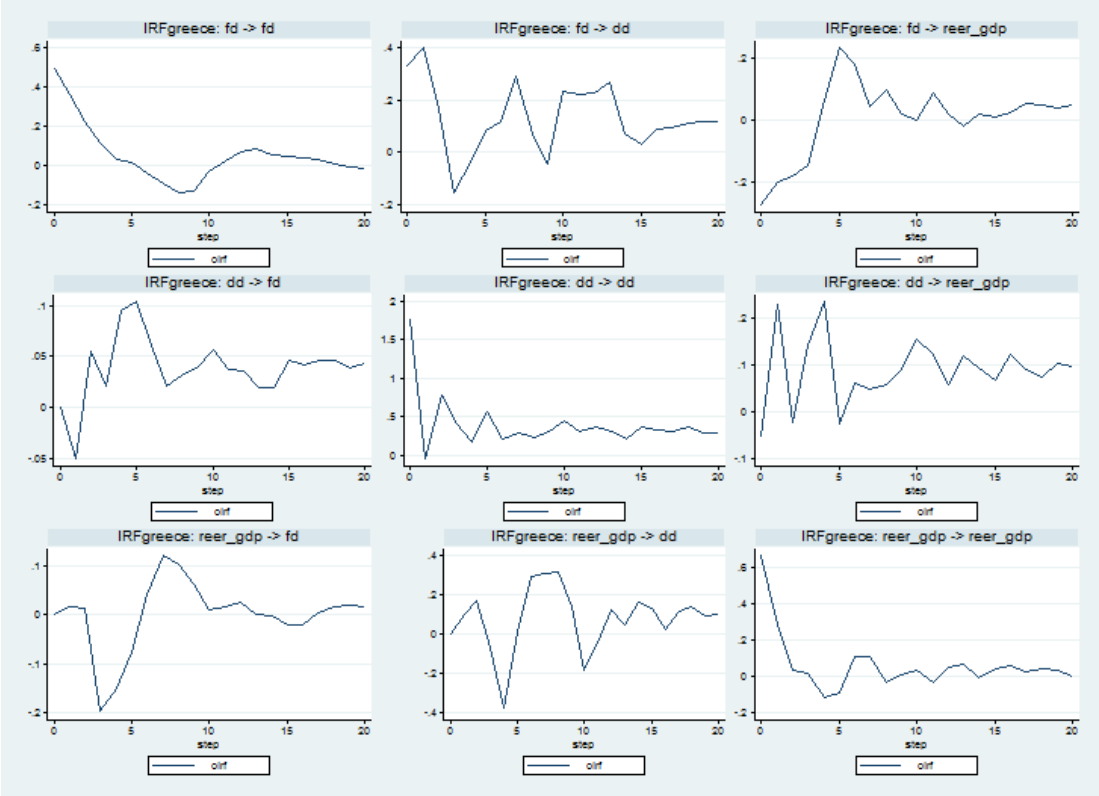
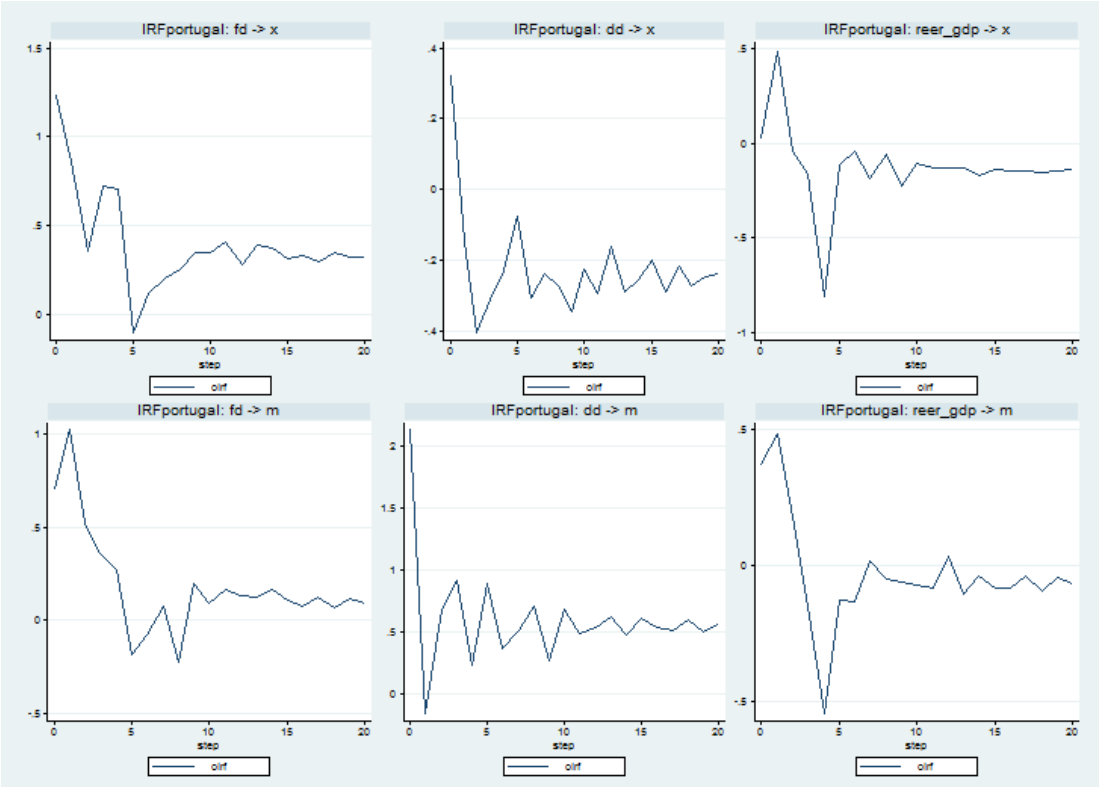


Figure A.13: Impulse Response Functions from VECM for Shocks to Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate (reer_gdp) for Greece.



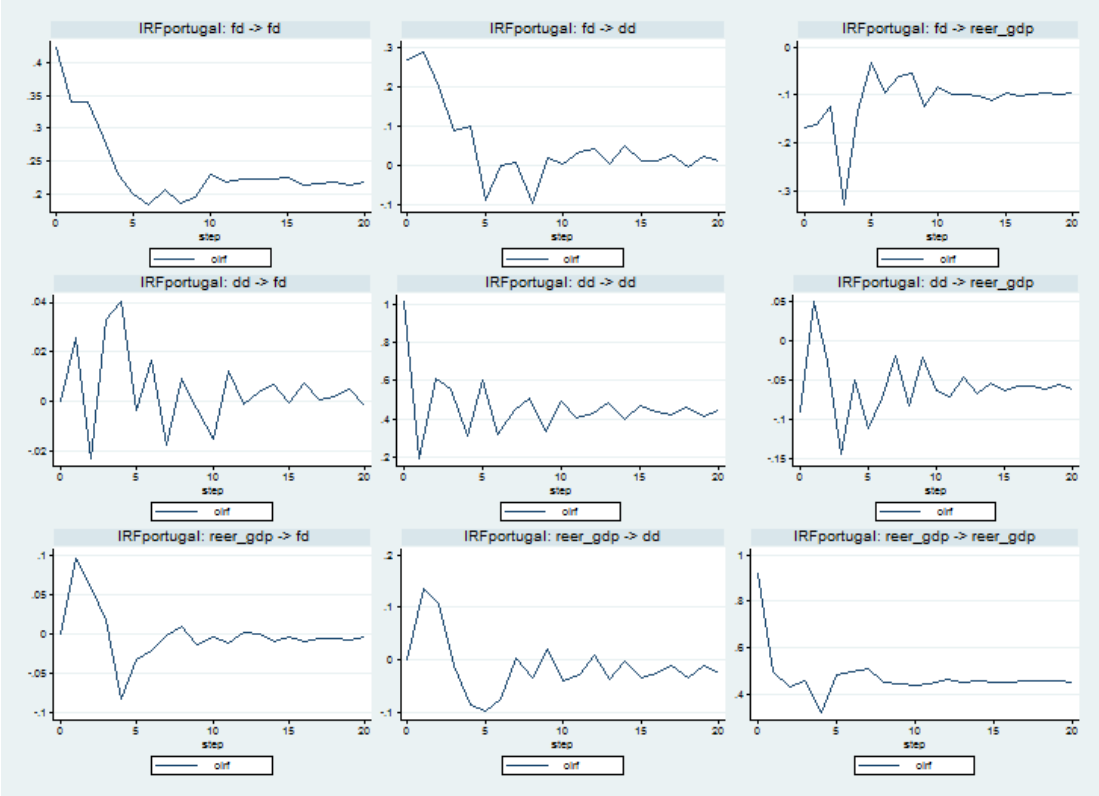
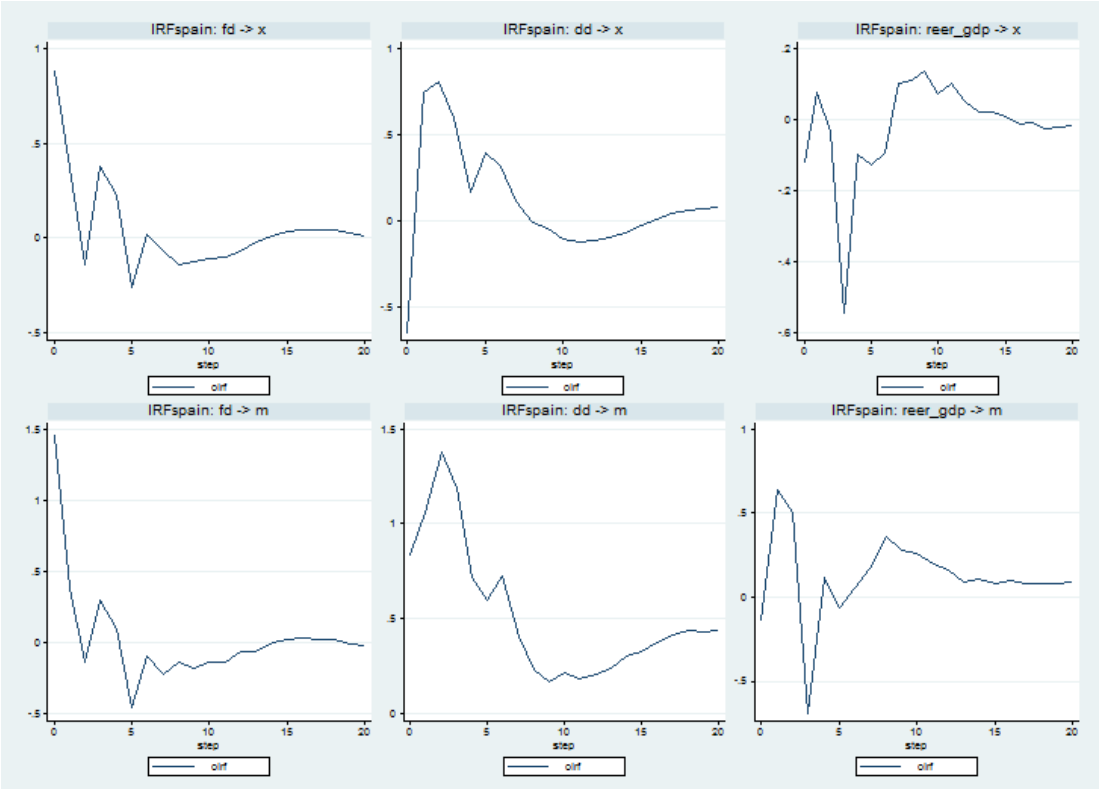


Figure A.14: Impulse Response Functions from VECM for Shocks to Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate (reer_gdp) for Portugal.



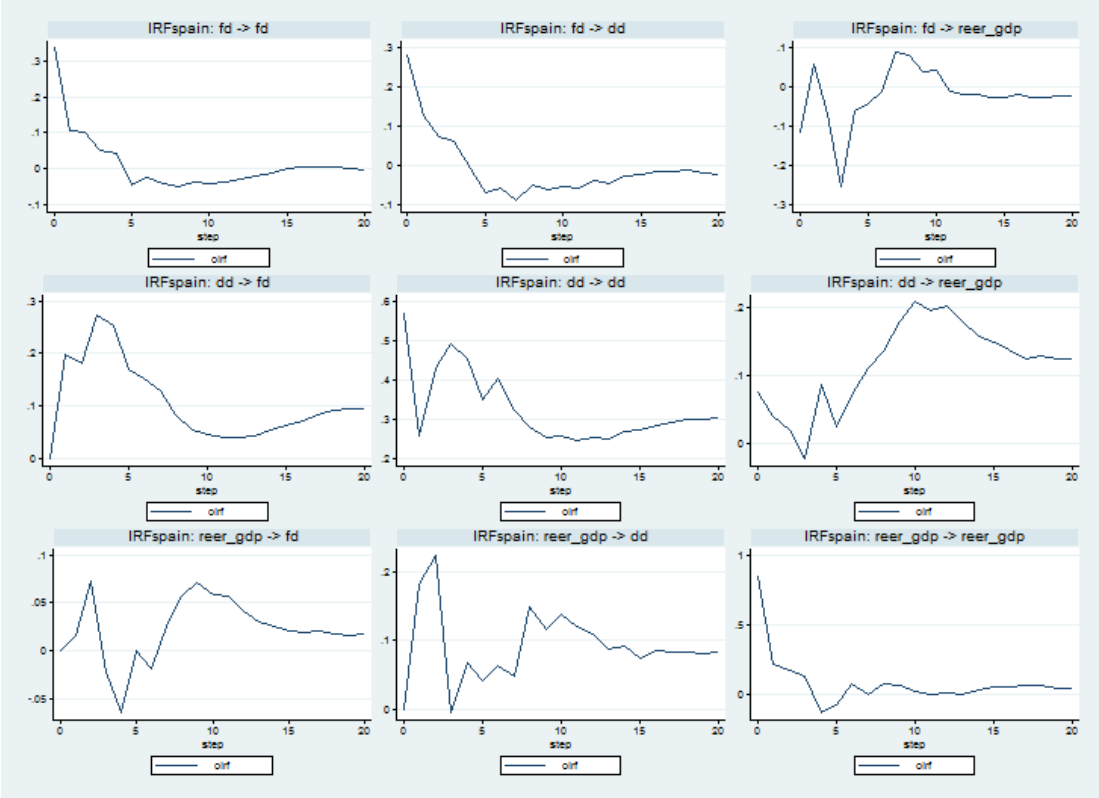
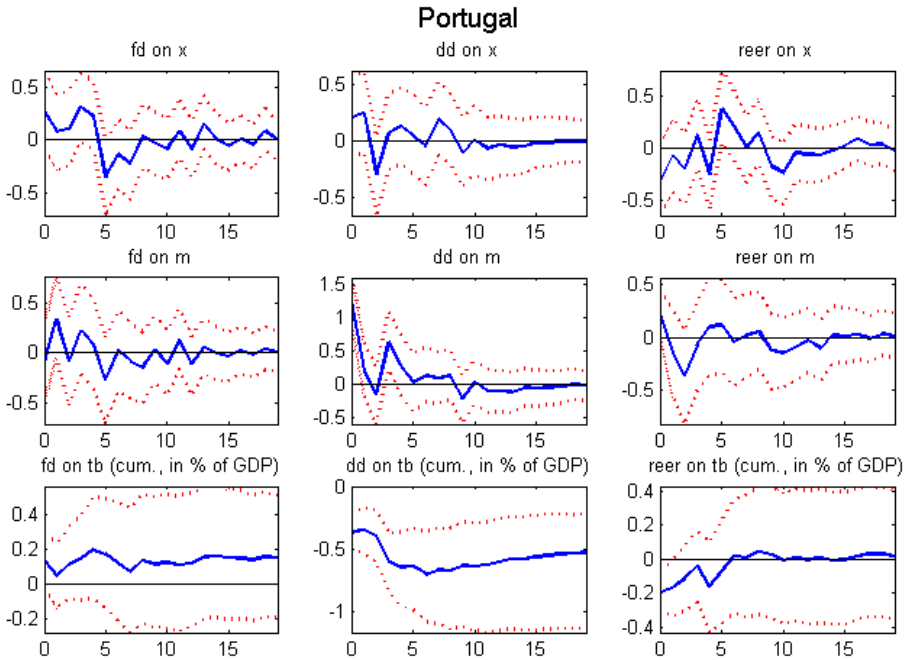


Figure A.15: Impulse Response Functions from VECM for Shocks to Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate (reer_gdp) for Spain.



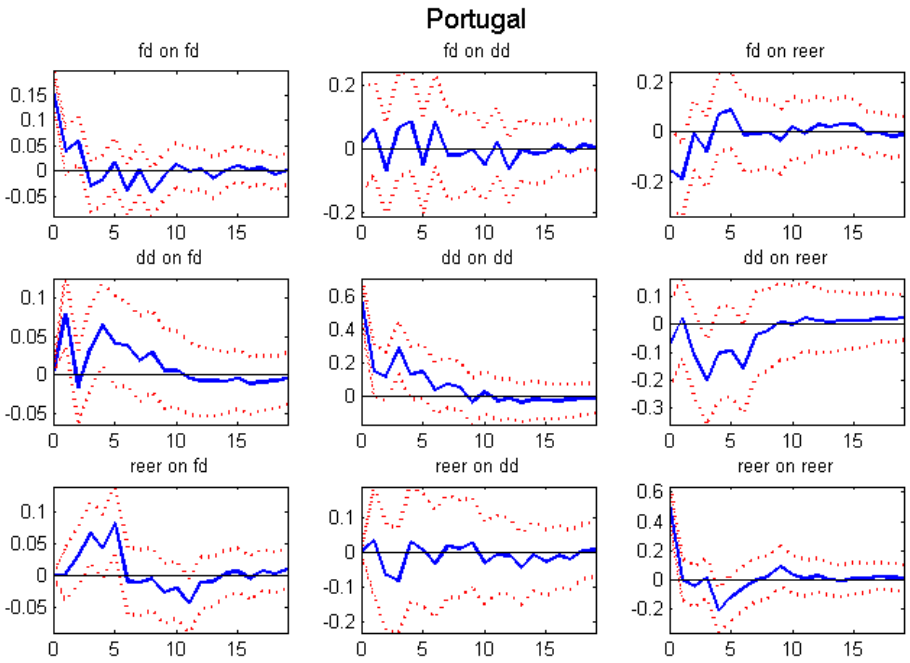
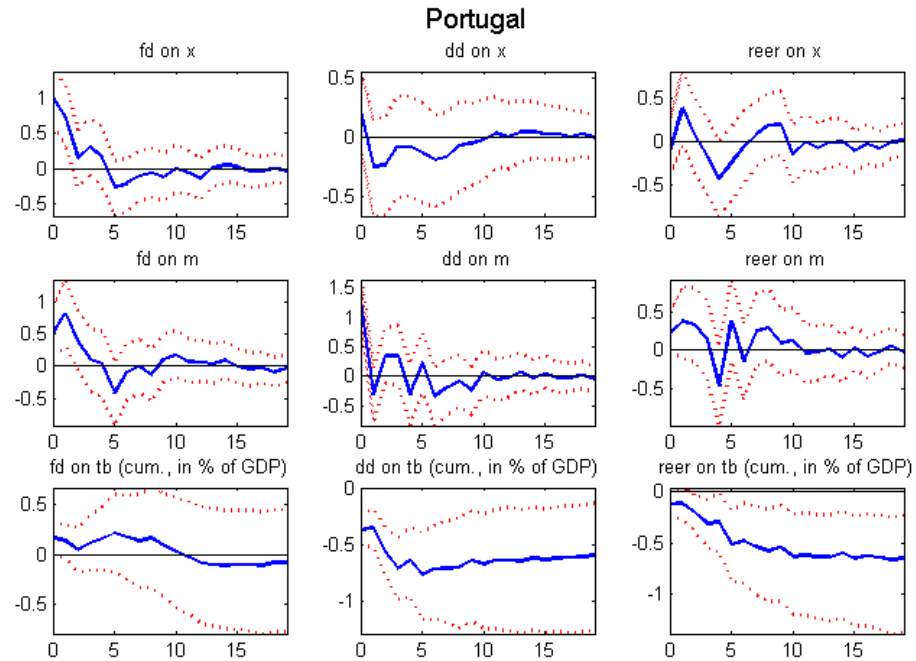


Figure A.16: Impulse Response Functions for the **Subsample 1995q1–2008q1** of Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate (reer) for Portugal.



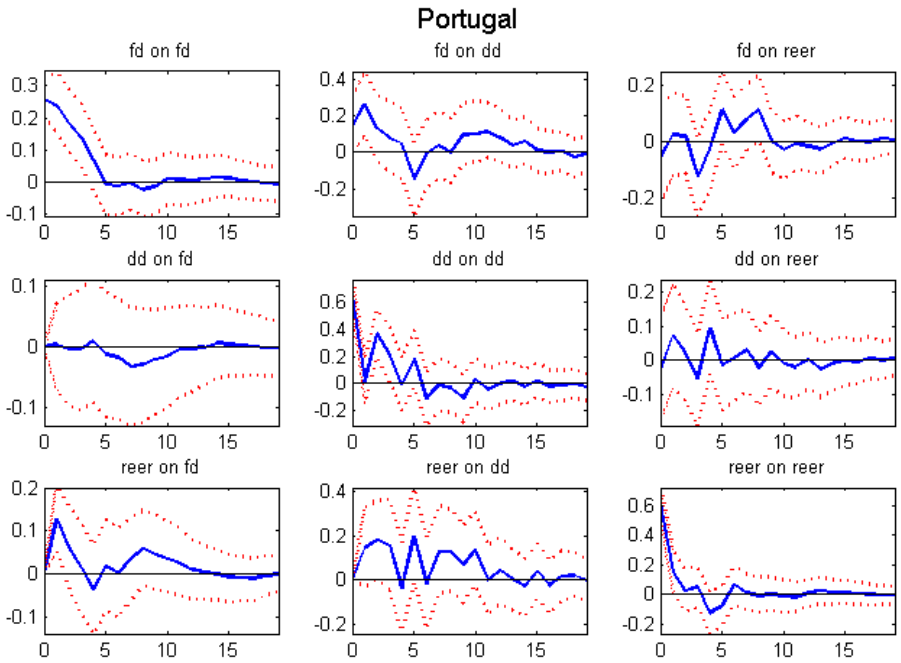
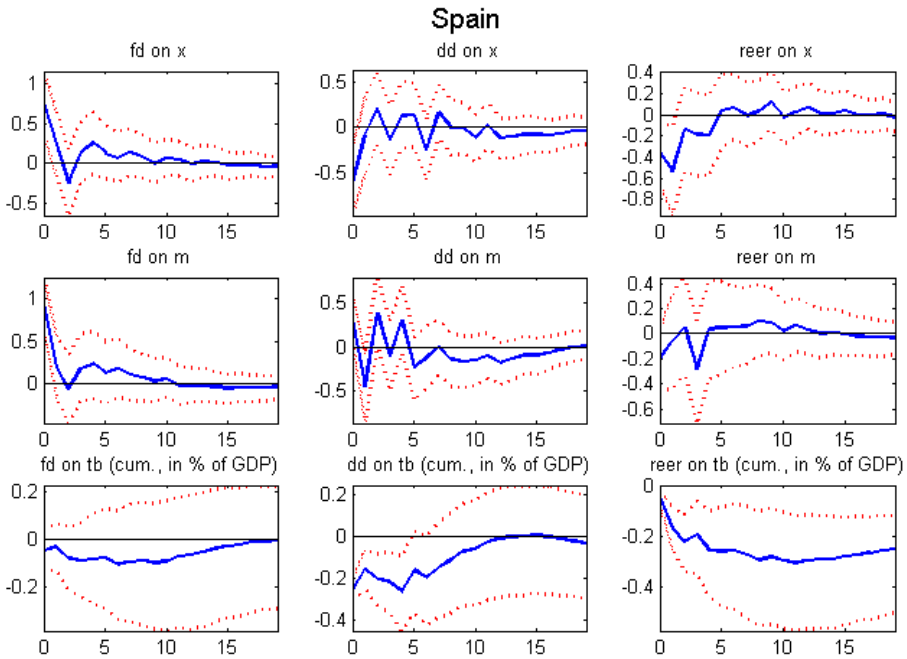


Figure A.17: Impulse Response Functions for the **Subsample 1999q1–2014q3** of Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate (reer) for Portugal.



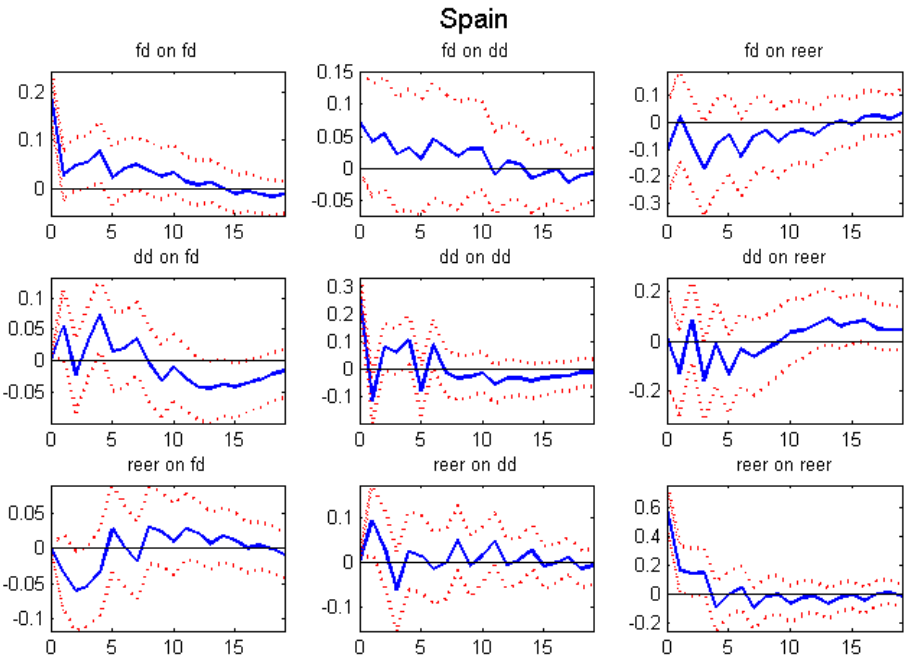
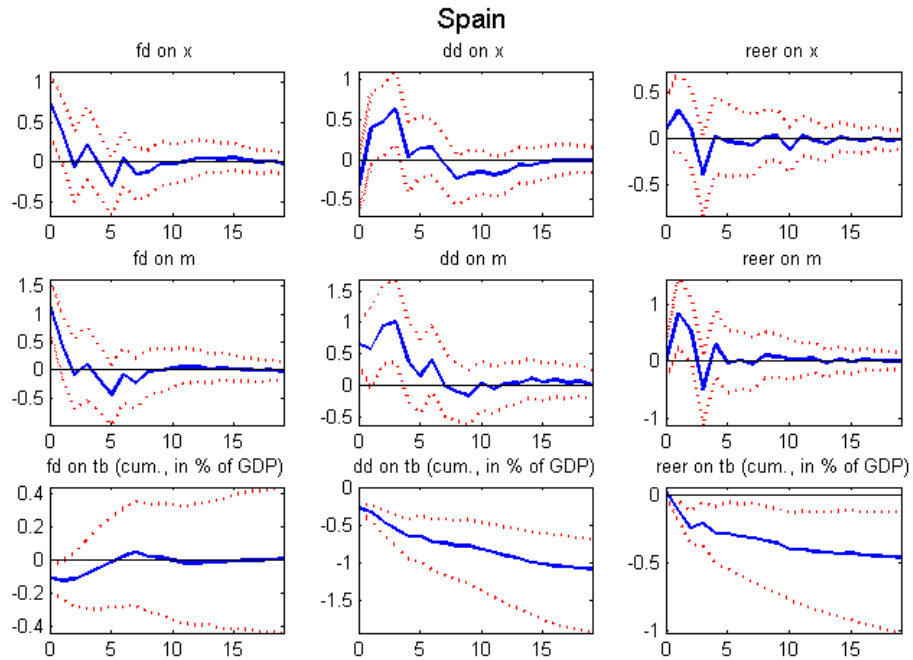


Figure A.18: Impulse Response Functions for the **Subsample 1996q1–2008q1** of Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate (reer) for Spain.



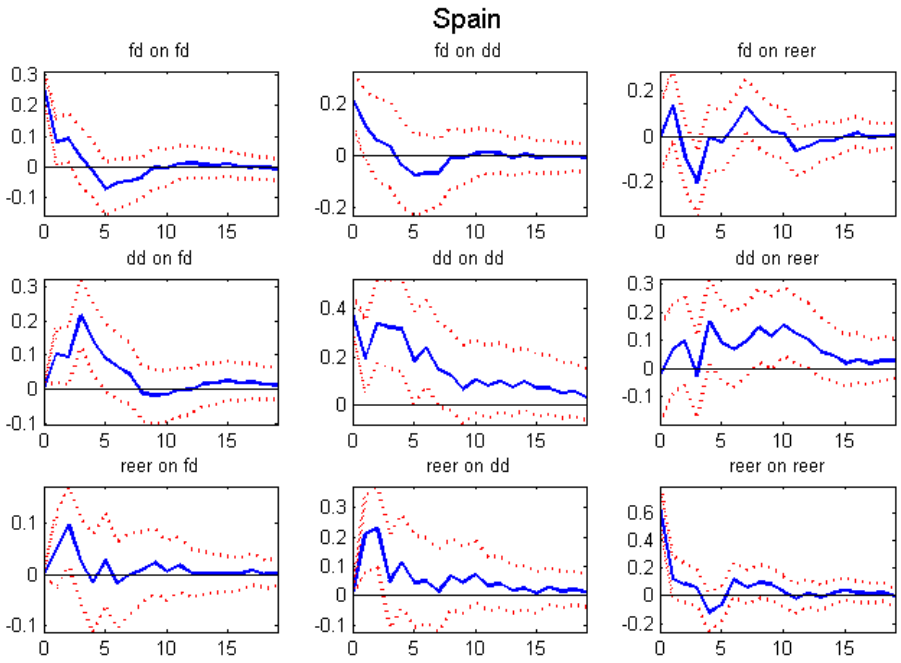


Figure A.19: Impulse Response Functions for the **Subsample 1999q1–2014q3** of Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate (reer) for Spain.

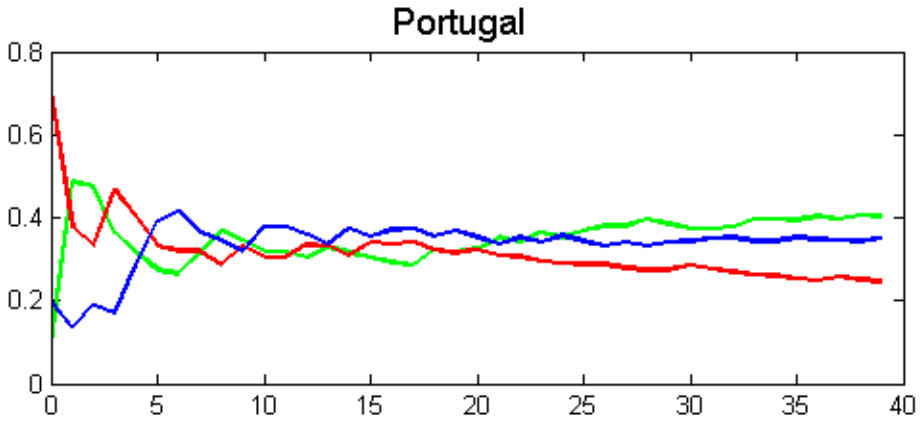


Figure A.20: Forward Error Variance Decomposition: Relative Contributions of Shocks to Foreign Demand (Green), Domestic Demand (Red) and the REER (Blue) to Their Joint Portion of the Forecast Error Variance of the *kth* Step Ahead Forecast of the Trade Balance of Portugal for the **Subsample 1995q1–2008q1**.

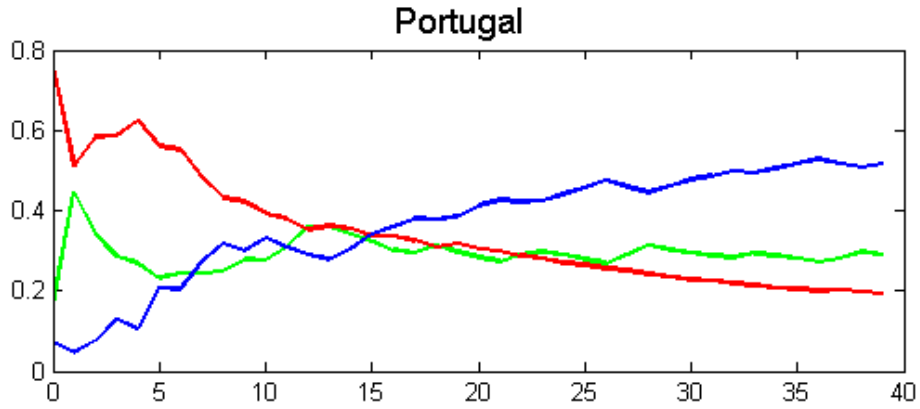


Figure A.21: Forward Error Variance Decomposition: Relative Contributions of Shocks to Foreign Demand (Green), Domestic Demand (Red) and the REER (Blue) to Their Joint Portion of the Forecast Error Variance of the *kth* Step Ahead Forecast of the Trade Balance of Portugal for the **Subsample 1999q1–2014q3**.

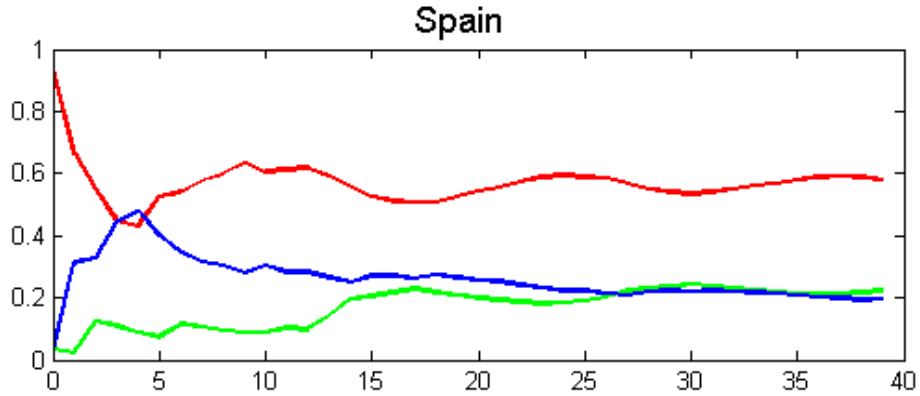


Figure A.22: Forward Error Variance Decomposition: Relative Contributions of Shocks to Foreign Demand (Green), Domestic Demand (Red) and the REER (Blue) to Their Joint Portion of the Forecast Error Variance of the *kth* Step Ahead Forecast of the Trade Balance of Spain for the **Subsample 1996q1–2008q1**.

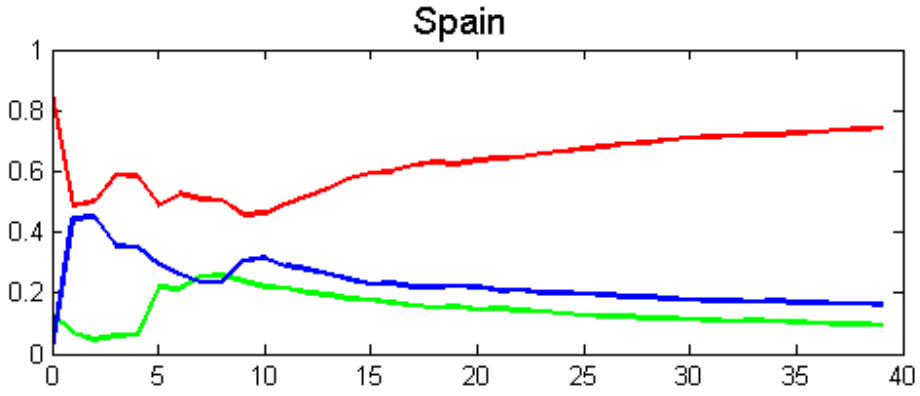


Figure A.23: Forward Error Variance Decomposition: Relative Contributions of Shocks to Foreign Demand (Green), Domestic Demand (Red) and the REER (Blue) to Their Joint Portion of the Forecast Error Variance of the *kth* Step Ahead Forecast of the Trade Balance of Spain for the **Subsample 1999q1–2014q3**.

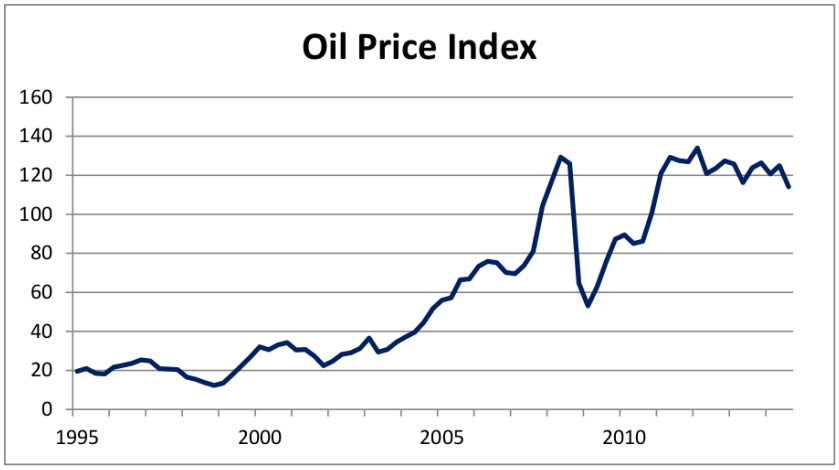
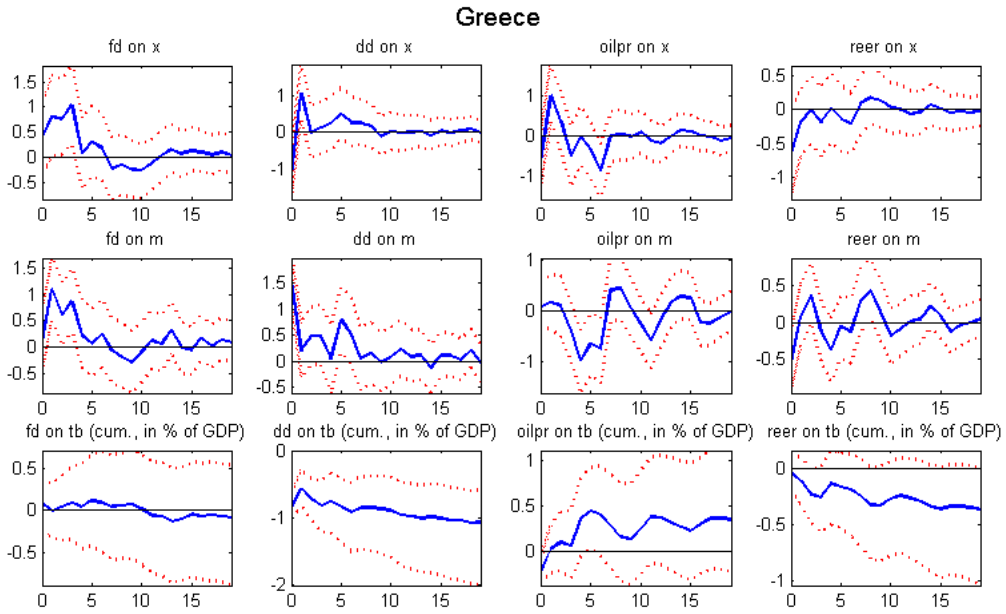


Figure A.24: Crude Oil Price Index, Brent Europe
Source: FRED Data Base



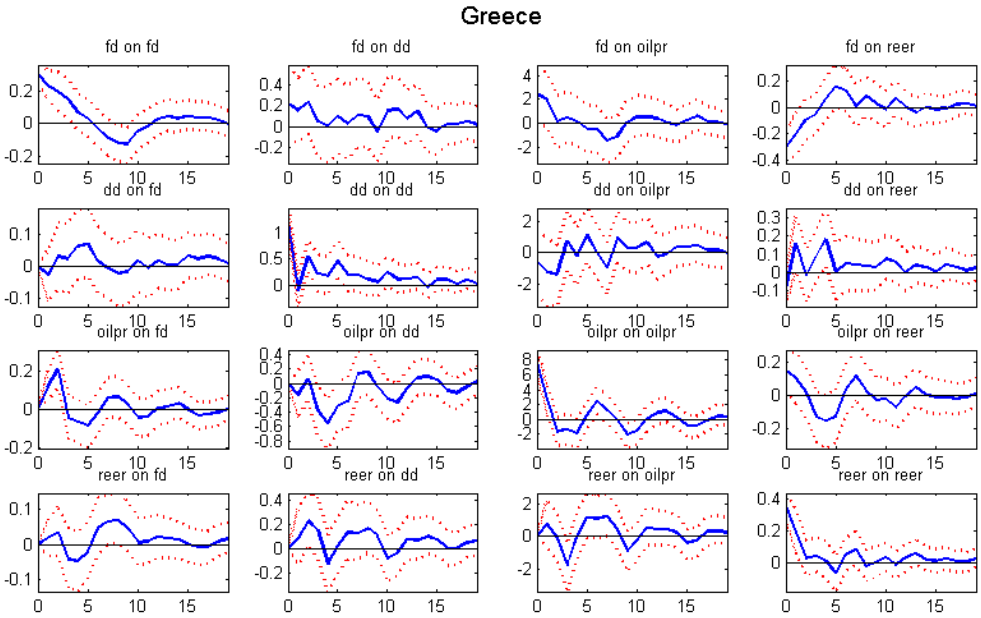
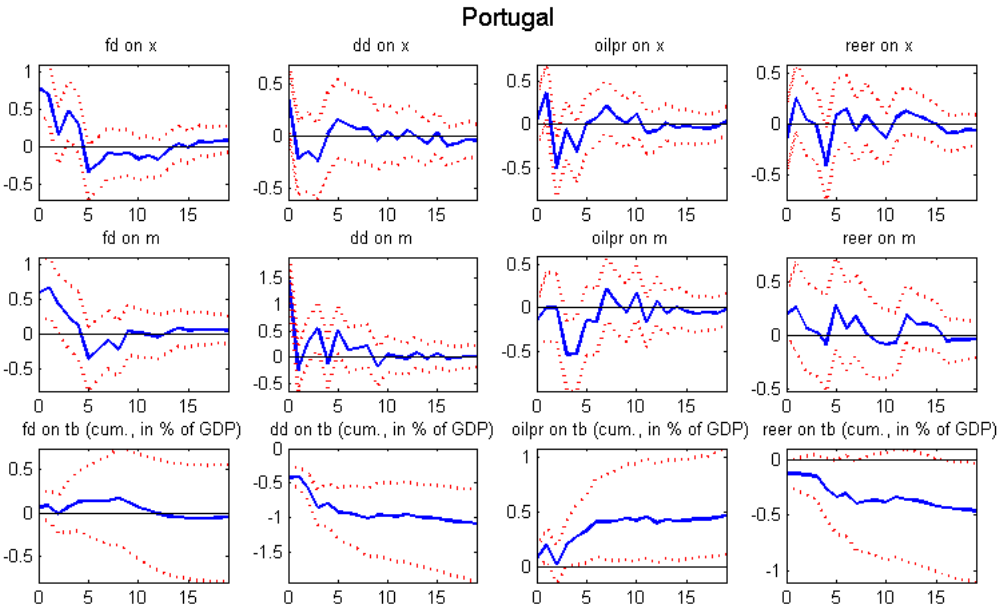


Figure A.25: Extended Model Impulse Response Functions of Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate (reer) for Greece.



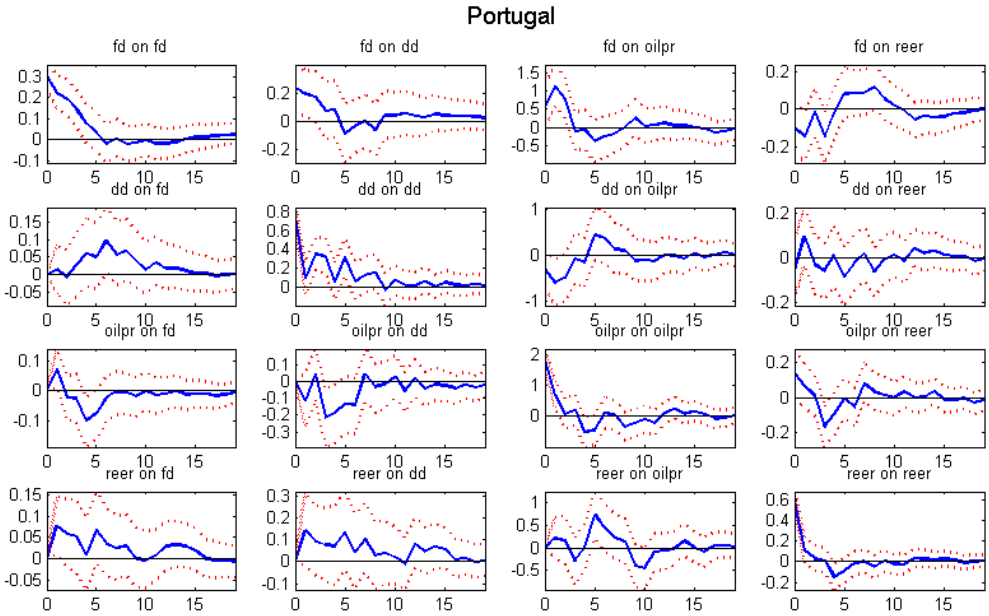
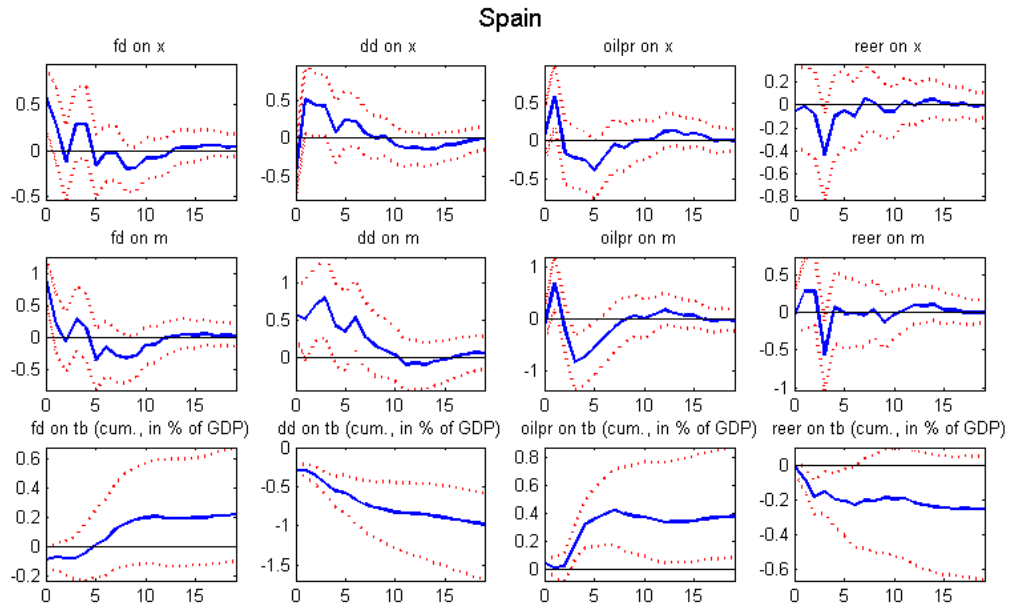


Figure A.26: Extended Model Impulse Response Functions of Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate (reer) for Portugal.



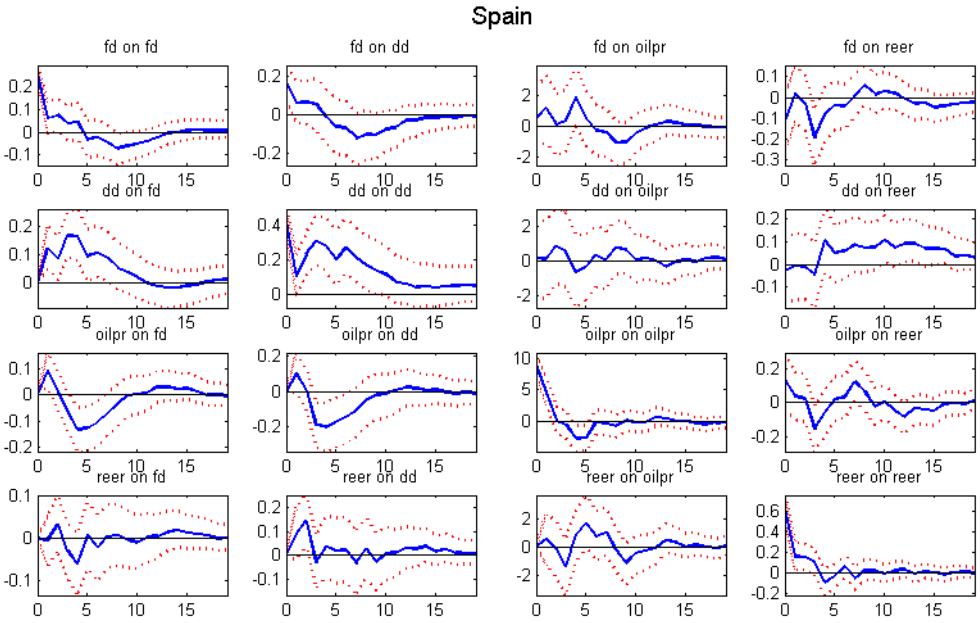


Figure A.27: Extended Model Impulse Response Functions of Foreign Demand (fd), Domestic Demand (dd) and the Real Effective Exchange Rate (reer) for Spain.